NATURAL HISTORY

THE JOURNAL OF THE
AMERICAN MUSEUM OF NATURAL HISTORY

VOLUME XXXI
1931

Published bimonthly by
THE AMERICAN MUSEUM OF NATURAL HISTORY
NEW YORK CITY

1931

CONTENTS OF VOLUME XXXI

January–February, No. 1

March–April, No. 2

May–June, No. 3

July–August, No. 4

September–October, No. 5

NOVEMBER–DECEMBER, No. 6

NATURAL HISTORY

Jan.-Feb.
1931

Price Fifty
Cents

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JOURNAL OF THE AMERICAN
MUSEUM OF NATURAL HISTORY
NEW YORK, N. Y.

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VOLUME XXXI
NUMBER 1

NATURAL HISTORY

JAN.-FEB.
1931

The Journal of The American Museum of Natural History

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Published bimonthly by The American Museum of Natural History, New York, N. Y. Subscription price $3.00 a year.

Subscriptions should be addressed to James H. Perkins, Treasurer, American Museum of Natural History, 77th St. and Central Park West, New York, N. Y.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

Entered as second-class matter April 3, 1919, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103 Act of October 3, 1917, authorized on July 15, 1918.

Photograph by Brown Brothers

OLOKELE CAÑON ON KAUAI, ONE OF THE HAWAIIAN ISLANDS

This scene explains why Hawaii is justly famed for its beauty. Here we may discern something of the grandeur that nature has created in the Hawaiian Islands

(*See "Race Mixture in Hawaii," Page 31*)

VOLUME XXXI

NATURAL HISTORY

NUMBER ONE

JANUARY–FEBRUARY, 1931

OLD EMPIRES OF THE ANDES

The Myron I. Granger Archæological Expedition—The First of a Projected Series of Studies by the American Museum Aiming at the Reconstruction of Culture History in Peru

By RONALD L. OLSON

Assistant Curator of South American Archæology, American Museum

I SHALL treat of the government of the Yncas Yupanquis, who were the ancient kings of Peru, and of their great deeds and policy. . . . I shall describe the superb and magnificent temples which they built, the roads of wonderful size which they made, and other great things which were found in this kingdom.

So wrote Pedro de Cieza de Leon, soldier and chronicler of the turbulent days which followed Pizarro's conquest of the land of Peru.

When Pizarro and his band of 190 doughty warriors landed at Tumbez in 1532, the greater part of the modern republics of Ecuador, Peru, Bolivia, and Chile was a powerful empire—the dominion of the Quechua people. Over it ruled the Inca, supreme emperor, demi-god, offspring of the sun.

About the year 1000 the Quechuas were a small tribe living in the region of Cuzco, just starting on the career of conquest which in five centuries culminated in an empire stretching the 2300 miles from northern Ecuador to middle Chile.

Not alone in size was this empire impressive. The splendor of its templed pyramids, the grandly conceived works of irrigation, the well-knit fabric of its society and government—all these filled the more thoughtful among the conquering Spaniards with an admiration which almost amounted to awe. As a consequence the word "Inca" is surrounded by a glamor that has resulted in giving the Quechuas (Incas) credit for more than their share of the achievements which mark Andean civilization.

A thousand years before the Incas began their conquests, Peru's Coast and Highland had already seen the beginnings of civilizations take root in their soil. The next few centuries saw these cultures flourish for a time, their arts reach a high plane of excellence, then fade. On the cold bleak shores of Lake Titicaca arose the mighty structures of Tiahuanaco—center and probable fount of the Megalithic Empire whose territory was perhaps as far-flung as that of the Inca Empire. But Tiahuanaco was already in ruins when the early Incas first came that way. Its heroic sculpture and art had a subsequent flowering far to the north at Chavin and at other centers. Centuries before the period of this Megalithic Empire, the coastal plain of Peru was the seat of other civilizations. In the region of

RUINS OF "LA FORTALEZA," NEAR PARAMONGA
According to tradition this fortress marked the southern boundary of the kingdom of the "Great Chimu," and was the scene of the decisive battle between the Chimu and the armies of the Incas

Nazca lived a people already versed in the arts of agriculture, ceramics, and weaving, and on the northern coast lived the Chimu, a people equally conversant with these pursuits. The pottery and textiles of these early periods excel those of subsequent epochs in beauty, technique, and decorative excellence.

Aside from a few vague hints of rude fisher-folk living along the ocean and of primitive hunters in the Sierra, we are in almost complete ignorance of the long history which must lie back of these complex civilizations of the Nazca and Chimu peoples. It is against all precedent and logic that highly developed civilizations such as these should be without cultural predecessors.

A number of things have combined to make Peru one of the richest archæological fields that we know. The ruins are numerous and large. The religious and cultural background of the people led them to bury a wide variety of objects with the dead. The dry, rainless climate of the coastal zone has preserved these objects in a most remarkable way. It is not uncommon to find bodies with the hair, nails, and tattooing marks almost unchanged after a thousand years. Pottery vessels exist in all their ancient polish and color, textiles are often perfect in their design and color. Food products, such as peanuts, yucas, potatoes, and meats, are often found in the pots which have been placed with the dead. The original frescoes and impressed designs on the walls of temples and houses are still visible. Perhaps only in Egypt is there an equally remarkable preservation of the remains of an old civilization.

For more than fifty years the archæological remains of Peru have attracted the attention of students. In most of the principal museums of the world sizeable collections of objects from the coastal belt are on display. It has been estimated that 30,000 pottery vessels have been taken from graves in the valley of Nazca alone. Yet the amount of positive knowledge regarding the development of civilization in the Andean-Coast region

is in almost inverse ratio to the amount of materials available. What lies back of the highly developed cultures of the Chimu and Nazca regions? Do these spring from a common source? How are they related to the megalithic cultures of Tiahuanaco and Chavin? Are the coastal civilizations derived from the Highland or those of the Highland from the Coast? Are both related to the other high cultures of Middle America in Colombia, the Maya area, and in the valley of Mexico? These questions are obviously fundamental to an understanding of Peruvian archæology. Yet disappointingly little progress has been made in answering them. The reason lies in the fact that most of the collections available for study are without adequate field data. They represent collectors' purchases from the "huaqueros"—the professional "pot hunters" who have been for many years engaged in sacking cemeteries and pyramids.

Only in recent years have systematic scientific studies been made by archæologists, notably by Uhle and Bandelier, more recently by Kroeber, Tello, Jijon y Caamaño, and others. Their findings have been used in the study of older collections by Means, Lehmann, Joyce, d'Harcourt, and Schmidt, to mention only a few. Each of these has, in one way or another, tried to sketch in broad outlines the historical picture of the past. It seems worth while to present a composite of these reconstructions—to pick out the more salient and more certain figures in each and unite them in a running sketch of the various epochs and peoples which have passed across the stage whose background is the Andean highland and the Pacific coast of South America.

As far back as the days when the mammoth, the mastodon, and other now extinct animals roamed the Andes, man came on the scene. This was five thousand, possibly ten thousand years ago. It may be that these animals of the Pleistocene survived in certain favored regions until well into the Recent period. These early human inhabitants were

THE INCA EMPIRE

———Boundaries of the Empire of the Incas at its apogee, about 1500 A.D.

– – – – –Route of the 1930 Myron I. Granger Archæological Expedition

Just before the Spanish Conquest the Inca Empire stretched the 2300 miles from northern Ecuador to middle Chile, a region larger than the Roman Empire at the time of Caesar's birth

MODERN FIELDS AMONG ANCIENT RUINS

On the high summits which flank the valley of the Uteubamba are located numerous ruins. Circular houses, often decorated like the one in the foreground, are more common than other types. Almost nothing is known of the archæology of this vast region

probably very primitive in culture. We know that they hunted the mastodon and other animals for food, and that they knew the art of pottery-making, but here our knowledge ends. Perhaps during this same period the Coast was inhabited by rude folk who lived mainly on fish and shell fish. At any rate, we may assume that several thousands of years ago the first settlers were drifting southward from Central America along the Coast and Highland in a series of waves. But the remains of these pioneers are either difficult to find or we have not yet learned how to locate them.

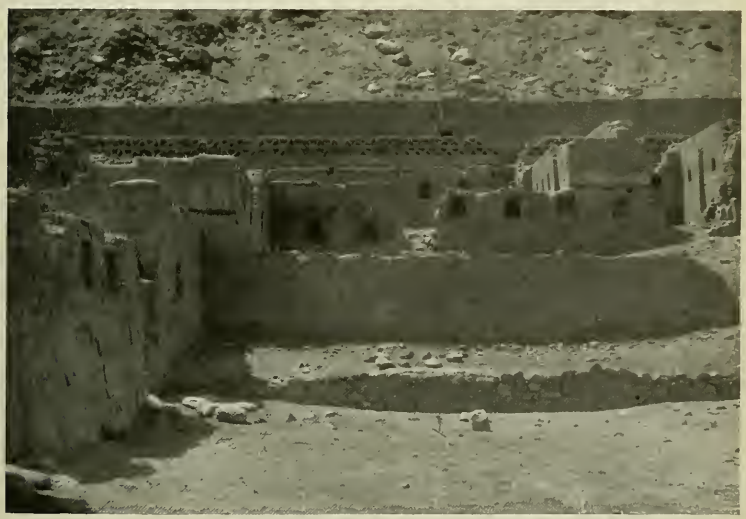
A long period of time now passes before we get the next glimpse of human history in this area. But the next picture is clear and surprising. Along the southern coast of Peru, in the region of Nazca, and a little later in the Trujillo region of the northern coast, appear civilizations of a high order. Here, as elsewhere in the area, our reconstructions of culture are based in the main on ceramic and textile remains, the figures and scenes depicted, less on the residuum of stray objects, of refuse deposits, and so on. The definite characteristics of the artistic elements enable us to identify the materials of these civilizations from others with considerable certainty. Though the early Nazca culture is probably earlier than that of the Trujillo section (seat of the Early Chimu civilization), our knowledge of the latter is more complete.

We can picture the early Chimu as a people living largely by means of agriculture, with maize, beans, potatoes, and cotton as the principal domesticated plants. To bring water to irrigate the dry alluvial fans, many miles of great canals and ditches were constructed. The social structure was a complex one, with chiefs,

priests, warriors, commoners, and slaves forming the strata of society. A pantheon of deities was worshiped, with the puma-god the most important. Great truncated pyramids were erected to serve as the bases for temples and the residences of high dignitaries of state. The art of weaving was highly developed, decorative fabrics and a poncho-like shirt being fairly numerous in the remains which have been preserved. Pottery is characterized by pleasing forms decorated chiefly in reds on a cream slip, and by "portrait jars." The painted decorations, done in graceful lines, often depict scenes from the life of the period. It is from these formally realistic decorations that we are able to reconstruct the culture of the people.

In the valley of Nazca during a slightly earlier period there flourished a culture basically like that of the Chimu. Scarcely an item in the decorative art of Nazca seems related to that of the Chimu, but we can reasonably infer a genetic connection between the two civilizations, for in features other than art there are many similarities. Nazca pottery is characterized by elaborate polychrome decorations, the chief motifs being flowers, birds, fishes, trophy heads, and a monster-deity with the characteristics of a composite feline-serpent. Textiles are often embroidered with elaborate representations of this same being. Nazca art is so much given to conventionalization and to the depiction of mythological fantasy that we are unable to reconstruct the everyday life of the people with the same sureness as in the case of the early Chimu.

The culture of Nazca is the earliest of which we have knowledge, but that of the Trujillo area is only a little later in point of time. Both seem to be restricted to the



INCA RUINS IN THE COASTAL BELT

The remains of Tambo Colorado in the valley of Pisco are among the best preserved in Peru. The window-like niches are painted in reds and yellows, and probably served as resting places for various sacred objects

THE RUINS OF "LA CENTINELA" NEAR CHINCHA

Both Inca and Chinca elements are blended in the architecture of these ruins. The size of the mass may be judged by the figures near the break in the wall. Like in nearly all others of the coastal belt, a huge cross has been placed at the summit of these ruins

forbidding deserts of the coastal plain—a region so unpromising that only somewhat civilized peoples could cope with natural conditions. The next epoch opens in the Highland, in the great plateaus which lie between the ranges of the Andes at elevations of 8000 to 14,000 feet.

We do not know what events took place in the Highland during the time of these early Chimu and Nazca periods. But somewhere near their end a unique civilization was arising at Tiahuanaco on the cold barren shores of Lake Titicaca. Somewhat crude at first, this culture soon flourished in the classic style of Tiahuanaco. The rainy climate of the Sierra soon destroys such remains as textiles and other objects which decay under moist conditions, and we must content ourselves with the study of architectural styles, stone sculptures, and ceramics. These show the Tiahuanaco culture to be quite distinct from that of Early Nazca and Early Chimu. The feline deity of the Coast was reverenced as well as the condor-god and the sun. The "weeping god" of the gateway and other stone sculpture of the ruins of Tiahuanaco are type examples of the lithic art of the era. The architecture is massive in design, truly megalithic in scope. The Tiahuanaco ruins show a city with its temples and other structures laid out according to a grand plan, impressive in a way quite different from the great adobe brick pyramids of the coast. The latter exhibit only a prodigious amount of labor expended to little ultimate avail: the Megalithic builders would have reared a splendid city with less effort.

Pottery forms are sometimes reminiscent of those of Nazca, but the decorative elements are often human and animal faces and figures which are very unlike the Nazca type. The feline and condor gods are often shown having human bodies. The colors employed are

reds, blacks, and less often whites. Even where these are the same basic hues used in Chimu and Nazca ware, their values and intensities are of a different order. While Tiahuanaco art is restrained and severe, that of Nazca is elaborate, almost flamboyant. A fairly constant detail of Tiahuanaco art are the "tear drops" or "tear streaks" that decorate the cheeks of faces.

Stone sculpture or pottery remains, reminiscent of the Tiahuanaco style, are found from the Diaguita area in the Argentine to San Augustin in southern Colombia. At Chavin in central Peru a secondary center sprang up, probably toward the end of the classical Tiahuanaco period. Here severity of line and simplicity of execution gave way to complex figures with single elements of the parent motifs often used to decorate a field. Conventionalized puma and condor heads executed in the Chavin manner are found in pottery of the early Chimu period, giving proof of reciprocal influences and of commerce between Coast and Sierra. We have certain proof that Early Nazca precedes Tiahuanaco. Chavin art, difficult to analyze as a predecessor of Tiahuanaco, is more explicable as a derivative. Since the Chavin style is associated in graves and ruins with that of Chimu, we are justified in placing Early Chimu as later than Early Nazca.

Toward or at the end of the Nazca period, pottery and textiles in the style of Tiahuanaco are to be found in coastal sites from northern Chile to northern Peru. Certain of these exhibit the style in all its vigor, but other finds show a degeneration in both technique and execution. To this period on the coast the name "Epigonal" (derived from Tiahuanaco) or "Tiahuanacoid" has been given. Perhaps this degeneration is to be explained by lack of further stimulation from the parent culture. A puzzling

THE GATEWAY TO THE FORTRESS OF CUELAPE IN THE VALLEY OF THE UTCUBAMBA

The area within the towering walls was filled and leveled and an inner fortress built. The ruins of some 200 circular houses are scattered about the main compound

feature of the Tiahuanaco-Chimu-Chavin relationship is that both Tiahuanaco and Chavin ware are found with Early Chimu. This might seem to indicate that Chavin and Tiahuanaco are contemporaneous. But the Tiahuanaco forms probably came as an influence from along the coast to the south, while those of Chavin had only to traverse the short distance across the western range of the Andes. The Tiahuanaco influence started to spread earlier but the time-distance element resulted in its reaching the Chimu area at roughly the same time as the Chavin influence.

The Tiahuanaco culture (or its hypothetical predecessors) had enriched its world by the cultural gifts of bronze, the potato, the domesticated llama, a distinctive architecture and art, and then passed into oblivion until resurrected by the archæological studies of a stranger race.

At the present time we are able to reconstruct but little of the series of events which had been taking place in the northern Highland of Peru during the Tiahuanaco period. In that area there has been little archæological work done, and the probable relationship of the megalithic cultures of Tiahuanaco and Chavin to those of Colombia and beyond is indicated largely by inference. We are without data which might give clues to the possible spread of the megalithic culture over this northern region of the Peruvian Highland.

A WEAVER OF THE ECUADORIAN HIGHLAND

In Peru and Ecuador both men and women weave, but only women spin. The looms used are identical with those of more than a thousand years ago. This photograph was taken on a day of fiesta, when European clothes are usually worn by the men

In the northern Sierra almost all of the ruins are found at high altitudes, in a belt of dense vegetation which makes exploration and excavation difficult. Pottery remains are hard to find, undisturbed graves are harder. A preliminary reconnaissance in this region in 1930 by the writer yielded the following results:

Fortresses, temples, houses, and other structures are in a type of stone architecture basically like that of Tiahuanaco and Chavin. Certain villages are composed entirely of circular stone structures some ten to thirty feet in diameter with stone roofs of a corbelled dome type.

Other villages show both round and square houses with similarly domed roofs. Since a domed stone roof is more in keeping with a circular than a square house, we may assume the former to be the earlier type. The dead were buried in niches in the walls, in caves, or in houselike tombs built against the faces of cliffs. Burials were flexed, the bodies wrapped in cloth. Contacts with the tropical forest or with the coastal belt are indicated by the presence of cotton fabrics and of coca. The pottery is a heavy, somewhat crude ware, usually undecorated. Decoration is by appliquéd strips of clay, by crudely modelled animal figures, or by curious spiral designs in a dark red on a creamy-red background. These bits of data permit no more than the bare statement that this northern highland culture represents that of Chavin-Tiahuanaco in an attenuated form. The round house forms are reminiscent of the "chullpas" of the Titicaca region which seem to relate to a period following Tiahuanaco.

THE WEAVER AND THE GOSSIP

A woman of Marcamachay and her friend enjoy a bit of sun while working on a new skirt. Wool from sheep, llamas, and alpacas makes imported clothes a rarity. A woman is seldom seen without her spindle and bundle of carded wool

Following the decline of the Tiahuanaco period in the southern Highland and later on the Coast, the picture is once more obscured. The coastal cultures seem to have gone through a period of stagnation. The refinements of the Chimu and Nazca arts and the strength of the Tiahuanaco-Epigonal style are lacking in the new forms which appear. On the northern and central coast from Chicama to Lurin there appears a red-white-black pottery which seems related to that of Recuay in the Callejon de Huaylas. This is perhaps best interpreted as a later counterpart of the early Chavin-Chimu influence. The classical (Early) Chimu style shows little affinity to these later coastal styles. It seems that the Recuoid ware, a peculiar cursive style, and the later polished black ware may be influences radiating from the Chiclayo-Leche region. Unfortunately there has not been sufficient work in this section to establish relationships with the Chimu-Chavin style.

About this time the Chimu culture had

POTTERY OF THE TIAHUANACO-EPIGONAL PERIOD

In point of time pottery of this type follows that of the Early Chimu and Early Nazca. The decorative elements are commonly pumas, condors, and human faces, but traits of all three are often combined in a single figure

POTTERY OF THE EARLY NAZCA PERIOD

Aside from some rather dubious materials, this style marks the earliest known epoch of Peruvian history, and dates from about the beginning of the Christian era. The two jars at the left show elaborate conventional representations of the feline-monster deity

CERAMICS OF THE MIDDLE AND LATE CHIMU PERIODS

At the left two vessels represent men carrying mummy bundles to the cemetery. At the right a rather oafish man lounges under a rude shelter. The kneeling figure in the center gives an idea of the appearance and dress of a man of affairs of the time

POTTERY OF THE EARLY CHIMU PERIOD

A warrior in full regalia is depicted on the vessel at the left. In his right hand he holds a mace, in his left a shield, spear thrower, and javelins. The central piece is a "portrait" jar. The vessel at the right shows a hand to hand combat between mythical beings

LOADED LLAMAS CROSSING THE BARREN PUNA BETWEEN TARMA AND OROYA

A llama can carry about sixty pounds, and serves best when allowed to feed as he travels. Favorite beasts have their ears pierced and decorated with gay ribbons and yarns

a revival. Perhaps a new political organization under the kings known as "Great Chimu" was related to the conquests which carried the Late Chimu culture over the entire coast from Huacho to Piura. This is the period of the building of Chan Chan, "capital" of the Chimu kingdom and largest city in prehistoric Peru. This late Chimu period persisted until the irresistible conquests of the Incas carried them to the northern coast about a century before the coming of the Spaniards.

On the southern coast the fading of the Tiahuanaco influence was followed after a time by the growth of a new culture which was centered in the valley of Ica, just north of Nazca. Here careful work and analysis by Uhle, Kroeber, and Strong have enabled us to establish the sequence; Nazca-Epigonal-Middle Ica-Late Ica-Inca with considerable certainty. In some respects the characteristics of each style show blended or attenuated forms in the succeeding style or styles. Accordingly we may suppose a continuous history, with the arts of previous periods serving to shape the new cultures. The Ica styles include a number of new vessel forms. Like their predecessors, the Ica vessels are decorated in three or four colors, with red, black, white, and slate predominating but often blended with still others. Ica decorations, like those of the Epigonal, lack the firmness and precision which characterize the Nazca style. The designs are mainly geometric, probably textile patterns applied to pottery. Traces of the Ica influence may be found as far north as Chincha. Like Late Chimu, the Late Ica civilization persists down to the Inca period.

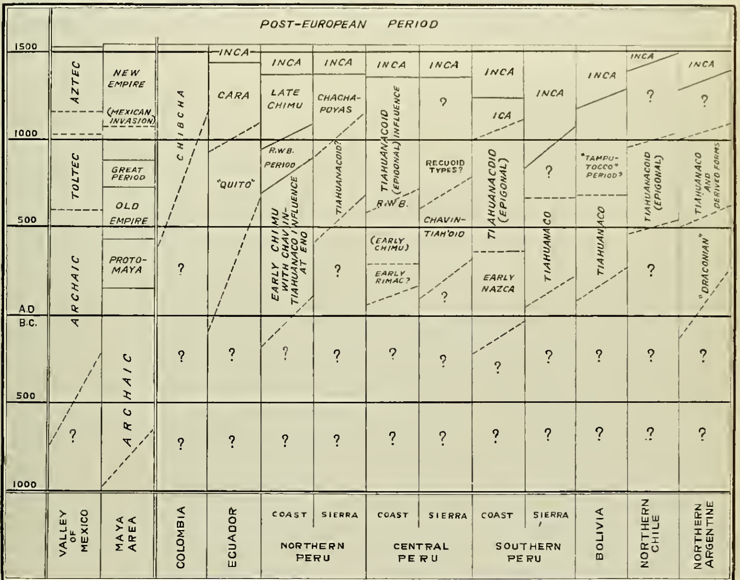
About the same time as Middle Ica new developments were taking place in the region of Chincha-Cañete to the north of Pisco. The pottery forms vary, exhibiting Late Chimu and Ica traits with other forms in a local "Chincha" style. Back of this period undoubtedly lie others as yet undiscovered or at best unplaced as to

time. The Chincha period at its end merges with the Inca.

It is now necessary to return again to events in the Highland. Tiahuanaco had been lying in ruins for probably several centuries. The Megalithic Empire had, however, enjoyed a brief renaissance at Chavin and other centers. Now these centers of influence as well had gone the way of their cultural mother. A period about which we know almost nothing had endured for a long span of time in the Highland.

But there was living in the upper valley of the Urubamba a small tribe, the Quechua, which was destined to play a brilliant, though ultimately unfortunate, part in the history of the native races. Perhaps the Quechuas (Incas) had been a subject people under the Megalithic Empire. Tradition concerning them begins about the year 1000, when the more or less mythical Manco Ccapac was "Inca." (The word "Inca" was the title of the ruler, but through an erroneous popular usage has come to apply to the entire Quechua people and to the empire which they conquered). This was only some five hundred years before the Spanish conquest—sufficiently close to the horizon of history to permit us to place some faith in Inca history as set forth in their oral traditions.

Manco Ccapac and his successor made their people supreme in the vicinity of Cuzco. The third Inca, Lloque Yupanqui, extended his territory to the south as far as Lake Titicaca. There followed a



THE SEQUENCE OF CULTURES IN THE ANDEAN HIGHLAND AND PACIFIC COAST OF SOUTH AMERICA

The diagram is designed to give a tabulated summary of known and inferred developments during the fifteen centuries of which we have knowledge. The two columns at the left cover the Valley of Mexico and the Maya areas

THE FIESTA OF SAN ANTONIA AT CHUQUITEN

For seven days and seven nights the music and dancing are kept up. Great quantities of food and chicha are consumed. An abundance of firecrackers and rockets add to the din of the "orchestra." Only one tune is played throughout

series of notable rulers each of whom extended the boundaries of empire during his reign. At the end of the reign of Pachacutec, who died about 1478, the empire had been extended well into what is now the Argentine, into northern Peru to Cajamarca, and on the coast over the territory of the Chimu. Under the next Incas, Tupoc Inca Yupanqui and his successor Huaya Ccapac, successful campaigns brought the boundaries of the empire nearly to Colombia in the north and to the Rio Maule, perhaps to the Rio Bio Bio, on the central coast of Chile—a distance of some 2300 miles, an empire larger than that of Rome at the time of Caesar's birth. Huayna Ccapac died at Quito in 1525. His heir, Ninan Cuyuchi, died soon after, and Huascar, second in line, now became Inca. But his right to the throne was disputed by the ill-fated Atahualpa, an illegitimate son. The civil war which followed weakened the empire and divided the loyalty of the people. Atahualpa was finally successful, but at the moment of victory news came to him at Cajamarca that a body of strange and mighty men had landed on the coast. This was November, 1532. Pizarro marched to Cajamarca, took Atahualpa prisoner by a ruse, and within a year had captured Cuzco and was in complete control of the Inca realm. Except for a series of increasingly futile rebellions, resistance was over, the Inca part in the drama was ended. The New World had lost its last chance to remain for a time free from the devastating effects of European civilization.

The Inca genius was one for conquest and political organization rather than of excellence in arts and crafts. Their pottery has a certain grace of form but is not so pleasing as the best of Chimu or

Tiahuanaco ware. Textiles are colorful in a gaudy sort of way. Inca architecture may be said to follow the megalithic tradition without showing the restrained grandeur of Tiahuanaco. In the coastal belt the structures of the period are far inferior to the impressive masses of the Chimu pyramids.

In some respects the Inca scheme of political organization was like that of the Romans. A vast system of roads was built in both the rugged highland and desert coast land. At regular intervals along these highways "tambos" or storehouses were built where supplies for travelers and for the army were kept. Messengers were constantly on duty at these points ready to relay messages from one part of the country to another. When a new area was conquered, a part of the inhabitants were transplanted to older parts of the empire and loyal subjects were moved in to take their place. This was to guard against rebellion and to disseminate the Quechua tongue over the conquered territory. The religious and social institutions of subject tribes were allowed to persist. A temple to the sun was usually erected near the foreign places of worship but there was never an attempt to stamp out the prevalent beliefs. This is in keeping with the tolerant attitude of most peoples other than those of the white race toward other beliefs.

A hierarchy of religious and civil officials served as mentors of social, political, and religious activities. At the head of these stood the Inca, the ruler-god, descendant of the sun-god, and supreme authority in all matters. The empire and its people were his by divine right. Aside from houses and personal effects, there was little private ownership. Since long before the days of the Incas,

THE BED MARKET AT HUANCAYO

Every Sunday thousands of people from the surrounding country come to sell their wares and buy from others. Native products from the hot Amazonian forests and from the cold puna as well as the latest European gew-gaws are among the things displayed

THE RUINS OF "EL PURGATORIO," LAMBAYEQUE
A few of the huge adobe pyramids which flank the rocky hill on every side. In the distance is the modern village of Túcume with another truncated pyramid towering above it at the left

the people of the empire had been organized in "allyus" or clans which owned the lands. The leaders of these allyus assigned certain fields to individuals to till for one year only. The following year there was a reassignment. The Incas wove this ancient social organization into their political system. A portion of the produce of each community was taken over by the state to satisfy the needs of religion and government.

The Incaic system was a form of communism curiously blended with a thorough but benign despotism. One governmental department looked after the conservation of wild animals, another safeguarded the forests from needless exploitation. A corps of engineers planned and built cities, temples, and bridges. Census takers annually noted the amount of a man's crops, the number of his children, his ability for work. Certain likely children were trained to be soldiers, others to be priests, still others to fill posts in the administrative service of the government. The system seems to be one instance where the theory of state communism was applied with a measure of success. It was, of course, built upon concepts of property and personal rights quite different from our own.

Many, perhaps most of "the great things which were found in this kingdom" (to use Cieza's words), were not the works of the Incas but, as we have seen, are to be ascribed to civilizations which existed long before. Indeed, the entire course of Peruvian history almost seems to have run contrary to progressive evolution. The earliest civilization, that of Nazca, excels all subsequent cultures in the numbers of colors used in ceramics and textiles, in control of technical processes in those arts, and in complexity of design. The somewhat later Early Chimu pottery excels in grace of decorative lines and

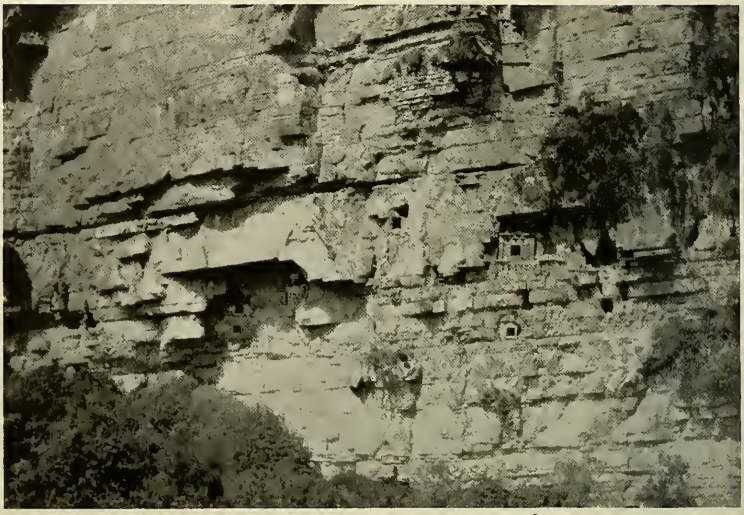
delicacy of color. The art of the next major period, that of Tiahuanaco, has the merit of strength in architecture and in pottery design, but more often the strength of design in ceramics becomes crudity or downright sloppiness. In both highland and coast its later examples run to flamboyancy or to original motifs broken up so that conventionalized parts of earlier figures serve to decorate an entire field. The objects surviving from the Inca period can lay small claim to artistic excellence.

In its broader outlines there is hardly any doubt of the correctness of the sequence: Nazca-Early Chimu→Tiahuanaco-Epigonal-Chavin→Late Chimu-Ica →Inca. The sequences and relationships within these periods may be, and are, still open to some question. But regardless of how we place these minor epochs the larger development still remains one of retrogression from the superior to the inferior. On the material side of life this is true only in part. The early (but not the earliest) pyramids of the Chimu period excel those of the later, and the Tiahuanaco style has claims to superiority. But on the other hand, grander irrigation works, cities of larger size, and a more varied food supply characterize the later periods. We cannot, of course, subject the social, political, and religious institutions of the several periods to a similar analysis because of the difficulty of reconstructing intangibles from archæological data.

We can dismiss the retrogressive evolution of the cultures of Peru by stating that evolution does not always result in progress. But we must still account for the appearance of the Early Chimu and Nazca cultures. Spontaneous and sudden generation does not take place in the

A PYRAMID OF THE CHIMU PERIOD AT SIPAN

Atop these truncated pyramids were built temples to the gods and houses for high dignitaries. The entire structure measures about 300 by 900 feet and is, roughly, 75 feet high. It is composed entirely of sun-dried adobe bricks



CLIFF TOMBS IN THE VALLEY OF THE UTCUBAMBA

These houselike tombs are reminiscent of the structures of the cliff-dwellers of our own Southwest. By wedging poles into crevices the ancient inhabitants were able to build these sepulchers hundreds of feet up the face of these vertical cliffs. The structures in this picture average about 7 feet in height

cultural sphere any more than in the biological. It must be, therefore, that back of the Early Chimu and Early Nazca periods lie long epochs of growth and development. The search for remains from these preceding periods has so far proved fruitless, though various individuals have laid claim to the discovery of an "archaic" period. But these finds have so far proved readily resolvable in terms of direct relationship with the familiar types.

There is, of course, the possibility that Early Nazca and Early Chimu were born and reared to their ripe old age on foreign soil, then suddenly transplanted to the Peruvian scene. But the most likely parent sources, Mexico and Central America, seem utterly lacking in remains related to them in other than a hazy generic way. Peru shares with these other high cultures the same basic mode of life—an agriculture based on maize, beans, squash, peppers, cotton. The pyramids of Mexico have their counterpart in Peru, and certain stone sculptures of the Aztec and Maya areas bear resemblances to those of Chavin and Tiahuanaco. Some items in religion, mythology, and social pattern are alike in the regions in question. Farther than this it is difficult to go, and there seems no alternative but to seek for the types ancestral to Peruvian early civilizations on Peruvian soil. The tropical forest of eastern South America is a most unlikely source, for it was and is peopled by savage, ill-cultured tribes. Certain authors have sought to derive the high civilizations of Middle America from Polynesia, ultimately from Asia and the Mediterranean. But these theories are hopelessly fantastic—Peru boasts of a civilization which goes back a thousand

years before the Pacific islands were populated.

One feature of the archaeological remains in Peru which makes the reconstruction of its prehistory very difficult is the rarity, often complete lack, of stratified refuse deposits. First applied to the Paleolithic remains of Europe, historical reconstruction by means of digging in stratified deposits has been used with great success in our Southwest, in Mexico, and elsewhere. Obviously where there is an accumulation of refuse the older objects lie in the lower strata, the more recent in the upper.. But in Peru, the bulk of the population seems to have lived in small scattered settlements in the arable areas where subsequent cultivation has destroyed the remains, or along the margins of the valleys where occasional floods, excavations for graves, or other causes have disturbed the accumulations of débris. A great portion of refuse seems to have been systematically saved to be used as a tempering or binding agent in the manufacture of adobe bricks. Because of the absence or rarity of other than minor refuse heaps, the main dependence on chronological determination has been on cemetery and grave association.

It is for this reason that there are so many "ifs," "probablys" and "seems" in any cautious reconstruction of the development of culture in Peru. Grave associations as the key to interrelationships are dependent upon careful and exact, often minute, data and well-documented evidence. A thousand graves may be opened before one is found that contains items bearing on the linkages between two periods or even on the minor developments within a period. As stated before, most collections from Peru are sadly wanting in just this type of documentation. Nearly all have been made by purchases from the "huaqueros"—the professional grave plunderers of Peru who throw away or destroy all objects not directly salable. Until a long series of carefully planned and executed researches are made, our knowledge of even the more splendid epochs promises to remain in its present obscure, guessed-at state.

A HOUSE OF THE RUINS OF TORTURA CUNGA, NEAR UCHUMARCA

Both round and square houses occur in this ruin. The corbelled dome roof of the structure shown here rises high above the squared walls. Sheep are now kept in the ancient llama corral a short distance away

At the time of the Spanish conquest, Peru seemed ready to enter upon a new era of development. We have already mentioned how the Inca Empire had welded together a large number of smaller states, related yet distinct in their civilizations. Perhaps the best of the arts of these would have been conserved and unified. Trade by sea with Central America and Mexico seems already to have been established. Peruvian civilizations excelled in the manual arts, those of the Maya area in the intellectual, and a closer contact would have stimulated developments in both areas. The northerners had already benefited by borrowing knowledge of the bronze technique, perhaps the Incas would have learned the art of writing and erecting dated monuments. A slight expansion to the north would have brought the Inca and Chibcha civilizations into contact and this might have resulted in still greater acceleration.

The civilizations of Middle America—Aztec, Maya, Chibcha, and Inca—had advanced far without possessing certain rather fundamental arts and inventions. Nowhere in Middle America was iron known. Bronze furnished a substitute but is inferior for most purposes. Transport was handicapped by lack of knowledge of the wheel. The task of moving the great stones of the megalithic structures, some weighing twenty or thirty tons, was accomplished without it. The New World was lacking in any animals as tractable and sturdy as the horse and ox of the Old World. The llama was used as a pack animal but it can carry only small burdens, is not adapted for riding and is not suited to low altitudes. The Aztec and Mayas possessed the rudiments of writing, an elaborate system of numeration, and a splendid calendric scheme, but knowledge of them had only begun to filter into South America. Splendid as were the achievements of the civilizations of prehistoric Peru in the way of agriculture, the arts, and political and social schemes, they were hindered by ignorance of these basic traits. Except for these they were perhaps as civilized as their European conquerors. But take these traits—writing, iron, the wheel—out of our own cultural scheme and we find ourselves unable to carry on our modern life. The wonder is that the ancient Peruvians, lacking these, had progressed so far.

A Decorated Wall in a Room at La Centinela

THE ASTEROIDS

The Thousand Minor Planets that Float in Space Between Mars and Jupiter
Astronomers' Plans for Studying Eros at Its Closest Approach to the Earth

By WALLACE J. ECKERT
Department of Astronomy, Columbia University

THE discovery of the asteroids or minor planets instead of the missing major planet in the space between Mars and Jupiter was another one of those happy disappointments where a scientist failed to find the thing for which he was looking, but found instead something unexpected and much more valuable. Had another major planet been found instead of the fifteen hundred or two thousand minor planets which have been discovered, the loss to Astronomy probably would have been great.

Kepler had shown how to calculate a planet's distance from the sun from the number of days required for the planet to travel around the sky; and on examining the distances thus obtained for the various planets he noticed that they increased in a regular manner, with the exception of an unusually large gap between Mars and Jupiter. This gap was even more noticeable from Bode's Law, which is a simple empirical formula for representing these distances. The application of this formula consists simply in writing a series of fours as shown in the table at the bottom of this page and adding to each successively numbers 0×3, 1×3, 2×3, 4×3, ———. The sums thus obtained when divided by ten give the distances of each of the planets in terms of the earth's distance, the so-called astronomical unit.

COMPARATIVE SIZES OF LARGE MINOR PLANETS AND THE MOON

The diameters of these four asteroids were measured with the 40-inch telescope of the Yerkes Observatory. Reproduced from "The Splendour of the Heavens" by T. E. R. Phillips and W. H Steavenson, through the courtesy of Robert McBride & Co.

This table shows excellent agreement with the exception of the fact that there is no planet at a distance 2.8. This was immediately noticed, and the agreement for the known planets was sufficient to persuade astronomers to make an organized search for the missing one.

Ceres, the first asteroid to be dis-

	Mercury	Venus	Earth	Mars		Jupiter	Saturn	Uranus
	4	4	4	4	4	4	4	4
	0	3	6	12	24	48	96	192
	4	7	10	16	28	52	100	196
Bode's Distance	0.4	0.7	1.0	1.6	2.8	5.2	10.0	19.6
Actual Distance	0.39	0.72	1.0	1.5		5.2	9.5	19.2

Courtesy of Yerkes Observatory

TRAIL OF THE ASTEROID EGERIA

The elongated white object just above the middle of the picture is the trail of the asteroid. This photograph was taken November 15, 1904, by Mr. Parkhurst, with the 2-foot reflector at Yerkes Observatory

covered, was found by Piazzi on the first night of the Nineteenth Century and was hailed as the missing member of the solar system, though its smallness was rather disappointing. Three more turned up in the next six years and gave ample evidence that these small objects were of a new and unexpected nature. The search has been continued until the present time and more are being found every year.

The asteroids are small and faint and so are hard to distinguish from the near-by stars. The first ones were discovered by accurately measuring the positions of all the fixed stars in a given region and comparing them with the positions of the same stars as determined at some other time. The planetoids which move with respect to the stars will have different positions from day to day. Since the invention of photography the task is greatly simplified, for now it is only necessary to take a long-exposure photograph of a given region. On the plate thus obtained the star images will appear as round dots while any moving object, such as a planet, will leave a streak. The illustration on page 28 is a reproduction of a photograph of the asteroid Eros taken in 1894. The photographic method of search has been so effective that well over a thousand have been found and observed over long enough intervals of time to have their orbits computed, and several hundred more have been found and lost again. Curiously enough the average distance turns out to be approximately the 2.8 of Bode's Law.

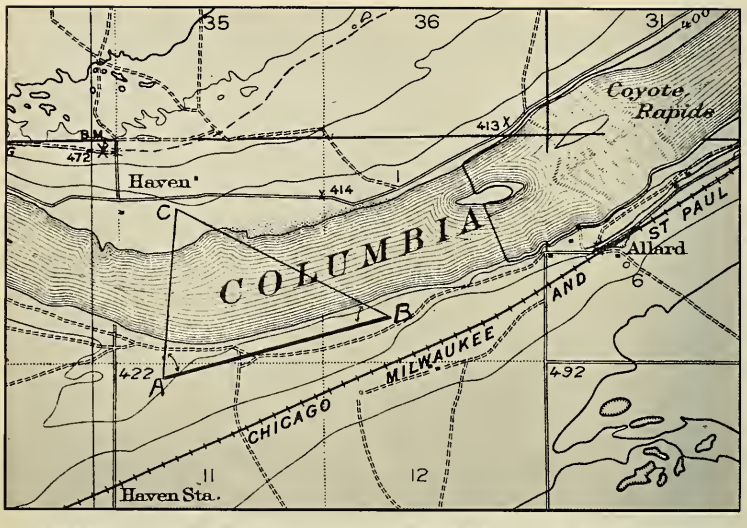
These bodies are so small that it is impossible to see any details of their surface even with the most powerful telescopes. The diameters of the four largest ones have been measured by Barnard and are shown in comparison to that of the moon in the illustration on page 23. The light from these objects is all reflected sunlight, so on the assumption that their reflecting power averages about the same as the four larger ones whose sizes have been measured, it is possible to estimate the size of the smaller ones from the amount of light they reflect. Such observations indicate that about a dozen have diameters between 100 and 150 miles, about one hundred and fifty have diameters greater than 50 miles, and most of them range from 10 to 50. Some are even smaller than this, and since the brightest and hence the biggest ones are discovered first, it is not unlikely that there are many very small objects as yet undiscovered floating in this region of space. Their masses are also minute: the combined mass of all the asteroids both known and unknown is probably between 1/500 and 1/1000 of that of the earth. The force of gravity on a body depends upon the mass, and for one of the smaller asteroids is so feeble that a boy standing on one of them could throw a stone into space with such speed that it would never return but continue to circulate around the sun as a new asteroid. Of course such a small body could not hold an atmosphere.

Since these objects are so small that the diameters of only the largest can be

Courtesy of Yerkes Observatory

TWO ASTEROID TRAILS

Two separate trails can be distinctly seen here, one represented by an elongated streak thinner than the other. The brighter trail is that of Bellona. Photographed December 28, 1908, with the 10-inch Bruce lens, and an exposure of one hour



DETERMINING THE DISTANCE TO AN INACCESSIBLE POINT BY TRIANGULATION
Here the "base line" AB is measured as are also the angles at A and B. From these measurements the distance BC is computed. The same method is used to determine the distance of a planet

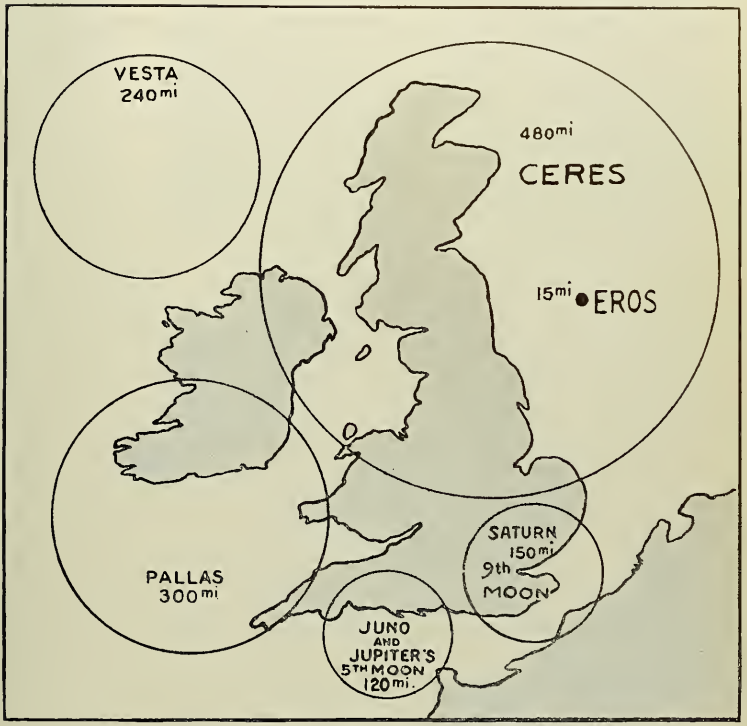
measured, it is hopeless to try to see any surface details, and they therefore have practically no telescopic interest. The question of life on them can be dismissed even more easily than in the case of our moon because of the lack of atmosphere. Their interest lies in the nature of their orbits and in their great importance in such questions as the origin and the stability of the solar system, for any theory which is to explain the past history of the major planets cannot ignore the swarm of similar though smaller bodies.

The orbits or the paths in space of these objects present a great variety of interesting cases for the celestial mechanician. Each of the major planets revolves about the sun in an ellipse which is nearly circular and all of which lie very nearly in the same plane; and for these reasons present comparatively simple problems. The asteroid orbits, on the other hand, may be inclined to this plane by as much as 48° and be so far from circular that the greatest distance from the sun is five times the least. While these orbits practically all lie between the orbits of Mars and Jupiter, their sizes, shapes, and positions in space are so varied that they form a complete tangle. If each orbit were a material hoop, and any one was lifted out of place it would take along with it all the others as well as those of Mars and Jupiter. The illustration on page 30 shows the orbits of five of them, and it is easy to imagine the effect of a thousand more crowded into the same region of space. With such an assortment at hand it is possible to find one to test almost any theory.

Probably the most useful orbit for a special purpose is that of Eros, with which can be obtained the scale of miles of the solar system, and thence of the sidereal universe. The laws of Kepler and later that of Newton made it possible to draw a

map of the solar system with all the relative distances correct, but with the scale of miles absent. To make such a map generally useful it is necessary to determine one distance with accuracy, and it turns out that the distance from the earth to Eros is the most suitable for this purpose.

The method of measurement employed is that known as geodetic triangulation used by surveyors in determining the distances of inaccessible points. If, for instance, the surveyor wishes to measure the distance to the opposite side of a river, he chooses two accessible points A and B (illustration, page 26) on his own side and a third point C on the opposite side. After measuring the angles at A and B and the distance AB, called the base line, he can compute the distance BC. The same method is used in astronomy for determining the distances of the sun, moon, and planets, and here the points A and B are two astronomical observatories situated at remote points of the earth, and the inaccessible point C is the distant celestial



ASTEROIDS COMPARED WITH THE BRITISH ISLES

The sizes of the four brightest asteroids are here shown in relation to a map of the British Isles. In part after A. C. D. Crommelin. Reproduced through the courtesy of Robert McBride & Co. from "The Splendor of the Heavens"

PHOTOGRAPH SHOWING MOVEMENT OF AN ASTEROID AMONG THE STARS

The camera is carefully guided on the stars so that their images are small round dots. The asteroid in the center of the plate moved during the exposure and so left a trail

object. The difficulty in measuring the distance of a planet is that the distance is very great in comparison to the length of the base line. The two observatories are chosen as far apart as possible, but this must necessarily be less than 8000 miles. Accurate measurement, therefore, requires the nearest possible object, and it so happens that the planetoid Eros at times comes closer to the earth than any other planet.

The distance at any time depends upon the positions of the earth and of Eros in their orbits, and hence there are rare occasions when the two are unusually close together. Such a close approach is the one which occurs during the present winter. On January 30 the distance is about 16,200,000 miles which is somewhat greater than the least possible value of 13,840,000 miles but which is less than it has been during this century. Of course, many observatories with the proper kind of equipment have planned to make observations to determine this distance. The observations will extend over several months, and the reduction will probably take several years: the end in view being to add another decimal place to the present value of the "solar parallax" or the scale of the solar system. The thing which limits the accuracy of this determination of distance is the fact that at the time of close approach Eros is moving very rapidly with respect to the earth, and to be able to compute its relative position in space with the necessary accuracy, the time of each observation must be very accurately known. In order to obtain suitable photographs of Eros and the near-by stars with which to compare its position, the exposure time will be comparatively long, and hence the mean time of exposure which depends upon such uncertain things as passing mist, etc., can be determined with a

limited accuracy only. To make matters worse for those observatories best suited for the undertaking, namely those situated north and south of each other, the object is moving almost due south at the critical time, and so any error in the time will enter directly in the results. The illustration on this page is a drawing by Crommelin to show the apparent path of Eros from October to March, and shows the path to be almost due south during the month of January.

While the orbits of many individual asteroids show striking properties, the entire group taken as a whole are even more interesting. One such peculiar property is the fact that out of a thousand there are practically none which have periods commensurable with that of Jupiter. This is explained by the fact that if an asteroid had a period of ½, ⅓, ⅔ etc. of that of Jupiter, it would, after a few revolutions, be back in the same part of its orbit when it passed Jupiter and the gravitational disturbances due to that body would be always in the same direction, with the result that the orbit of the asteroid would be altered until this condition no longer existed. Curiously enough those which have periods exactly equal to that of Jupiter have stable orbits and continue to oscillate about one or the other of the two points which with the sun and Jupiter form an equilateral triangle. Seven such asteroids are known and constitute the so-called Trojan Group.

Another striking feature of the orbits taken as a whole is that the orientation in space of the individual ellipses tends to be the same as that of Jupiter.

The question of the origin of these bodies has received considerable attention, but the problem is by no means solved.

Two alternative hypotheses advanced are

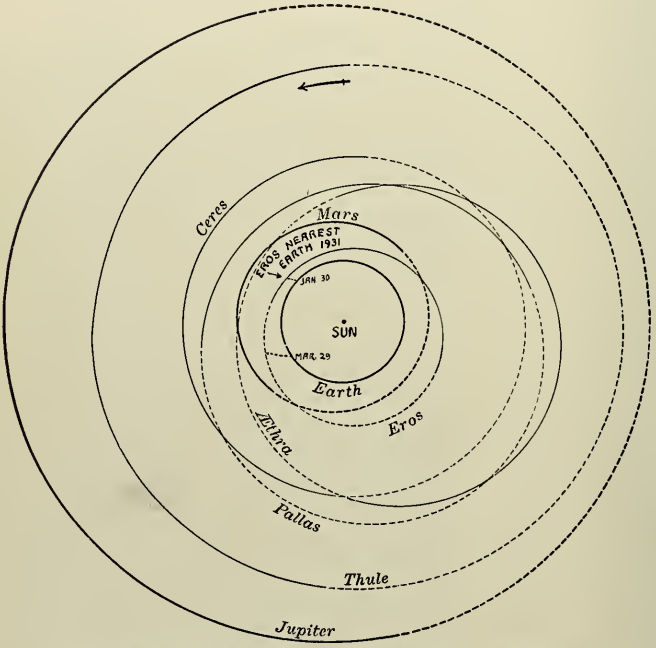
THE PATH OF EROS AMONG THE STARS

Opposite each date appears the distance of the asteroid from the earth in millions of miles. After A. C. D. Crommelin. Reproduced through the courtesy of Robert McBride & Co. from "The Splendor of the Heavens"

(1) That they are the débris of a planet which exploded.

(2) That they are the makings of one that never formed.

Many attempts have been made to verify the former by carrying back the orbits to show that they all intersected at some past time, but the effects of the other planets, especially Jupiter, are so great that such a phenomena could probably not now be recognized. There are certain peculiarities of the orbits which would not be changed by the effect of Jupiter, and these seem to indicate that most of the asteroids belong to about five distinct families. The existence of these five families may indicate the origin of the asteroids from the disruption of five larger bodies or it may indicate five principal condensations in a ring of matter which has thus showed a tendency to collect and form a planet.



THE ORBITS OF THE MINOR PLANETS AND JUPITER

Mars and the earth drawn to scale. The planets move around the sun in the direction of the arrow, and as seen from the north side of the plane of the earth's orbit. Parts of orbits lying below this plane are shown in dashed lines. The orbit of Eros crosses that of Mars, but the planes being inclined to each other, the two bodies are actually many millions of miles apart at the points where the orbits apparently cross

RACE MIXTURE IN HAWAII

The Story of the Polyglot Inhabitants of Hawaii, with a Discussion of a Few of the Resulting Population Problems

By H. L. SHAPIRO

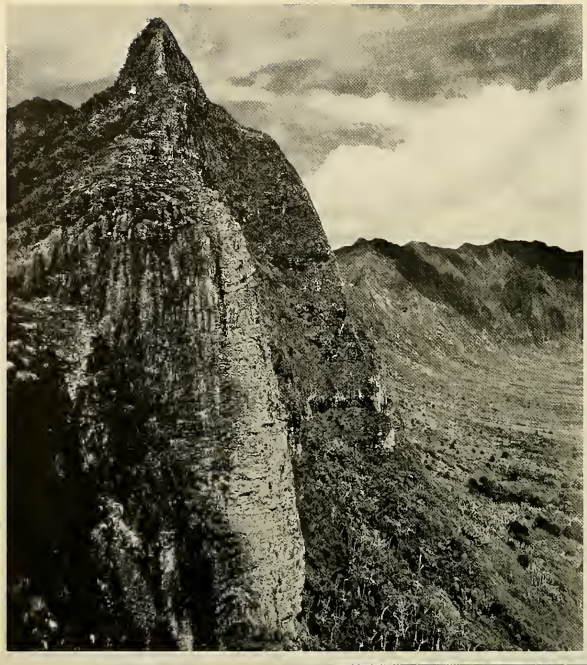
Associate Curator of Physical Anthropology, American Museum

NOTHING is so sad to the romanticist nor so fruitful for the scientist as change. The student of nature observes it everywhere as the objective expression of the very laws he seeks to discover. Yet we cannot help but contemplate with regret the destruction of a simple and harmonious culture by a more complex and alien civilization. In few places has so relatively great a revolution in population and culture taken place as in the Hawaiian Islands within the brief span of a century and a half since their discovery by Captain Cook in 1778.

We may best see what has occurred by contrasting the conditions existing in 1778 with the situation at the present time. When Cook first visited the islands, he estimated that they were comfortably populated by about 400,000 natives of the Polynesian race—a stock full of health and vigor, admirably adapted to an outdoor, semi-aquatic life, and splendid in its physical development. Local sources supplied the simple needs of the population, and without too much labor there were materials for a joyous and complete existence. Food, consisting mainly of fish, pork, a few vegetables and tropical fruits, was abundant. Houses were neatly and easily constructed of thatch. From the bark of the paper mulberry tree tapa was manufactured, and provided an adequate clothing, the beauty and quantity of which depended upon individual skill. There were some restrictions imposed by religious ritual and social custom, but they were negligible in the daily life of the Hawaiian.

Today, after a serious decline in the native population, the 1929 Report of the Registrar General estimates about 357,000 inhabitants for the Hawaiian Islands. But only some 20,000 of these are Hawaiians. The major replacement has been by Japanese, who now number 137,000. In addition there are 63,000 Filipinos, 38,000 Americans and others of north European origin, 29,000 Portuguese, 25,000 Chinese, and smaller contingents of Spaniards, Porto Ricans, and Koreans. An important element in this heterogeneous conglomeration is the hybrid group which has inevitably arisen from contact between these various stocks. The dignified simplicity of the old life has disappeared except as degraded remnants in remote corners of the islands; and in its place is a commercial, mechanical civilization which, having destroyed the beauty of a more primitive existence, has made the graces of its own culture unattainable for the vast majority of those who support it.

But the important fact is that a large group of people has been virtually dispossessed and replaced by new stocks which have been thrown into a more intimate contact with each other than they have ever before experienced. Not only has Hawaiian culture been grafted with European civilization, but on to the same tree have been added the cultures of the various people who have immigrated into the islands. Consequently a situation



Photograph by Burton Holmes Courtesy of Matson Navigation Co.

THE PALI

The cliffs of the Pali are among the most magnificent of the many beautiful scenes on the island of Oahu. According to a legend, Kamehameha drove an opposing army over these cliffs to their destruction

A ROYAL FEATHER CAPE

These capes are made of small feathers, usually red and yellow. In former times they were insignia of rank. The headgear which is reminiscent of a Greek helmet was also covered with feathers

Photograph by Underwood and Underwood

Courtesy of Matson Navigation Co.

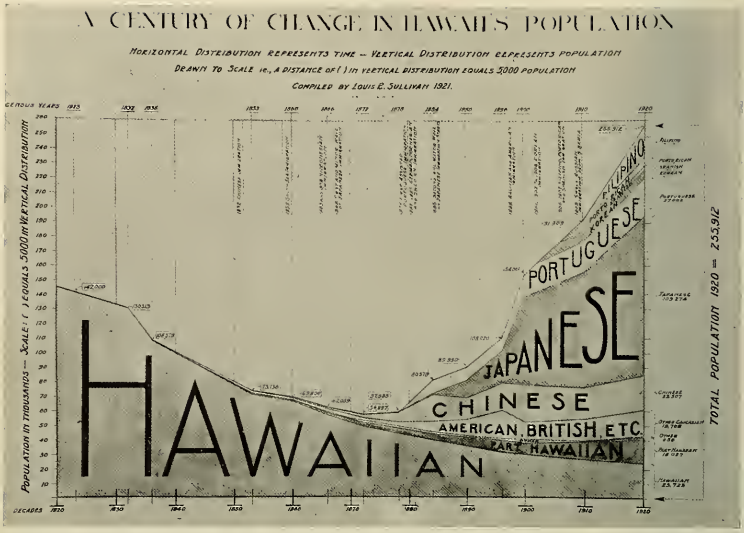
A CAÑON ON KAUAI

Kauai is the fourth largest island in the in the Hawaiian archipelago, and is considered the most beautiful of the group. This was the first of the Hawaiian Islands to be visited by Cook in 1778

A NATIVE HAWAIIAN HOUSE

The type of house shown below is no longer used in Hawaii, although it is ideally suited to the climate. The thatch is laid over a framework of light poles lashed together

Photograph from Ewing Galloway



A GRAPHIC PICTURE OF HAWAII'S POPULATION

The changing racial composition of Hawaii from 1820 to 1920 is graphically illustrated above. Beginning in the last quarter of the Nineteenth Century, the islands have received large numbers of European and Oriental immigrants

has developed which is profoundly significant for all students of population problems. For in Hawaii it is possible to observe the result of various kinds of culture contact and to note changes in old conservative groups such as the Chinese. Equally interesting is the stability of certain culture traits in spite of economic and social pressure. For example, the Japanese women have remained faithful to their native costumes and diet, while their daughters born in Hawaii have largely abandoned the kimono except ceremonially. Rice has been adopted by Hawaiians as an important element in their diet, while the native poi has been added to the dishes of the foreign groups.

Just as the physician finds answers to his problems of the normal in the abnormal, so may we expect to discover in these unusual conditions in Hawaii clues to the perplexing problems of continental populations. With commendable zeal the University of Hawaii has inaugurated a series of researches on some of the many problems which demand solution. In one aspect of this research—race mixture—the American Museum of Natural History has welcomed the opportunity to cooperate.

To define more clearly what we may hope to achieve as a result of this investigation, it might be helpful to outline briefly the racial history of Hawaii which has produced the present conditions so rich for students of human genetics. Up to 1820, cóntacts between Hawaiians and Europeans were intermittent and scattering. Early voyagers such as Cook, La Perouse, Vancouver, and others, made brief visits to these islands. And following them came the early whalers and sandalwood traders. Although a numerous

Photograph from Brown Bros.

A NATIVE LUAU

The principal dish in a native feast is roast pig. Hawaiians are always ready to enjoy this delicacy, which is justly famous

Photograph from Underwood and Underwood

EATING POI

Poi is a staple Hawaiian food made from baked taro. It is slightly fermented and varies in consistency, but is usually soft and viscous and requires considerable skill to manipulate gracefully

Photograph by Burton Holmes *From Ewing Galloway*

A NATIVE OVEN

Hawaiian feasts or luaus are properly baked in outdoor ovens, which are simply holes in the ground in which red-hot stones are placed and then covered to preserve the heat

mixed progeny undoubtedly sprang from these casual contacts, a more serious result was the introduction of European diseases which decimated the native inhabitants. In this respect the history of Hawaiian intercourse with Europeans repeats the monotonous story of other Polynesian islands. In the forty years after the discovery of the Hawaiian Islands by Captain Cook the population declined with alarming rapidity. Even if the estimate of 400,000 inhabitants in 1778 is slightly high, nevertheless the missionaries' estimate of only 142,050 in 1823 indicates an exceedingly rapid depopulation. The writings of early observers such as Mr. Bishop and David Malo, a Hawaiian, picture the ravages of syphilis, alcohol, cholera, measles, smallpox, and other introduced scourges. War also contributed largely to the steady decrease of population. For soon after the discovery of the islands, Kamehameha I began his famous series of conquests by which he consolidated all the islands into one kingdom over which he reigned. The following table gives the official census returns for the years 1832 to 1860.

Year	Foreign	Native	Total
1832		130,315	130,315
1836		108,579	108,579
1850	1,962	82,203	84,165
1853	2,119	71,019	73,138
1860	2,716	67,084	69,800

These figures vividly show the extent to which the native population decreased even before the major immigration of foreigners began.

The earliest white settlers recorded were Isaac Davis and John Young. These men were sailors from a ship which had been wrecked about the year 1790

Photograph Courtesy of Matson Navigation Co.

FISHING WITH SPEAR AND NET

A favorite method of catching fish in Hawaii is by spearing Skillful fishermen are able to dive into the sea and transfix their prey under water

Photograph from Underwood & Underwood

SURFING AT WAIKIKI

The most characteristic sport in Hawaii is surfing. In this picture the great skill necessary to ride the surf is evident. The young men spend much of their time in the water, engaged in this exciting game

Photograph from Publishers' Photo Service

A HAWAIIAN CANE FIELD

Sugar is the principal source of wealth in the Hawaiian Islands and a large part of the population is concerned in its production

by natives who plundered her and slew all the crew except these two men, who were taken under the protection of the king and later became influential in island affairs. But the first considerable invasion came in 1820, when the first party of missionaries arrived from Boston, fired with zeal to convert the heathen savage to Christianity. The launching of this endeavor is said to have been the result of a visit of Obookiah, a native Hawaiian, to New Haven in 1808, where Mr. Edwin W. Dwight found him "sitting on the doorsteps of one of the buildings [of Yale College], weeping because the treasures of knowledge were open to others, but were not open to him." Soon after, Hiram Bingham and Asa Thurston, two young ministers, aroused enthusiastic interest in missionary efforts in Hawaii. Accompanied by a group of zealots, they sailed in 1819 for Hawaii. In the succeeding thirty-four years, they were followed by thirteen other parties from New England. Very early the affairs of the islands fell into the hands of the missionaries, who attempted to recreate another New England in this tropical setting. The old Chamberlain house, solidly constructed of stone, still stands in Honolulu —a veritable New England farmhouse and a monument to the unswerving loyalty of the missionaries who would not compromise with a softer and more gracious climate. That phase has fortunately passed, except for a lingering sentiment among the descendants of the missionaries for the home of their ancestors.

Until the decade from 1860 to 1870, the small foreign population was mainly composed of Americans. But the prosperity of the sugar industry injected a new factor which has been responsible for the present racial complex in Hawaii. The following figures are instructive of the growth of sugar in the economy of the islands. According to Anderson, 257 tons

Photograph Courtesy of Matson Navigation Co.

SCALING A COCOANUT TREE

Natives are able to climb the almost perpendicular trunk of the cocoanut tree, to reach the fruit forty or fifty feet above the ground

AN EXAMPLE OF AN INTRODUCED CULTURE

The water buffalo is native to southern Asia but has been brought to Hawaii to be employed in the cultivation of rice

Photograph from Ewing Galloway

HAWAIIAN TYPES

These photographs illustrate some of the types found among Hawaiians of unmixed origin. Note the differences between the two women figured above

RECENT ADDITIONS TO HAWAII

The newer immigrants to Hawaii.—Upper left-hand corner, Portuguese; upper right corner, Chinese. Below, on the left, Filipino, and on the right Japanese

of sugar were exported in 1814. This figure increased to about 2647 tons in 1863. The 1927 crop of sugar cane yielded 811,333 tons. Native Hawaiian, as well as other Polynesian and Micronesian, labor in the increasing acreage of the sugar plantations proved unsatisfactory and insufficient for the demand for cheap and efficient workers. Anderson reported that in 1864 Chinese were being actively discussed as a source for cheap labor. Although a few Chinese had reached Hawaii as early as 1852, some from Californian gold fields, it was not until the decade of 1870–80 that large numbers were imported to work in the cane fields. When, after 1876, sugar became the principal source of the wealth of Hawaii as a result of the reciprocity treaty negotiated between the Hawaiian monarchy and the United States, the demands for labor became ever more pressing and various groups were imported in increasing numbers. Portuguese, in 1878, entered in as an assisted immigration. A small group of Scandinavians were introduced in 1881–1885. Toward the end of the last century Japanese were induced to migrate to Hawaii in such large numbers that they soon became the dominant group in size. Koreans about 1901 and a few years later Spaniards and Porto Ricans entered in smaller numbers. The most recent people to be imported are the Filipinos, who are at the present time the principal source of labor for the sugar planters.

Photograph by John Edwin Hogg *Courtesy Matson Navigation Co.*

A JAPANESE LABORER

The most numerous group in Hawaii is the Japanese, who form an industrious and ambitious section of the population

It has been in this fashion, in response to demand for labor on vast sugar fields, that the present rapidly increasing population was introduced to Hawaii. As the earlier of the foreign stocks tended to set themselves up in other occupations, new groups were sought to replace them in the fields. The Chinese, for example, are no longer employed as field labor.

Photograph by Burton Holmes *From Ewing Galloway*

A JAPANESE TEMPLE

Shinto temples such as these may be found in Honolulu. One can find many examples of foreign culture transplanted in Hawaii, where they frequently become modified

TYPES OF HAWAIIAN MIXTURES
The man at the left is Hawaiian–Chinese; the woman is Hawaiian-Japanese

CHILDREN OF HAWAII
These three brothers and sister are the offspring of German and Japanese parents

TYPES OF HAWAIIAN MIXTURES
The boy at the left is Hawaiian-American; the girl is Hawaiian-Chinese

A FAMILY GROUP OF MIXED ORIGIN
The father is German; the mother (at the extreme right) is Hawaiian

For the most part they are merchants in the towns, and a certain proportion have been educated in the professions which they practise successfully. A similar movement is discernible among the Japanese who, as they adjust themselves to new opportunities, leave an agricultural employment they consider inferior.

At the present time the following groups are found in Hawaii in appreciable numbers: Hawaiian, Chinese, Japanese, Korean, Filipino, Porto Rican, Spanish; English, Scotch, German and other north Europeans, and Americans of diverse origin. Illustrations of some of these types will be found on pages 40 and 41. In these people, two major racial groups are represented: the white stock by Americans and Europeans, the Mongoloid by the Chinese, Koreans and Japanese. The Porto Ricans and some Portuguese have, in addition to their south European blood, negro admixture in varying degree. The Filipinos in Hawaii are probably of mixed origin but principally of Malay derivation. The Hawaiians themselves are by no means of pure descent. Recent studies indicate that they have both Mongoloid and Caucasian racial traits among their group characteristics. But the mixture is very old and may be regarded as a subtype.

Although mixture between these various stocks was inevitable and might have been foreseen, the system of labor hire increased the mixture to a much greater extent than might have normally taken place. The labor imported consisted almost entirely of young unmarried men or of men without their wives. The natural result of such a situation was a large number of marriages with Hawaiian women, who are without race prejudice and mingle as easily with one group as with another. The Registrar General's report for 1929 gives these figures for the mixed groups: 10,598 Asiatic-Hawaiian and 16,687 Caucasian-Hawaiian. Both these groups combined constitute roughly about 8 per cent of the population. In spite of this high percentage of hybrids, there is a real tendency to group solidarity and when it is possible to select wives from their own group, the men tend to do so.

The attitude in Hawaii toward racial miscegenation has also been effective in the growth of the hybrid population. Very little prejudice has been directed against individuals of mixed blood. In fact, it is said that some Hawaiian blood is a distinct advantage politically. Consequently the disabilities so frequently attached to mixed unions in other parts of the world are absent here, and marriages between high-grade individuals of different races are more common and more successful. At the same time the more conservative and cohesive groups such as the Japanese and Chinese still regard with disfavor marriages outside the group, especially since the sex ratio has become more nearly equalized. Although race contacts are on the whole very friendly in Hawaii, the picture has been frequently idealized. Each group tends to be judged by the others who form a more or less crystallized opinion about it. It is interesting to hear the curiously monotonous judgments rendered on various groups, often based on misconceptions. But this is a natural phenomenon and need not elicit any particular surprise.

In spite of the favorable conditions which exist in Hawaii for studying the results of race mixture, comparatively little work has been done on the subject. In 1920 Dr. Louis R. Sullivan, of the American Museum of Natural History, began collecting data for an exhaustive investigation, but unfortunately his untimely death prevented the execution of his program as projected. Somewhat earlier, in 1916, Dr. A. M. Tozzer, of Harvard University, made, I believe, the first anthropometric examination of

hybrids in Hawaii. Later, in 1920, he added more data, all of which were turned over to Dr. Leslie C. Dunn, now of Columbia University. The principal part of the material consisted of pure Hawaiians and Hawaiian-"White" crosses. Unfortunately the number of subjects obtained was insufficient in some of the classifications, but enough evidence was secured to reveal the potentialities of further studies. Doctor Dunn, in his paper "An Anthropometric Study of Hawaiians of Pure and Mixed Blood," published by the Peabody Museum of Harvard University, concluded that offspring of Hawaiians and Europeans resemble the Hawaiians in corpulence, in brachycephaly (roundheadedness), in breadth of nose and in the dark pigmentation of eye, hair, and skin. On the whole, the first generation progeny of such crosses are more like the Hawaiian. Such European traits as blue eyes, fair pigmentation, and narrow noses reappear in the second and later generations as recessive characters. The hybrid group showed evidence, as we should expect, of greater variability. Some evidence for hybrid vigor among the first generation offspring is seen in their increased stature. Pure Hawaiians average about 171.3 cm., North Europeans about 172 cm., while the hybrids have a mean stature of 173.5 cm. A similar phenomenon occurred as a result of a cross between Tahitian women and the English mutineers of the "Bounty."

Photograph by Fred J. Halton *From Brown Bros.*

SCENE NEAR WAILUKU, MAUI

A lover of nature will find many beautiful vistas in the Hawaiian Islands. The islands are volcanic, rugged, and cut by many spectacular valleys

The study of human genetics for which the University of Hawaii is sponsor was begun last summer and is expected to continue for two years. The group which is being investigated first is the Chinese-Hawaiian. There are several reasons for this selection with which to begin a series of similar studies on other groups. The great majority of Chinese-Hawaiian crosses do not antedate 1870 and are

therefore still within the memory of living people. The Caucasian-Hawaiian crosses, on the other hand, frequently are so old that the essential genealogical data is obscured and frequently lost. In addition, the Chinese reached Hawaii before the present enormous diversity of races had been achieved, and consequently many of the Chinese mixtures were with Hawaiians unmixed with other strains. A further advantage in the Chinese-Hawaiian group is that it has been established long enough for a second generation to have reached maturity. Therefore a full range of Mendelian combinations exist and permit a more complete analysis than is possible among the Japanese-Hawaiians, who are few in number and are still largely of the first generation. Finally, the number of Chinese-Hawaiians is great enough to provide adequate material.

It is the hope of the author that such a study will enable him to make analyses of the genetic behavior of human traits and that, together with psychological, sociological, and physiological studies, a complete picture of a mixed group in its biological and social setting may be presented.

Photograph from Brown Bros.

A bee at work—a vital aid in the biology of the higher plants

INSECTS vs. THE PEOPLE

The Relationship of Insects to the Maintenance of Life on the Earth, and Their Contributions to the Processes of Nature

By FRANK E. LUTZ
Curator, Department of Insect Life, American Museum

FOR hundreds of years there has been a case before the Court of Public Opinion. It is the case of Insects vs. The People. From the nature of things, the insects have had nothing to say about it and, unfortunately, they have had very few witnesses or active advocates on their side.

One of the charges against insects is that they destroy or appropriate to their own use about twenty per cent of our fruit crop. In this connection I beg to present to the Court the following hypothetical question:

Suppose we had never had any apples, pears, plums, peaches, oranges, strawberries, or anything of that sort. Suppose, however, that a group of strangers brought us delicious samples of a great variety of such fruits and told us that they, the strangers, could make it possible for us to grow all of these things. Suppose that, in return for this possibility which only they could grant, they asked that a twenty per cent commission be paid to their relatives. Does the Court think that this would be an unfair proposition? I am sure that we would be glad to accept the bargain and then, later, we would try very hard to beat the relatives out of their twenty per cent.

Although I have stated this in more figurative language than Science is apt to use, it expresses rather exactly the relation between insects and our fruit crop. There is no disputing that certain insects do immense damage, in the aggregate, to our orchards, but it is not fair to forget that we would not have any of those orchards if it had not been for other insects that carried pollen from flower to flower, enabling the plants to set the seed in connection with which the fruits develop.

This process of carrying pollen from one flower to another is called cross-

PEONIES IN BLOOM

Without the beneficial activities of certain insects—bees, flies, butterflies, and others——the most beautiful of our flowers would largely disappear. We owe to insects not only the fragrant gems of our gardens and greenhouses but also those of our waysides and meadows

A CEYLON BLACK PEPPER VINE

Plants with inconspicuous flowers such as the grasses, secure cross-pollenation by inefficient, wasteful methods. Those plants that attract insects have their pollen carried by these insects to other plants with a minimum of waste

A FLOCK OF NEW ZEALAND SHEEP

When white settlers introduced sheep into New Zealand the animals did not thrive owing to the absence of clover. Red clover was introduced, but lacking a cross pollenizing agent, did not produce seed. Finally bumblebees were imported. Now sheep and clover are firmly established

Publishers Photo Service

A TRINIDAD COCOA TREE

Our fruits and berries, as well as flowers, benefit by the activities of insects. Without insects the seeds found in these pods would not have formed, and chocolate and cocoa would not be available for use

© *Publishers Photo Service*

A NEW ENGLAND APPLE TREE IN BLOOM

Every nature lover has noticed the activities of bees about blooming apple trees. Their labors result in the enormous crops of apples that are an important factor in agriculture

fruit trees and berry bushes have flowers which are attractive to hundreds of kinds of native bees, to flies, to butterflies, and to other insects. These insects, flying directly from flower to flower accidentally, so far as they are concerned, carry pollen on their bodies and bring about the cross-pollenation which makes possible future generations of the plants visited.

If we were asked what fabrics we owe to insects most of us would quickly mention silk but we would be likely to stop there. In the Court of Public Opinion we have heard much about the cotton boll weevil, the pink boll worm, and perhaps half a dozen other insects which injure cotton plants, but mention is rarely made of the scores of insects busily flying from cotton flower to cotton flower carrying the pollen that enables the plant to set the seed from which we get not only one of our most important fabrics but a literally astounding lot of by-products made from cotton seed.

pollenation in contrast to self-pollenation, the process by which certain flowers fertilize their seed with their own pollen. Whatever may be the possibilities of self-pollenation either as a regular practice of some plants or as a last resort with others, cross-pollenation is exceedingly important in the biology of the higher plants. Plants with inconspicuous flowers, such as the grasses, and trees like maples and oaks, secure cross-pollenation by the inefficient, wasteful method of producing vast quantities of pollen and allowing the wind to blow it over the landscape on the chance that here and there a grain will fall on another flower. Plants such as our

Linen in all of its varieties is woven from flax, the fibers of insect-pollenated plants. But the fabric which shows in the most interesting way both the complexity of biological relations and fundamental importance of pollenating insects is wool.

Sheep may be raised exclusively on grasses, such as timothy, that are wind-pollenated, but no practical sheep-grower would try to do it. He wants clovers of some sort and all kinds of clover, includ-

ing alfalfa, are insect-pollenated. The sheep-growers of New Zealand imported red-clover seed to improve their pastures. The red clover grew, but the New Zealand sheep-men could not get any seed from their clover plants for the next year's crop because New Zealand did not have the proper insects to pollenate red clover. Bumblebees were introduced from England. These insects became established in New Zealand and are now year after year pollenating clover, making possible continuous and rich grazing for the New Zealand sheep. Just as we never miss the water 'till the well runs dry, so we in America have most thoughtlessly taken our clover for granted and have overlooked our debt to the native insects which have made it possible.

Of course, what is true of wool is true of the mutton which it covers. Also, the same thing is true of cattle, the beef we eat, the milk, the butter, the cheese, and even the leather on which we walk.

I am certain that anyone who has not already done so—and that means practically everyone—will be surprised at the long and important list of things which we owe to these pollenating insects. Every important vegetable in your garden, except corn, came directly or indirectly from a seed that was fertilized by pollen which insects carried; also your roses and the other beautiful flowers, cultivated and wild; the tobacco you smoke, if you do smoke; the coffee, tea, and cocoa that you drink. These are just some of the things we owe to flower-visiting insects.

But even wind-pollenated plants must have good soil in which to grow. Darwin rightly praised the soil-making activities

Publishers Photo Service

AN APPLE TREE LADEN WITH FRUIT

As a result of the activities of the insects among the blossoms, such crops as this tree offers become available to mankind

Publishers Photo Service

A HERD OF CATTLE IN HOLLAND

These cattle are feeding on grass that is cross-pollenated largely by the wind. Nevertheless, the activities of earthworms and ground-burrowing insects bring about the soil conditions best suited for growing plants. Thus, indirectly because of insects, mankind benefits through obtaining meat and dairy products

PICKING TEA IN JAPAN

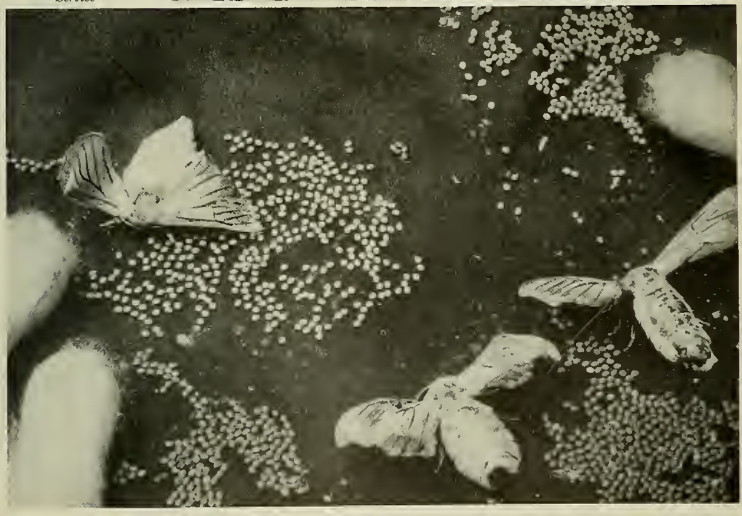
Tea and coffee, as well as cocoa, are benefited by the activities of insects just as all agriculture is. That insects cause some damage must be admitted, but the benefits that result from their activities are preponderant

© *E. M. Newman*

Publishers Photo Service

A FIELD OF LILIES IN BERMUDA

The heavy pollen of such flowers as these is carried almost exclusively by insects, and the soil in which they grow is improved by the activities of other insects. Agriculture's greatest allies are citizens of the insect world



SILK COCOONS, MOTHS, AND EGGS

These insects supply us directly with one of the most important of our materials for use in the manufacture of textiles. Silk and honey are two insect products that are in almost universal use

Publishers Photo Service

AN AUSTRALIAN VINEYARD

Throughout the world the beneficial activities of insects are vital and constant. Yet rarely do these results of their labors obtain a hearing. The harmful results of certain insects are widely discussed and condemned, but the constructive work they do is seldom enlarged upon

of earthworms and became their most effective press agent. Risking the false impression that I think the value of earthworms is overrated, I would like to point out that ground-burrowing insects are more widely—in fact, universally—distributed than are earthworms, that they are more numerous in any given locality, and that they are much more active. Furthermore—and this is a generally overlooked fact—an additional reason for their being more effective soil-makers than earthworms is that they carry beneath the surface not only decayed leaves but rich nitrogenous plant-food such as manure and the dead bodies of animals.

Time will not permit even a sketchy continuation of this line of thought, but perhaps you are already about to ask how land-plants of any kind ever existed without insects. Others have asked that question and a part of the answer is that geological history shows that there was no extensive growth of land plants and no flowering plants at all before insects became well established on earth.

Let us barely mention one or two other items in our tremendous debt to insects. Do you like trout fishing? What do you try to imitate when you tie brightly colored things to your hooks. What makes up practically the entire food of our fresh-water fishes? You know the answer. You owe your fishing to insects.

Do you enjoy the song and the sight of birds? Some of these birds are insectivorous. Others are seed-eaters but, since even the seed eaters are largely indebted to insects for the seeds they eat, you are indebted to insects for the birds themselves.

Birds are of immeasurable value to us in their beauty of sight and sound and this

value, which is real, should be a sufficient reason for their protection, allowing us to drop the sordid and, as we now know, largely fictitious reason that they stand between us and the menace of injurious insects.

Not more than half of one per cent of the tens of thousands of kinds of insects in the United States are now seriously injurious to man or to his property, and even the best of birds are not economic entomologists distinguishing between man's insect enemies and his insect friends.

Of the relatively few kinds of insects that are now our serious enemies practically all have been brought here by man from foreign countries. Why are these introduced insects so injurious here although they were not particularly injurious in their native homes? Because birds kept them in check there? Not at all, but because they were kept in check by other insects that were not brought to this country with them. The outstanding feature of modern economic entomology is the discovery that our greatest protection against insects which are either potentially or actively injurious is the host of other insects which are the special enemies of those that we rightly fear.

How, then, stands the case of Insects vs. The People? Some insects are, from the viewpoint of the people, undoubtedly guilty of great damage. It is right that we should do everything in our power to control these guilty kinds. But it is not right that we should condemn all kinds because of a few. Furthermore, it would clearly be wise for us to learn more about our insects friends and to cultivate their friendship more carefully.

ORANGE BLOSSOMS AND ORANGES

For the protection of certain crops, such as oranges, insects have been widely used. A destructive scale, formerly very harmful to orange trees, is largely controlled by introduced insects

The Capture

SOME MORE SPIDER FISHERMEN

Fresh Data on the Peculiar Habit of Spiders of Catching and Eating Fishes

By E. W. GUDGER

Bibliographer and Associate, Department of Fishes, American Museum

It has long been held that spiders, while known to be carnivorous animals, are insect eaters only. That they can and do feed on vertebrate animals was very much scouted. However, in previous issues of Natural History Magazine *(1922, Vol. XXII, No. 6 and 1925, Vol. XXV, No. 3) Doctor Gudger has brought together, with illustrations, some interesting accounts of spiders which have not only caught and fed upon fish, but also upon tadpoles and frogs, snakes and lizards, birds, and (among mammals) mice and bats. In the following article Doctor Gudger presents to the readers of* Natural History *further accounts of the capture of fishes by spiders, that have come to his notice since the publication of the earlier articles.*—The Editors.

EARLY in September, 1925, Mr. Eugene A. Fuchs of Atlanta, Georgia, while following along a small brook in a ravine in a wooded section of the suburbs of Atlanta, came upon a small pool about twelve feet wide and fifteen long, in which the water was perhaps two and one half feet deep and very clear. Across the brook below the pool was a fallen log on which he sat down to rest. Presently his attention was attracted by a splashing in the pool ten feet away. Drawing near, he found that this was caused by a small fish about one and one-fourth inches long, which had been caught by a large spider. The spider was endeavoring to drag the fish up on a leaf floating near the center of the pool and the fish was violently resisting.

Eventually the spider succeeded in drawing the little fish on to the leaf, where it held tightly to its prey in straddling fashion. Mr. Fuchs then brought to shore the leaf with its burden.

The fish was dead but the spider was very much alive, and, fearing that it might bite him if he attempted to catch it, Mr. Fuchs struck at it with a twig. The spider then for the first time let go of the fish and ran out on the water for a short distance, but it was soon killed with a stick. It was replaced on the fish in its original position and photographed. This photograph appeared later in the photogravure section of the *Atlanta Journal* of September 20, 1925, where it was seen by a member of the American Museum, Mr. L. B. Robeson, of Atlanta, who sent it to me. A letter to Mr. Fuchs brought the spider, the fish, the leaf from which the fishing was done, a copy of the original photograph, and very careful notes. From these Mr. Arthur Jansson, one of the Museum artists, has made the excellent drawing which serves as the headpiece to this article. There is no doubt that the spider killed the fish by sinking its fangs into the body and injecting poison. The little fish is a common minnow and the spider belongs to the genus *Dolomedes*. This genus, noted for the large size and activity of its species, has been accused before of catching fishes.

The latest record of a fishing spider is a note in the *Bulletin of the New York Zoological Society* for 1927 (page 77) from Mr. Wallace Adams of the Steinhart Aquarium in San Francisco. He writes as follows:

> A year or more ago we had a number of pigmy sunfish in one of the balanced aquariums in our swamp room. The specimens kept disappearing in a most unaccountable manner until one morning I found the remains of two in the folds of an overhanging leaf in which a spider had made a nest. Unfortunately I was unable to capture the spider for identification but at least the fish stopped disappearing as soon as the overhanging leaf was removed.

Photograph by E. A. Fuchs

WITH FANGS SUNK IN ITS PREY

Spiders have been known to attack not only fishes but many other members of the vertebrate kingdom, from amphibians to mammals

Seeking fuller information, I wrote Mr. Adams who kindly replied in considerable detail. It seems that 15 pigmy sunfish (*Elassoma zonata*) were placed in a balanced aquarium 12×14×54 inches in size. This was set on a concrete base three feet above the floor and isolated from everything around it with one exception. The aquarium was covered with a glass plate resting on wooden strips which held it about one quarter of an inch above the frame. Back of this aquarium was a bird-of-paradise plant and the base of one of its leaves overhung and rested against the glass cover noted above. Furthermore, in the crease along the midrib of the leaf a spider-web tunnel had been built. The remainder of the story follows in Mr. Adams' own words.

> During the early part of the following month, it was noticed that several of these fishes had disappeared and shortly afterward the dried remains of one of them was found on top of the glass cover near the plant leaf. It was quite apparent that this fish could not have reached this position unaided. A careful investigation failed to disclose other remains. A day or so later fragments of two of these fishes were found in the tunnel of the spider and carefully removed. Search was made for the spider but it was not found at this time. However, careful watch was kept and a small spider was discovered between the glass cover and top of the tank frame. It eluded capture and the following morning another fish was found in the tunnel. The spider was feeding on this specimen but got away. The remains of four more fishes were found on the ground below the plant leaf where they had evidently been dropped.
>
> The janitor, in dusting off the top of the tank, destroyed the web and possibly killed the spider for it was never again seen.

The spider that caught these little fish was only about three quarters of an inch long, and was thought to be one of the Lycosidæ or wolf spiders, which are known to be fishermen.

In my 1925 paper I quoted accounts of the fish-catching activities of South African spiders of the genus *Thalassius*. These accounts ranged in time from 1911 to 1923. However, this habit of this spider had been long known, for in 1903 F. Pickard-Cambridge (*Proceedings Zoological Society, London*, Pt. 1, p. 158) refers to it, says he had had no personal experience, but quotes McCook (see my 1922 paper) that spiders do catch fishes. He then says that this account

> has recently received confirmation by Mr. A. N. Stenning in South Africa. He tells us that *Thalassius* . . . has been often observed by himself in the act of devouring the small fry of a species of trout, and calls the attention of pisciculturists in those regions to the fact, and begs them to keep an eye on these spiders.

Pickard-Cambridge seems to have had full confidence in Stenning's statements for he remarks (p. 152) that they "are likely to be trustworthy"—as they have been shown to be in the articles referred to in my 1925 paper.

In the *Revue Britannique* for 1835 (Vol. 17, p. 177) a Doctor Morsten is said to have discovered in the forests of Australia a huge spider which catches fishes. He is quoted as saying that

> I have several times seen them enter the marshes and then descend to the bottom of the pools whence they presently reappeared bearing small fishes. I have, however, never seen them eat any of these.

No source for this citation is given and all endeavors to run down and verify it have been fruitless. It is given here for what it is worth.

To these accounts may be added a "left-handed" one as follows:

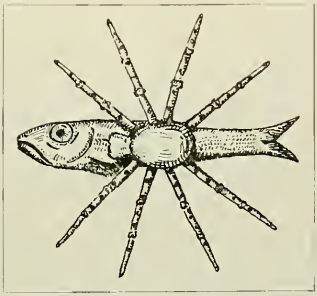
In the *Transactions and Proceedings of the New Zealand Institute* for 1877 (Vol. 10, pp. 200–201), Mr. C. H. Robson records the collecting at Cape Campbell of a spider which, after the fashion of our fresh-water diving spiders, lives under water. However, this marine arachnid appropriates the deserted holes left by the rock-boring mollusk, *Lithodomus*. To close the mouth of the hole and keep out the water, the spider weaves a water-

proof web. But the point of interest just here is Mr. Robson's statement that

> When a small fish is placed in a bottle of water with one of these spiders, the latter will attack at once, driving its long sharp falces into the fish near the head and killing it instantly.

Nothing is known of its feeding habits, but one may conjecture that it eats fishes.

In my first article (1922), I quoted five separate and distinct accounts of spiders catching fishes. These observations had all been made in the United States and ranged in time from 1859 to 1921. In the second article (1925) four new and recent accounts were given—two from South Africa, one from Panama, and one from the United States. The present article includes three well attested accounts, two from the United States and one from South Africa; and to these are added a reported (but not verified) case from Australia, and a presumed case from New Zealand. Omitting these latter, there are in all ten well attested accounts of spiders which have deliberately sought and captured fishes.



THE SPIDER AND THE MINNOW
From a drawing by Mr. E. A. Fuchs

The "House Kiap," built by government order to accommodate traveling officials and other white men

LIVING WITH THE NATIVES OF MELANESIA

How Ethnological Work Is Carried on by Representatives of the American Museum among Primitive People of the South Seas

By MARGARET MEAD
Assistant Curator of Ethnology, American Museum

IN the cases of the South Seas Hall of the American Museum hang many specimens, pieces of costumes, ceremonial staves, ornaments, weapons, canoe models, the outer and visible symbols of the civilizations which have been built up by the patient brown peoples of the Pacific Islands. To the hall in the Museum it is only possible to bring these physical things, the carved float and net, the kava bowl with its opalescent tint testifying to the generations of kava drinkers which it has served, the child's grass skirt, tightly bound to preserve the carefully crinkled waves against the day when it was to be worn. But if these lifeless specimens are to be placed in their true setting, if we are to understand the uses to which they were put, the difficulties under which they were manufactured, the human needs which they satisfied, it is necessary to go to these island communities and learn meticulously those aspects of their lives which can never be enclosed within a wall case, nor caught more than superficially in a model. It becomes the task of Museum ethnologists to make expeditions into primitive communities just as those who are to prepare the great habitat groups of animals have to follow the elephant and the tiger into their native haunts.

We are accustomed to think of expeditions as large groups of scientists equipped to the teeth with scientific paraphanalia. Such expeditions carry preparators, camera men, guides, shooters, beaters, in addition to the central quota of scientists. They march across deserts or into jungles, carrying their food and their tents with them, setting up a microscopic world of their own wherever they go. Such are the ideal conditions for an expedition in the natural sciences other than ethnology.

But the ethnologist cannot march upon a native community like an invading army, for that community is going to be not only a source of labor and food, but also the very stuff of his investigation. He must slip in quietly, lower himself or herself as gently as possible into the placid waters of native life, make the unprecedented arrival of an inquiring white person as inconspicuous as possible. For such an expedition there are no camera men, no preparators, no army of carriers, not even servants, because to take servants from another community causes friction and upsets the nice balance of native life. An ethnological expedition is limited to one, unless it be that a husband and wife or father and daughter can go together and take their place in native society. Two members of the same sex would work against each other, vying for the attention of the same informants, and the natives would not be slow to play them off against each other. Upon our last field trip my husband and I went together, a felicitous scientific arrangement, as there are such strong sex antagonisms in Melanesia that no member of one sex can hope thoroughly to win the confidence or understand the point of view of the other.

As one cannot take an army of helpers neither can one take too bulky an amount of equipment. Tents and pavilions would stand out too sharply on the native scene, tend to distinguish the investigator from the native at the very points at which the investigator wishes to blur the differences. We therefore took with us only a minimum amount of equipment, two

PUNTING UNDER DIFFICULTIES

The woman whose back is turned and whose cotton cloak is blown out in the wind, is trying to punt the canoe and at the same time keep her head decently covered against a possible encounter with her father-in-law

THEY ROLL THEIR OWN

A group of small girls under the supervision of a young male of eight are rolling for themselves cigarettes from a stick of Louisiana twist and squares of newspaper

PLAYING AT BEING A WHITE MAN

In the native conception a white man is always sitting on a chair writing or reading a book. Ponkob, aged three, is attempting to imitate these alien manners. His left foot betrays the intense strain under which he is laboring

PLUCKING PIGEONS

Plucking pigeons was beneath the male dignity of the little house boys, so they drew upon their weekly allowance of tobacco and bribed the small girls to do it for them

A STRANGLE HOLD

Native children are trained to ride in this fashion on their parents' backs and taught that no matter what happens they must never slacken their hold. This small girl who is riding on Doctor Mead's back is anticipating a grave emergency

THE VERANDA AT HIGH TIDE

The houses are built upon high piles, and at low tide stand some ten to twelve feet above water level. But at high tide, the lagoon deepens and the veranda becomes a convenient land platform for the canoes which are the only means of transportation in this water Venice

stretchers, two tables, two chairs, a typewriter, camera, developing apparatus, and a shotgun. The rest of our luggage was packed with note paper, drawing paper for the children—I took a thousand sheets and the supply ran out in the first month—baubles by the gross, beads, toys, balloons, paper flowers, etc. and large and bulky amounts of rice and tobacco. Everything had to be packed into cedarwood boxes with double locks, one of which sang when it was turned like a musical clock to warn the owner of the prowling thief, the other put on for safety, as there were many duplicate keys about. The tobacco had to be unpacked from the telltale crates in which it is shipped from Louisiana and repacked in ambiguous cedar boxes.

In Rabaul, the capital of the Mandated Territory, we had acquired a Manus boy from the village of Pere, who spoke excellent pidgin and would serve as an interpreter in his own village. As he was a government servant and therefore allowed by ordinance to wear a shirt, he was of no use whatsoever for any more menial tasks. In Lorengau, the seat of the Manus district government, we acquired a second boy from the village of Pere, and our insidious approach was by now well begun.

The next step was taken by the District Officer, who summoned Gizikuk, so-called headman of the South Coast Manus, because he was the one man who could make the ten independent little democracies coöperate to the extent of providing canoes when these were needed by the government. Gizikuk came, very proud and bedezined with bead work, and was presented with preliminary "grease," no

less than twenty sticks of tobacco. He looked over our luggage and decided that it would take nine canoes to transport it the day's journey to Pere. This proved to be just four and a half times as many canoes as would really have been needed. We agreed to pay five shillings a canoe, and Gizikuk went away to muster the fleet. Meanwhile with the aid of Banyalo and Manawai, the two Manus boys, and through the medium of pidgin English, a start was made on the Manus language.

The fleet which Gizikuk had declared necessary arrived, and a box or so was allotted to each craft, slender dugouts built up with wide sidestrakes, the whole topped by a wide platform, upon which small dome-shaped houses are constructed. As it was impossible to foresee what the attitude of the natives would be concerning questions of food, whether they would expect us to share their meal, resent our eating in their presence, or tabu eating in mixed company altogether, we took no provisions, but prepared to tighten our belts for the day. And so it proved, for with characteristic Melanesian manners, our boat's crew cooked messes of sago and cocoanut oil on the small fireplaces on the edge of the platform, and feasted happily, completely ignoring our famished presence. Entrance into native life is always accompanied by just such delicate situations, into which the average white trader or government official can step without trepidation, making the native custom bend to his whim but toward which the ethnologist has to act with the greatest circumspection. A misstep at the start may result in weeks or even months of delay. So on a Polynesian island, to take one's own food instead of relying upon the hospitality of the natives which is always tendered with the grand manner, would be to insult one's hosts irrevocably.

After traveling all day along the edges of the mangrove swamps, sometimes crossing the reef, more often poling our

THE BUTLER IN HIS "TIME OFF"

Pomat, who as the "boy belong make 'im table," preserved during meals the decorum of a well-trained butler, is now out, enjoying a cigarette and stalking a few fish with his bow and arrow. He is fourteen

MAKING CAT'S CRADLES

Manus children do not have to work and, although the water provides them with a perfect playground, they weary of rollicking all day in their canoes. When they become bored with their strenuous play, they climb up on the little island and play at making cat's cradles, of which they know many varieties

way through the shallow reef-bound lagoons, we arrived at about eight in the evening at Bunei, the village of Gizikuk. Here another situation arose. Gizikuk wished us to stay in his village; but Bunei was smaller than Pere—this had been ascertained from the census—and as I wanted particularly to study children, it was necessary for the village to be large. Furthermore, we had two boys from Pere who might be miserable in Bunei. But if Gizikuk were really a chief, as he claimed to be, to offend him by refusing to make his capital our headquarters would have been fatal. However, we bet on his authority being a mere matter of personality and government backing (a guess which subsequent experience proved to be correct), and we insisted, to his great disgruntlement, upon pushing ahead to Pere. At midnight the fleet of canoes, under full sail, swept into the moonlit lagoon village, between the rows of pile-built houses, up to the doors of the "House Kiap," the government barracks, where we took up our temporary abode.

The "House Kiap" is in the village, built by government order to accommodate traveling officials and other white men, but it is distinctly not of it. From its narrow walls, 14×12, we again temporized, learned more of the language, tried to get an accurate enough picture of the social scene, so as to know whom to trust, and whom it was dangerous to displease. Meanwhile, through our two boys, and another and then another who were speedily added to our menage, we let it be known that we wished to learn the

language and witness all the important events in the lives of the people. For one to understand the onslaught to which we were subjected by such an invitation it is necessary to remember that these people have had only one kind of contact with white people, as inferiors, either as work boys or merely as native British subjects dealing with occasional government officials very much on their dignity. The house of a white man, any house in which a white man took up temporary quarters, was forbidden to the native, except in his servant capacity as cook or house boy. Missionaries, who must use softer methods to entice the heathen into the fold, had never been among the Manus. Into this setting stepped ethnologists who could not work unless all these carefully constructed barriers for the peace of the white invader were summarily shattered. To the native it was as if we had hung up a shingle saying "We want to be bothered. We aren't like other white people," and they responded to this chance of a lifetime with great vigor. All day the house was crowded and not until midnight was there any peace.

We set about having a native house built, and the clan of Pere proper courteously accorded us the privilege of building our house abutting on one of the two small bits of land which are used as village greens and dancing grounds. But obtaining a house site was not obtaining a house. The thatch had to be bought in lots of ten shingles each, from the land people. Payment had to be made in advance, then runners sent out to collect. It took two months before a large thatched structure on piles was almost ready to receive us. Before it was finished I came down with malaria, and within two days three of our boys were down also. In Manus, all sickness is due to the spirits, and an elder of the other end of the village, who was anxious to hasten our removal to his section, divined the cause of the illness as the malicious work of a dead police boy, appropriately domiciled in the

THE ENTREPRENEUR OF THE VILLAGE

Paleao had been a German police boy and learned the value of some of the white men's ways. Back in his native village he was quick to take advantage of the trade possibilities which a white man offered. He was "shoot boy" for the expedition and managed the convoys which brought out its stores

A SPOILED CHILD

Even quite large children, when they are tired, will often insist by scolding and whining that their hard worked mothers carry them on their backs

"House Kiap." Very solemn, he sat on the floor and explained that neither the boys nor I would recover until we moved into the new and uncompleted house. I balked for twenty-four hours, as the prospect of moving with half the household sick was not enticing; then a fourth boy came down with the fever, and we moved to a doorless, stepless dwelling, where the cook house had no floor. Such intimate participation in the religious and social life of the community is inconvenient and wearing, but it is the only way in which the necessary knowledge of native society can be obtained. And the way is full of pitfalls. I shall never forget the panic caused among a group of visitors, early in our stay, when my husband complied with one person's tentative request that he pronounce my name. Several people almost fell into the sea in their horrified retreat from such blasphemous behavior.

The endless tabus upon mentioning the names of any relative-in-law in a person's presence make it necessary to know the social organization of the village by heart, all the past marriages, the present marriages, the contemplated marriages. In addition it is necessary to know each person's three or four names. Even then one is continually trespassing, as when I inadvertantly sneezed in the presence of a woman whose daughter was engaged to a youth named "Sneeze." There are relatives-in-law who may not look at each other, and it was necessary to construct a house with several exits, so that mothers-in-law could depart as sons-in-law entered, for it is always the women who have to do the running away. On one occasion, when I was alone in the village, and had added to my household of six small boys and two girls, a man and his wife, there were so many complicated relationships that the only place where Ngaoli my seventeen-year-old-girl could eat, without transgressing, was huddled in a corner behind the bed. And the linguistic confusion which resulted from getting a new cook boy who was the brother-in-law of three of the other boys, was terrifying. One could not say his name in front of them, but must refer to him grandiloquently as "the husband of Pondramet"

(their sister); if he were also in the room, even this would not serve, as his wife's name could not be mentioned in his presence.

A large part of one's time in these remote villages is taken up with doctoring, as there is no doctor within a day's journey and often not one as near. Here again there are many dangers. To give medicine to someone who may die, is to risk crippling one's field work, as the natives may blame one for the resulting death. The children were continually fainting from malaria; a fact which was advertised to the entire village by the wails of the mother. The prescribed method of bringing the child around was for a hundred people to collect in the house, all the female relatives of the child gathering close about it, wailing, for which expression of affection they were subsequently paid, while some important man, or possibly two, stirred bowls of water with long sticks and invoked their guardian ghosts' aid in returning the child's purloined soul stuff. It was a simple matter to thrust a bottle of aromatic spirits of ammonia under the children's noses, but the natives never admitted that this brought them to, insisting that the spitting and coughing were signs that the spirits disliked the horrid medicine.

Sometimes, however, my doctoring brought rich rewards. There was one tall, shaggy-headed sorcerer, with one injured eye and a bad case of ringworm, who sought my aid to cure his disfigured skin. Day after day he came to be treated, while I supervised the application by one of the small boys of a stronger lotion than the natives were allowed to have themselves. After about two months Pataliyan was cured, and made me the confidant of his projected elopement with a widow. The wrath of the ghostly husband shook the village and killed an unfortunate woman go-between, and the whole village was thrown into confusion—which was priceless to the ethnologist—all from a steady application of ringworm medicine to make the lover beautiful and desirable to a much wooed and most excellent maker of pots.

A FLOATING LABORATORY

In order to study the children it was necessary to follow them about everywhere, on land, and at sea. Here a group are setting out to see a turtle which has just been caught

THE HOUSE-WARMING FEAST
When the expedition's new house with its adjacent patch of ground was finally ready, a canoe race and feast were held, and natives came from other villages to share in the festivities

The children were my chief concern, as I was trying to add to our knowledge of child psychology at the same time that I worked on the general ethnological background of the people. By selecting the oldest boys of the adolescent group, youngsters of about fourteen, as house boys, we were able to attract all the rest of the children to our little patch of back yard. Each fourteen-year-old had a ten-year-old slavey, who in turn delegated the disagreeable aspects of his task to a six-year-old. Dinner was often prepared by some dozen small hands, one small boy tending each pot, faithfully blowing up the twig fire underneath it. The little girls were enlisted to pluck the wild pigeons and to fetch the fire wood. I was making a collection of drawings by these savage little youngsters who had never seen paper or pencil before, and this practically disrupted the household. Every available square inch of table, box, or trunk surface was preëmpted by children engaged in drawing. They would have drawn all night happily, had I permitted them, and they came to wake me before dawn with requests for "paypa." Getting meals prepared or floors cleaned in this general nursery-school atmosphere was often difficult and always accomplished in the midst of a terrific din of happy insistent voices.

Photography demanded more organization. In that climate films have to be developed at once; there is no packing them off to the dark room of a commercial photographer. This meant working at night. Water had to be brought from the mainland almost a mile away, and the only water fit for photography came from a "place of blood" where some of the

ancestors of the village had been slain. Such blood lingers and has a bad habit of entering the bodies of the descendants who are foolhardy enough to approach within its death-dealing atmosphere. So it took many sticks of tobacco to obtain a large enough supply of water for washing films. If the water ran out, there was no remedy, for no one would venture into that fearful place after dark. As there were many films to be washed, we trained a squad of native children as helpers, retaining two extra children, one to watch that no torch-lit canoes came near the house and one to scratch the backs of the other children so that they wouldn't drop the films which they were washing.

By such devious means and amid such peculiar surroundings, we worked our way into native life, until our house was known generally as the "kamal" or club house, because it was always so crowded. From the native children which I had assembled into a household, it was possible to reach out into their respective homes, and to follow the details of the ceremonies, quarrels, and reconciliations which went on within the thatched walls of other houses. By oneself assuming the tabus and duties, the privileges, and obligations of a native woman, as much as possible, one receives in return the confidence of the women and learns the carefully guarded secrets which have been hidden from twenty generations of husbands and fathers. The temper, the emphasis of native life, from the woman's point of view, gradually unfolds before one's eyes, as do the moods, the thought processes, the interests of the group of children who sleep on one's floor and eat one's rice day after day. The native language becomes more and more a familiar idiom. One learns to joke in it, perhaps even to pun a little, (although I knew that I was never permitted to swear, as both of my parents are living and profanity is only permitted to the orphaned). One learns to shudder when tabus are violated, to meet the news of a misfortune with the immediate question "Which ghost is responsible?" The personalities of all these alien people who

A BUSINESS MAN AND HIS WIFE

This man and his wife were two of Doctor Mead's firmest friends and assistants. When she was alone in the village, they moved into the house and constituted themselves her chaperons and protectors

press about one all day long become as clearly realized as those of the members of a family.

Only a six-weekly or less frequent mail breaks this long detailed identification with native life, from which one finally emerges wearied with the continuous restraint, the continuous re-valuation of experience, but bearing, as a field trophy, a knowledge of the native customs and the native thought attainable in no other way.

GOING FOR WATER

The village was built in the lagoon about half a mile from shore. All water for drinking, cooking, bathing, and developing photographs had to be brought from a brackish swamp on the main island

JOHN CHAMPION FAUNTHORPE

Sportsman, Civil Servant, Soldier, Conservationist, and Friend

By ARTHUR S. VERNAY

At the opening of the Vernay-Faunthorpe South Asiatic Hall of Mammals, the one man who might be said to be principally responsible for this beautiful addition to the American Museum of Natural History was absent. Lieutenant-Colonel J. C. Faunthorpe, with whom for eight years I was associated in the effort to obtain for the American Museum the world's finest collection of animals from India and Burma, had succumbed to an attack of pneumonia only eleven months prior to the completion and opening of the hall. Perhaps it is harder for me than for almost any of his other friends to write about him, for he and I, during the past eight years, have been together on many big game expeditions that make men either hate one another or draw more closely together than brothers. During this long association I invariably found him an incomparable companion—unruffled, full of resourcefulness and humor and efficiency. I never expect to see a finer type of sportsman, for he was not only a marvelous shot, with a profound knowledge of shikar, but he also had the true sportsmanship of character and outlook.

It was during the Great War that I first met Colonel Faunthorpe, and later, when the war had ended and he was connected with the British Embassy at Washington, I had many conversations with him. It was at this time that I was contemplating a trip around the world and when he was transferred from Washington to the post of Commissioner at Lucknow he urged me, in case I made my contemplated visit to India, to join him there so that we might do some hunting together. Prior to this time, Faunthorpe had visited the American Museum of Natural History and had written to President Henry Fairfield Osborn, offering to make a collection of Indian animals if the Museum would provide a capable taxidermist and mount them properly. Consequently, when I arrived in India and joined him for our shooting trip, we discussed the matter with the result that on returning to America our scheme was presented to the Museum, and definite plans for the collection were soon under way.

The story of the collection, however, has been ably told by Mr. H. E. Anthony, in a previous number of Natural History Magazine, and it is now my purpose merely to attempt to give some account of the charming and capable character with whom I was associated in this task.

Well over six feet tall, of slender frame, with exceptionally broad shoulders, Faunthorpe was cut out from boyhood to excel in any sport he took up. He was a son of the Reverend Pincher Faunthorpe and was born May 30, 1871. As a youth he attended the Rossall School and later went to Balliol College, Oxford. At college he did a little rowing, but his earliest and most lasting love was for shooting. I doubt whether there has been any Englishman of our time more expert in the theory and practice of rifle shooting. It was not until he had graduated from college and entered the Indian Civil Service, however, that any exceptional opportunities offered themselves in the sport that meant so much to him. In his work in India he came in contact with many Englishmen and native gentlemen through whom came many of the

longed-for opportunities to develop his ability along the lines which appealed to him so strongly. Always imperturbable, never talkative, invariably pithy in his statements, never ruffled, he was essentially human; never worried by human weaknesses, his quiet sense of humor, his remarkable balance resulted in an unusual popularity with officers and civilians, as well as with the natives themselves. Faunthorpe never acted hastily, but when occasion demanded he could act strongly. His opinions were never hurriedly formed, and because they were based on sound judgment, he had reason to stick to them strongly. The Indians learned that he would not only listen to their cases but would hear them through, and they soon learned, furthermore, that his word was invariably good.

ARTHUR S. VERNAY

The author of this article was for eight years associated with Colonel Faunthorpe in the work that was required for the new Vernay-Faunthorpe Hall of South Asiatic Mammals in the American Museum

In 1921, for instance, when serious agrarian trouble broke out in southern Oudh, both Sir Harcourt Butler who was Governor of the United Provinces of Agra and Oudh, and Colonel Faunthorpe, who at that time was Commissioner at Lucknow, found themselves faced with a serious and difficult problem. The rising was of Indian tenants and landless people against their Indian landlords. It is true that order was restored in a week, but it was largely due to Colonel Faunthorpe's wise handling of the local situation that no bitterness was left; nor would his success have been so great as it was had it not been for the fact that the Indians had long since learned that he was sympathetic, fearless, and honest; that what he promised them would be carried out. As a result of these difficulties he was especially selected to make an inquiry into certain feudal or manorial dues which the landlords exacted from their tenants. As a result of his investigation corrective legislation was undertaken and his report is an exceedingly valuable document in agrarian relations.

Thus it will be seen that with so able an individual as my associate, and with one who was so favorably known among British and Indian officials and princes, we were enabled to begin a collection with many difficulties removed. Nevertheless, science was interested in certain species that for years have been protected in India, and only because of Colonel Faunthorpe's clear and convincing explanations of our plans were we able to carry through the considerable task we had set ourselves. Having gone out to India as a civil servant in 1892, Faunthorpe had become thoroughly conversant with the Indian character, with language, customs,

and hunting technique. The open-air life of the district officer—the backbone of British rule in India—exactly suited him. He seemed to read the minds of natives as surely as he read the life of the jungle, and his good sense, his prowess in sports, and his happy, sympathetic humor made him an administrator of whom nobody could get the better and whom everybody trusted and loved.

JOHN CHAMPION FAUNTHORPE
1871–1929

There is no great sport in India in which Faunthorpe did not reach the front rank. He was an excellent horseman and a fearless rider. He was equally at home on the polo ground and at pig-sticking. He was keen on racing and his pony "Devon" won the then great pony race of India—the Civil Service Cup at Lucknow. He had many great achievements to his credit in shooting on the range and in sport, but in big-game shooting he quickly made a name as being in a category by himself. He could arrange a tiger beat as well as any native hunter who had spent his entire life in the business, and no mahout in India could give him points on the management of elephants on a big-game expedition. He could organize a shoot in the jungle of the Nepal Terai as well as any of the Indians who had given their lives to the subject. He had always been interested in natural history and because of this interest, coupled with his unusual ability, he became as intimately acquainted with jungle life as any native hunter who had been born there.

His interest in riding and in shooting brought with them an interest in military matters, with the result that he was always a keen soldier and ultimately came to be Lieutenant-Colonel of the Light Horse of the United Provinces. He entered into all military work with the keenest enthusiasm and throughout his life remained actively interested. That his military service proved him a man of exceptional ability is demonstrated by the fact that in 1922 this volunteer officer was appointed aide-de-camp to His Majesty, King George V.

Due to his thorough understanding of their characters, as well as to his exceptional success in their pastimes, the native

COLONEL FAUNTHORPE ON A TIGER HUNT
He had the reputation of being able to arrange a tiger beat as well as any native hunter who had spent his entire life in the business

princes became warmly attached to this impressive, efficient, understanding Englishman, and were only too happy to give him facilities for the sport he loved, for it must be remembered that in India such sports as tiger hunting are truly the sports of kings. Only the enormous wealth of the native princes can stand the strain of the lavish and complete hunting paraphernalia, the herds of elephants, the armies of servants, hunters, and mahouts. Thus the friendliness of the man and the impressiveness of his character aided him enormously in earning his reputation as the best big-game shot in India, and but for his amazing knowledge of shikar and for the many doors that he was able to open, the Vernay-Faunthorpe collection could never have become an accomplished fact.

Faunthorpe, though a civilian to begin with, had, as I have explained, all the interest and ability that go to make a first-rate soldier. He did as much as anyone to raise the Light Horse, and he took over the command when it became a recognized unit of the Indian Defense Force. When the Great War came, he was appointed Military Director of the cinemas on the western front and his battle film of the Somme is still regarded by experts as a masterpiece of organization. He served as an intelligence officer as well, and was in France with the British Expeditionary Forces from the end of 1915 to the end of 1917. In January, 1918, he was made a member of the British Mission to America as a representative of the Public Information, and

COLONEL FAUNTHORPE (left) AND MR. VERNAY
With the one-horned Indian rhinoceros (*Rhinoceros unicornis*) collected for the Vernay-Faunthorpe Hall in the American Museum

COLONEL FAUNTHORPE, MR. VERNAY, AND MR. R. C. MORRISS
Colonel Faunthorpe (right), Mr. Vernay (center) and Mr. R. C. Morriss, with the bull elephant the expedition collected for the great center group in the Vernay-Faunthorpe Hall. Mr. Morriss, of Honnametti, India, is the outstanding authority on the game of southern India, and was of great service in aiding the Vernay-Faunthorpe Expeditions

later was associated with Sir Geoffroy Butler, a brother of Sir Harcourt Butler, in publicity work for the British Embassy. His work in the British Embassy in Washington was largely connected with the activities of Indian agitators, and during this service at the American capital he grew to have a deep regard for America and Americans. It was as a result of his friendliness for America that he and I decided that as two Englishmen anxious to show our regard for the American people we could not do better than to collect and present to the American Museum of Natural History the finest specimens and groups of Asiatic mammals that it was possible for us to find. It was then that the idea took hold of both of us of using his unrivalled experience to amplify the collection of such mammals in the American Museum.

As I have already said, he entered the Indian Civil Service in 1892 and retired in 1925, but always he remained interested in India. Furthermore, his activities never flagged, whether connected with his official duties or his activities in the field of sport. Only the year before he died, so active was he still in the sport to which he had given so much of his time, that he won the competition at Bisley at the running deer, and the expeditions in which he and I were engaged occupied his attention almost to his last moment. For the last ten years of his full and varied life, I think I am right in saying that this Museum project was his dominant interest. Through six separate expeditions he was indefatigable in carrying out the work which led us to many different Indian and Asiatic states.

I rarely think of Faunthorpe without recalling how patiently he could listen to the plans of others, and I recall distinctly how, after listening to me until I had explained in detail what it was I had in mind, he would look up quietly, with a friendly twinkle in his eye, with the simple question "Finished?" And if I had interested him—if I had so stated my case as to win his support—the task could always be counted on as being on its way to completion. As an example, the pink-headed duck took nearly three years to secure, and it took three years of careful thought and effort before permission was obtained to collect the lion of India from Junagadh, but in both cases the object was accomplished.

It was a tremendous disappointment to many of Colonel Faunthorpe's friends that he could not be present at the opening of the hall for which he had done so much. However, it is a pleasure for those of us who knew him best to realize that in the hall that bears his name and mine, the fruits of his labors and his experience will be preserved for all time and with them the name of Faunthorpe—an Englishman who was a sincere friend of America.

One of the Camps of the Vernay-Faunthorpe Expedition

"THE MUSKRAT CAME UP DEAD, BUT IN HIS CLENCHED PAWS WAS A LITTLE EARTH"

INDIAN BEAVER LEGENDS

North American Indian Myths About an Animal Which the Aboriginal Imagination Often Endowed with Supernatural Power

By WILLIAM H. CARR

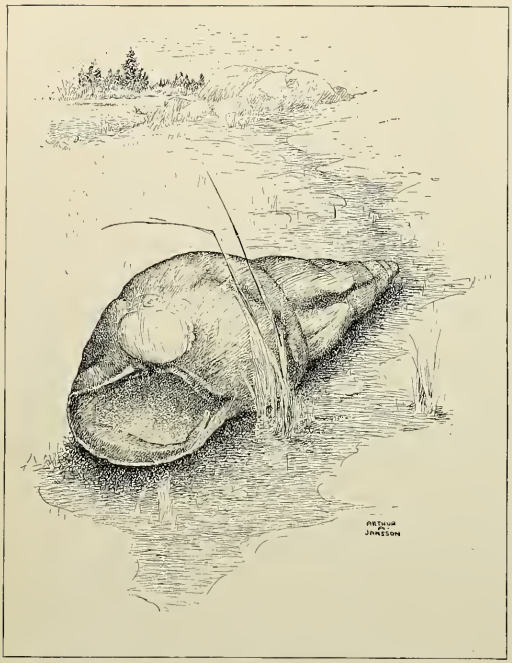
Assistant Curator, Department of Education, American Museum

CITATION NUMBERS IN THE TEXT REFER TO CORRESPONDING NUMBERS IN THE BIBLIOGRAPHY AT THE END OF THIS ARTICLE

For a number of years Mr. Carr has been studying beaver, both from the historical and the natural history standpoints. He is about to publish the results of this research in a work entitled "Beaver—Builder of Empire," and NATURAL HISTORY *has been granted the privilege of publishing from these volumes the chapter on Indian Beaver Legends that appears below.*—THE EDITORS

THE numerous fanciful myths and legends of North American Indians are an excellent clue to the importance with which ancient Americans regarded wild animals. In these legends frequent reference is made not alone to the part animals play in the Indians everyday life, but also in his spiritual and imaginative existence. These tales, weaving together material gleaned from countless sources in earth and sky, beast and human, are related with such delightful, childlike simplicity that many of our modern, clever, and oftentimes sophisticated stories of mysticism seem pale when compared with the guilessness of Indian legends that breathe of the soil from which they sprang.

The beaver, either as a hero or villian, appears many times in the animal legends of the North American Indians. Often this rodent, when not playing a leading rôle, is at least an important character—a picturesque personality interwoven in the general fiber of the account. These tales come from nearly every section of



"THE HEAT OF THE SUN AT LENGTH RIPENED THE SNAIL INTO A MAN"

the United States and Canada, testifying to the past greatly extended distribution of the beaver and also to the common beliefs and similarity of their expression among widely separated Indian tribes.

One may divide beaver legends into three major parts:

(1) Beaver and myths of creation
(2) Fables of Indian and beaver relationship
(3) Stories of beaver and various other animals in which human beings do not participate in the events

In the myths concerning the creation of the earth, whenever water enters into the situation, various tasks are assigned to the beaver because of his ability as a swimmer. An Algonkian legend (1) tells of Nanibozhu who, striving to form the world, "selects the beaver from all the animals to dive after some earth. The beaver tries and comes up dead," a true pioneer, making the greatest sacrifice in the field of highly adventurous exploration. "The otter is sent next and meets the same fate. Then the muskrat tries and comes up dead, but in the clenched paws is a little earth." From this earth the "New World" was formed.

The Cherokee Indians of the southeast, did not forget the beaver in one of their myths of the world's birth. He is mentioned, not as a "prime mover" it is true, but as a well recognized relation. In this tale, "How The World Was Made" (2a), one learns that—

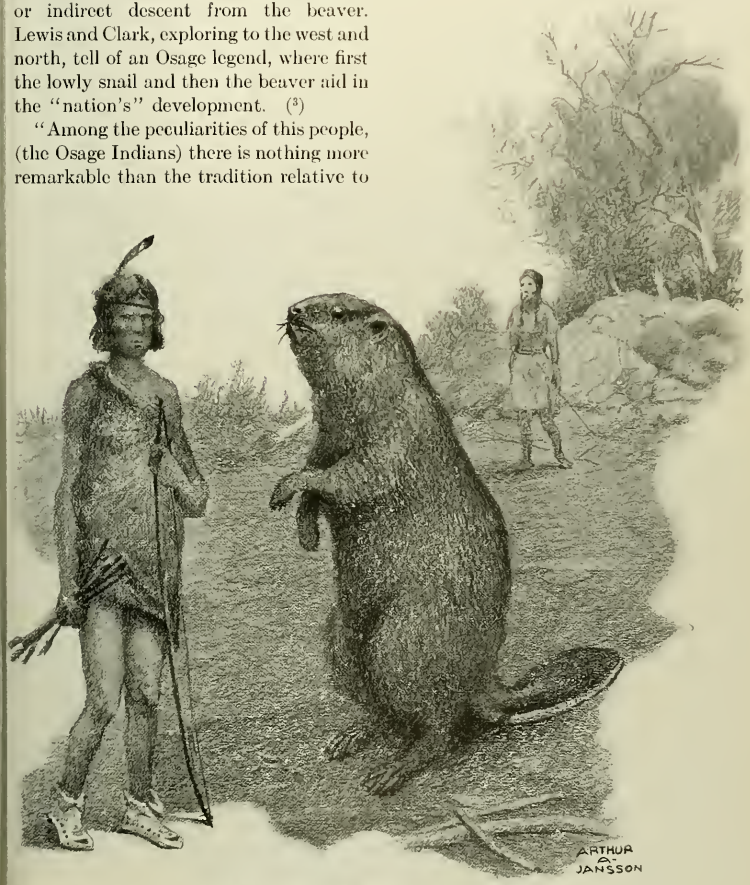
"The earth is a great island floating in a sea of water, and suspended at each of the four cardinal points by a cord hanging down from the sky vault, which is of solid rock. When the world grows old and worn out, the people will die and the cords will break and let the earth sink down into the ocean, and all will be water again. The Indians are afraid of this.

"When all was water, the animals were above in Gălûñ'lătĭ ('above on high') beyond the arch; but it was very much crowded, and they were wanting more room. They wondered what was below the water, and at last Dayunsi, (Beaver's Grandchild), the little Water-beetle, offered to go and see if it could learn. It darted in every direction over the surface of the water but could find no firm place

to rest. Then it dived to the bottom and came up with some soft mud, which began to grow and spread on every side until it became the island which we call the earth. It was afterwards fastened to the sky with four cords, but no one remembers who did this. . . . "

So great was the breadth and scope of the Indians' imagination that one is not surprised to hear of tribes claiming direct or indirect descent from the beaver. Lewis and Clark, exploring to the west and north, tell of an Osage legend, where first the lowly snail and then the beaver aid in the "nation's" development. (3)

"Among the peculiarities of this people, (the Osage Indians) there is nothing more remarkable than the tradition relative to their origin. According to the universal belief, the founder of the nation was a snail passing a quiet existence along the banks of the Osage, till a high flood swept him down to the Missouri, and left him exposed on the shore. The heat of the sun at length ripened him into a man, but with the change of his nature he had not forgotten his native seats on the Osage,



"THE BEAVER HAUGHTILY INQUIRED WHO HE WAS"

toward which he immediately bent his way. He was, however, soon overtaken by hunger and fatigue, when happily the Great Spirit appeared, and giving him a bow and arrow, showed him how to kill and cook deer, and cover himself with the skin. He then proceeded to his original residence, but as he approached the river, he was met by a beaver, who inquired haughtily who he was, and by what authority he came to disturb his possession. The Osage answered that the river was his own for he had once lived on its borders. As they stood disputing, the daughter of the beaver came, and having by her entreaties reconciled her father to this young stranger, it was proposed that the Osage should marry the young beaver, and share with her family the enjoyment of the river. The Osage readily consented, and from this happy union there soon came the village and the nation of the Wabash or Osages, who have ever since preserved a pious reverence for their ancestors, abstaining from the chase of the beaver, because in killing that animal, they killed a brother of the Osage. Of late years, however, since the trade with the whites has rendered beaver skins more valuable, the sanctity of these maternal relatives has become visibly reduced, and the poor animals have nearly lost all the privileges of kindred. "

Thus does the march of commerce break even the ties of blood relationship!

From another source (4) we know that "The Amikonas, or 'People of the Beaver,' an Algonquin tribe of Lake Huron, claimed descent from the carcass of the great original beaver, or father of the beavers; and the beaver was one of the eight clans of the Iroquois . . . Hochelagans, or 'Indians of the Beaver-Meadow'."

The flathead tribe of the northwestern section of the United States, apparently not to be outdone by their eastern brothers, believed the beavers to be a "fallen race of Indians, who, in consequence of their wickedness, vexed the Good Spirit, and were condemned by him to their present shape." Some hope is held, however, that happier days are ahead, for, "in due time they (the Beaver) will be restored to their humanity." (5) All this, no doubt, is as it should be.

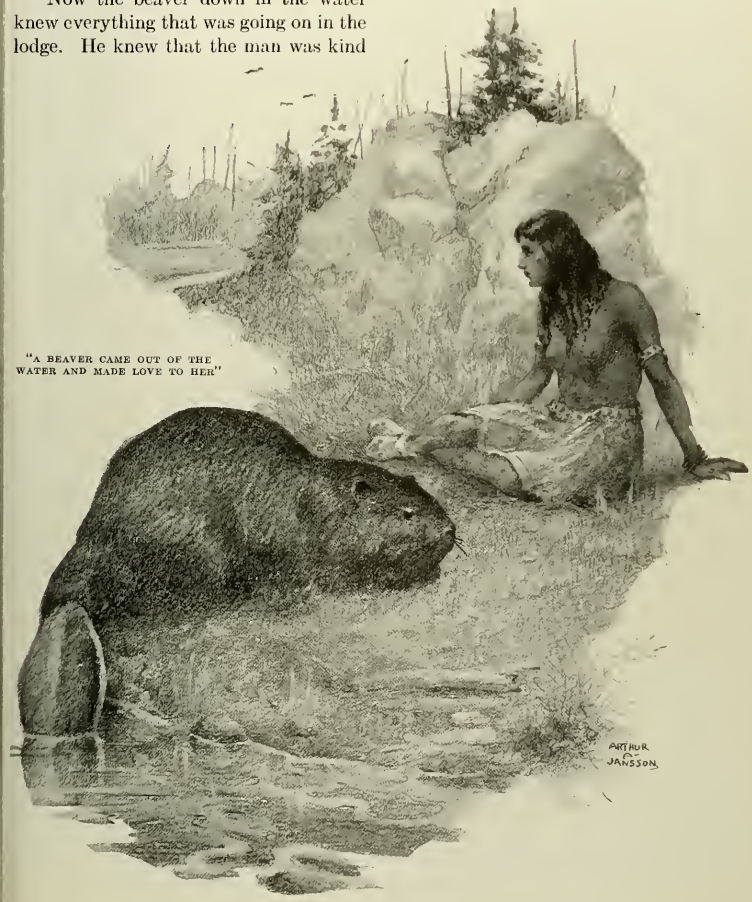
When we consider folk tales of marriages between beavers and Indians, we are led to believe that the Indian women never heard the expression "equal rights" in relation to their being placed upon a satisfactory footing with their husbands or with men in general. Do the men marry the animals and thus suffer the indignity of such a relationship? No! Of course not! Witness this tale of the Blood Indians, this highly original variation of the ageless "triangle problem." (6)

"Once there was a man and his wife camping alone on the shore of a small lake. This man was a great hunter, and had in his lodge the skins of almost every kind of bird and animal. Among them was the skin of a white buffalo. As he was always hunting, his wife was often left alone. One day a beaver came out of the water and made love to her. This went on for some time, until finally she went away with the beaver to his home in the water. When the man came home, he looked all about for his wife, but could not find her anywhere. As he was walking along the shore of the lake, he saw her trail going down into the water. Now he knew what had happened. He did not break camp, but continued his hunting. After four days, the woman came up out of the water and returned to her lodge. She was already heavy with child. When her husband returned that evening, he found her in her usual place and she told him all that had occurred.

"In the course of time the woman gave birth to a beaver. To keep it from dying, she put it in a bowl of water which she kept at the head of her bed. In the

evening her husband came in as usual, and after a while, hearing something splashing in water, he said, 'What is that?' Then the woman explained to him that she had given birth to a beaver. She brought him the bowl. He took out the little beaver, looked at it, and put it back. He said nothing. As time went on he became very fond of the young beaver and played with him every evening.

"Now the beaver down in the water knew everything that was going on in the lodge. He knew that the man was kind to the young beaver and so was not angry with him. He took pity on the man. Then the father of the young beaver resolved to give the man some of his medicine songs in exchange for the skin of birds and animals the man had in his lodge. So one day, when the woman went down to the lake for water, the beaver came out and instructed her to request of her husband that whatever



"A BEAVER CAME OUT OF THE WATER AND MADE LOVE TO HER"

he (the beaver) should ask in his songs, that should be done. He also stated the time at which he would come to the lodge to be received by her husband.

"At the appointed time the beaver came out of the lake and appeared before the lodge, but, before he entered, requested that the lodge be purified (a smudge). Then he entered. They smoked. After a while the beaver began to sing a song in which he asked for the skin of a certain bird. When he had finished, the man arose and gave the bird-skin to him. Then the beaver sang another song in which he asked for the skin of another bird, which was given him. Thus he went on until he secured all the skins in the man's lodge. In this way the man learned all the songs that belonged to the beaver-medicine and also the skins of the animals to which the songs belonged.

"After this the man got together all the different kinds of bird and animal skins taken by the beaver, made them up into a bundle, and kept the beaver-medicine."

There is another strange tale, "The Women Who Married the Beaver" (7) related by the Coos Indians of Oregon. In this instance, there was a scarcely understandable error on the part of two apparently bewitched girls. They set out in good faith to marry a youth, who was "the son of a rich man who had much shell-money and many otter hides. He was a sea-otter hunter and had a beaver and muskrat working for him." The girls, however, mistook the beaver for their intended mate and, not waiting for any confirmation, married him forthwith. They soon had cause to wish their hasty marriage annulled, for the beaver proved to be a cantankerous old individual who made life none too happy for his brides. He had a distressing habit of becoming enraged and screaming, "because he could not get anything to eat."

After many sad experiences, the girls decided that they had indeed joined their lives with the wrong character so, after several misadventures, the old beaver was discarded in a most decisive manner. He was killed! One of the girls then married the rightful husband. The story does not tell what happened to the other sister. Perhaps she wedded the muskrat, who can say?

So great were the mythical accomplishments of the all-wise beaver that one Omaha legend adds the power of reincarnation to the list. (8) In this legend the principal actor visits the beaver, who, apparently at some pains to feed his guest, slays and prepares one of his own children! One should not be alarmed by this apparently brutal homicide for, when the meal was finished, "the beaver gathered the bones and put them into a skin, which he plunged beneath the water. In a moment the youngest beaver came up alive out of the water."

What a unique way of solving the food problem!

From this tale of wonder-working we go on to another, in which the beaver attempts, unsuccessfully, to rescue an unfortunate sufferer. This Cherokee myth (2b), describing the peregrinations of one Untsaiyi, the Gambler, tells how, after losing a game in which his life was bid to the winner, he ran away to forestall the collection of the debt. Eventually he was overtaken, despite the fact that he was a magician capable of changing his form. A cruel fate awaited him even though the beavers were his friends.

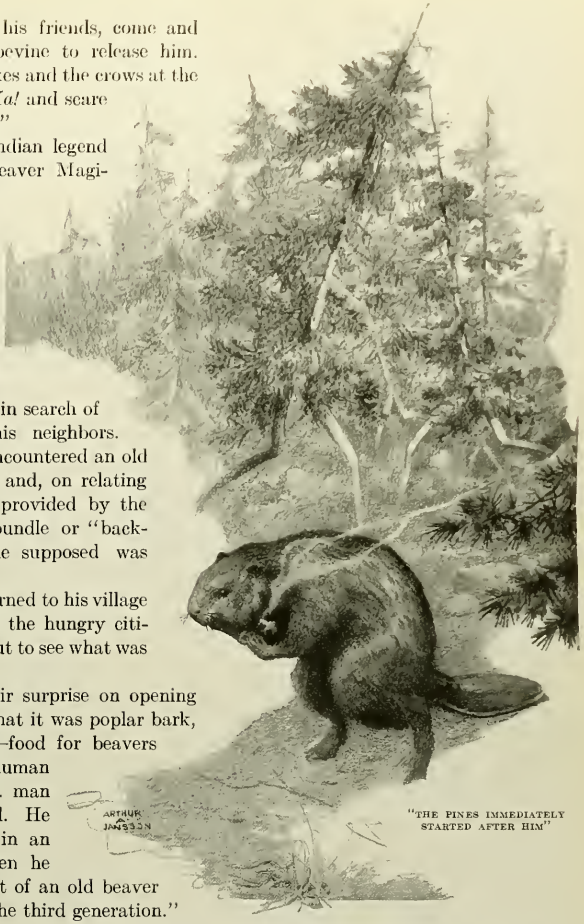
"They tied his hands and feet with a grapevine and drove a long stake through his breast, and planted it far out in the deep water. They set two crows on the end of the pole to guard it and called the placed Kagunyi, 'Crow Place.' But 'he' never died, and cannot die until the end of the world, but lies there always with his face up. Sometimes he struggles under the water to get free, and sometimes the

beavers, who are his friends, come and gnaw at the grapevine to release him. Then the pole shakes and the crows at the top cry *Ka! Ka! Ka!* and scare the beavers away."

In a Micmac Indian legend (9) called "The Beaver Magicians and the Big Fish," we discover the beaver in a new character — that of a deceiver of the Indians. It seems that an Indian hailing from a starving village went forth in search of food to succor his neighbors. On the trail he encountered an old man in a wigwam and, on relating his troubles, was provided by the ancient with a bundle or "back-load" of what he supposed was meat.

The hunter returned to his village with the load and the hungry citizens gathered about to see what was in store.

"What was their surprise on opening the pack to find that it was poplar bark, instead of meat,—food for beavers instead of for human beings. The . . . man had been deceived. He supposed himself in an Indian's hut, when he had been the guest of an old beaver and his litters to the third generation."



"THE PINES IMMEDIATELY STARTED AFTER HIM"

The unfortunate people, their hunger still unappeased, decided to hunt for the strange beaver that had played them so mean a trick. Alas, when they reached the vicinity of the wigwam, gone was the "old man." "The old fellow had been nothing but a wily magician. He had practiced a double deception upon his dupe."

A superstition of the Cherokees (26), concerning the teeth of beaver, in relation to Indian children, should not be overlooked. Here the beaver is regarded as a "good spirit."

"The beaver (dayi), by reason of its well-known gnawing ability, against which even the hardest wood is not proof, is invoked in behalf of young children just getting their permanent teeth. According to the little formula which is familiar to

nearly every mother in the tribe, when the loosened milk tooth is pulled out or drops out of itself, the child runs around the house with it, repeating four times, 'Dayi, skinta' ('Beaver, put a new tooth into my jaw') after which he throws the tooth upon the roof of the house."

Straightforward, unadulterated Indian animal tales are perhaps the most familiar. These charming stories should be known to every American grown-up as well as to boys and girls. Many of them are popular, yet, so numerous are they, that it will be many years before even the best of them will be fully presented. Here is one called "Beaver and Porcupine," a delightful little narrative embodying the main characteristics of all Indian stories. In this tale, related by the Tlingit Indians of the North Pacific, our hero, the beaver, learns the sting of retribution. ([10])

"The beaver and the porcupine were great friends and went about everywhere together. The porcupine often visited the beaver's house, but the latter did not like to have him come because he left quills there. One time, when the porcupine said that he wanted to go out to the beaver's house, the beaver said, 'All right, I will take you on my back.' He started, but instead of going to his house he took him to a stump in the very middle of the lake. Then he said to him, 'This is my house,' left him there, and went ashore.

"While the porcupine was upon this stump he began singing a song. 'Let it become frozen, let it become frozen, so that I can cross to Wolverine-man's place.' He meant that he wanted to walk ashore on the ice. So the surface of the lake froze, and he walked home.

"Sometime after this, when the two friends were again playing together, the porcupine said, 'You come now. It is my turn to carry you on my back.' Then the beaver got on the porcupine's back, and the porcupine took him to the top of a very high tree, after which he came down and left him. For a long time the beaver did not know how to get down, but finally he climbed down, and they say that this is what gives the broken appearance to tree bark."

Next in popularity to direct animal stories, are those telling of the "origin" of various things.

The Thompson River Indians of British Columbia had an intriguing tradition about the "Origin of Fire." ([11]) Once more the beaver enters into the activities and gives a satisfactory account of himself. It is called "The Beaver and the Eagle; or The Origin of Fire"

"In the beginning the people were without fire. The Beaver and the Eagle said they would find out where fire could be obtained, and accordingly sent out the Swallow, who flew over the country on a search. At last he came back with the intelligence that he had discovered fire in the possession of a family at Lkamtcin (Lytton). The Beaver and the Eagle then said, 'We will go and obtain it'; and they laid their plans accordingly. The Eagle soared away through the air, and at last discovered the shell of a fresh-water clam, which he took possession of. The Beaver appeared at the place where the people drew water out of the creek. They lived in an underground lodge. Some young girls, going down to the creek for water in the morning, came running back with the intelligence that there was a beaver at the watering place. Some young men went out with bows and arrows and shot him, and brought him up to the house. They began to skin him. In the meanwhile the Beaver thought, 'Oh, my elder brother! He is long in coming. I am nearly done for.' Just then the Eagle perched down on the top of the ladder, and at once attracted the people's attention, so that they forgot all about the Beaver in their anxiety to shoot the Eagle, which they could not kill, although they fired arrows at him. Meanwhile the Beaver caused the

house to be flooded with water. In the confusion the Eagle dropped the clam-shell down into the fire. The Beaver immediately filled it with fire, put it under his armpit, and made off in the water. He spread it over the whole country. After that the Indians could make fire out of trees."

Here is another "fire" story of the Nez Perces, in which the beaver takes active part. [12]

"Once, before there were any people in the world, the different animals and trees lived and moved about and talked together just like human beings. At this time the pine-trees had the secret of fire, and guarded it jealously from the rest of the world, so that, no matter how cold it was, nobody could get any fire to warm himself by, unless he was a pine. At length an unusually cold season came, and all the animals were in danger of freezing to death because they could get no fire; but all plans to find out their secret from the pines were in vain until the beaver hit upon one which proved successful.

"IN HIS EFFORTS TO CLEAR THE CHANNEL, THE GIANT OVERTURNED HIS CANOE"

"At a certain place on Grande Ronde River, in Idaho, the pines were about to hold a great council. They had built a large fire at which to warm themselves after coming out of the icy water from bathing, and had posted sentinels round about to keep off all the animals and other intruders, who might steal the fire secret. But Beaver had hidden under the bank near the fire before sentinels had been posted, and so escaped their notice. After a while a live coal rolled down the bank close by Beaver, which he seized and hid in his breast, and then ran away as fast as he could. The pines immediately raised the hue and cry, and started after him. Whenever he was hard pressed, Beaver darted from side to side, and dodged his pursuers, and when he had a good start he kept a straight course."

At last the Beaver outwitted his enemies and distributed fire to other trees along the way. The Indians claimed that the trees given fire by the Beaver were the best ones to use as fire sticks.

It is small wonder, if Indians believed themselves indebted to beaver for fire and other necessary and vital creations, that they should regard the animal with awe. In the case of the Cheyennes, there are many evidences that both sexes reverenced the beaver.

"It is said that in very old times beavers were not so often killed, and that no Cheyenne woman would dress or even handle a beaver-skin." (13a)

Another account, coming from the same tribe, says, "In ancient times certain doctors used to make drums called beaver drums, which implies beaver songs and a beaver worship. It is said that these doctors had beaver cuttings which they shot into people whom they did not like, and which caused diseases which were fatal. The Blackfeet have a similar belief." (13b)

The exploits and adventures of animals, according to many Indian traditions, often resulted in the formation of various scenic wonders, such as cliffs of peculiar design, rivers with curious channels, and the like. One "Athabascan" story (14), "The Great Beaver" is typical.

"A family of very large beavers lived on the Great Slave Lake, long ago, and the lodge is still there. Well, they all started down the Mackenzie River, and when they had gone a long distance, one of them killed one of his companions and roasted the flesh, but left it hanging before the fire while he fell asleep. While he slept, a wolverine came along and took the roasted beaver and left a roll of moss in its place. After a time the sleeping beaver awoke. When he found that the roasted flesh was gone he was vexed, so he took the bark dish that he had placed under the roasting meat to catch the fat, and emptied it into the fire saying, 'Burn and never go out.' And it never has

(Beds of lignite along the banks of the Mackenzie a few miles above Bear River, have been burning for a century at least.)

"Then he went down-stream until he came to some high rocks, where he met a wolverine whom he wished to fight; but the wolverine said, 'No, I will not fight with you and you cannot catch me.' He then tried to escape by running up the face of the cliff. Then the beaver said, 'Stay there and never come down.' And the wolverine was turned into stone, and can be seen there to this day.

(Roche Carcajou, an anticlinal uplift of Devonian limestone, one thousand feet high.)

"As he continued his journey down the river he went so fast at one place that he created the 'Sans Sault' Rapid.

(The only rapid in the Mackenzie River of any consequence, and one that is easily passed by the steamers in any but the lowest stages of water.)

"As the beaver went on down the river he was discovered and pursued by a giant, to whom he said, 'If you can clear all the rocks from the river, you may kill me, but if you cannot clear the river, you will never kill me.' In his efforts to clear the channel the giant overturned his canoe, which turned into stone and forms an island in the bed of the stream.

(An island at the Sans Sault Rapid divides the stream into an eastern and a western channel, the latter being 'the steamboat channel'.)

"Failing to accomplish his task, the giant said, ' I cannot kill you; but never mind, there will soon be plenty of men here who will always hunt you and all your tribe'" What remarkable truth there was in that prophetic announcement!

"'The beaver replied, 'Since you cannot kill me, keep still awhile and I will paint your picture.' Then the beaver painted the picture of the giant on one side of the ramparts, where it may still be seen.

(*At the ramparts, the Mackenzie, much contracted in width, flows between vertical cliffs of Devonian limestone varying from one hundred to two hundred feet in height. This gorge is but a few miles south of the Arctic circle, and is one of the most interesting features of the great river.*)

After this the giant left the country."

The Indians of the "Great Lakes Region" did not hesitate to ascribe heroic deeds to beaver. When Father Allouez, a Catholic missionary, traveled through "Wisconsin" in 1669 and 1670, he learned that the "savages" had their own ideas about the origin of the waterways. (15)

"They believe that Lake Superior is a pond made by beavers, and that its dam was double, the first being at the place called by us the Sault, and the second five leagues below. In ascending the river, they say, this same god (Michabous—Great Hare) found the second dam first and broke it down completely; and this is why there are no waterfalls or whirlpools in that rapid. As to the first dam, being in haste, he only walked on it to tread it down; and, for that reason, there still remain great falls and whirlpools there."

The Indians further related that the god drove the beavers from the lake and they "spread throughout the rivers and lakes of this entire country."

Turning from ideas of the beaver as creator and as an instigator of various whimsical and often contradictory themes, we come finally to the point where this marvelous creature is endowed with complete powers of destruction, for another Cheyenne tale (16) informs us that a beaver controls the destiny of the world and will, on some distant, fatal day, cause the ultimate termination of all earthly things. We learn, briefly, and clearly, that,

"The earth rests on a large beam or post. Far in the north there is a beaver as white as snow who is a great father of all mankind. Some day he will gnaw through the support at the bottom. We shall be helpless and the earth will fall. This will happen when he becomes angry. The post is already partly eaten through. For this reason one band of the Cheyenne never eat beaver or even touch the skin. If they do touch it, they become sick."

So much for that!

Our legends of beaver reach the cycle's end. We have journeyed with the perservering animal through many strange situations, from the creation of the world to the final cataclysm, through birth, marriage, and death; fire, pestilence, and health. Truly, of all the animals, the beaver must have held a very high rank in the Indian's estimation, provided one bases his conclusions upon these tales. The accounts come from east and west, north and south. Though one reads the myths for sheer enjoyment, he will, nevertheless, find stories within stories, if he will but glance between the lines.

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SAILING SOUTH

THE "BASILISK"

A Yawl Built Especially to Aid Certain Scientific Studies Among the Islands of the West Indies. A Duplicate of the Little Craft in Which Joshua Slocum Circumnavigated the Globe

By G. KINGSLEY NOBLE

Curator, Herpetology and Experimental Biology, American Museum

INTERIOR VIEWS OF THE "BASILISK" WERE TAKEN BY MR. E. B. FLADUNG OF BALTIMORE, THE OTHERS BY MR. W. G. HASSLER OF THE MUSEUM STAFF

The "Basilisk" has been built by Mr. Gilbert C. Klingel in order to aid in carrying out a series of scientific studies in the field of herpetology and experimental biology. Experienced in such studies on various West Indian islands, Mr. Klingel has long felt the need of a boat especially designed for his uses, and having studied the matter carefully he finally decided to duplicate one of the most famous of all small boats—Captain Joshua Slocum's "Spray." Thus, through the vision and interest of Mr. Klingel, the American Museum of Natural History and the Natural History Society of Maryland, now have an excellently equipped boat capable of carrying on an important series of studies. In addition to financing the construction of this new craft, Mr. Klingel is assuming the responsibility of taking her to the West Indies, there to carry out, in company with Mr. W. Wallace Coleman, the studies for which the boat was built.—THE EDITORS.

IN the course of its sixty years of existence, the American Museum of Natural History has sent innumerable expeditions to almost every corner of the world. The Arctic and the Antarctic have been penetrated. Every continent and every sea have been visited. On foot, by camel caravan, by motor car and ship, the scientists of the institution have journeyed all about the world on their never-ending search for knowledge.

In the "City of New York," the "Morrissey," and other sailing ships, representatives of the American Museum have gone voyaging, but now, for the first time in the history of the institution, a ship has been built especially for a scientific expedition—built and equipped especially for the Museum's purposes. And now this floating laboratory is on her way with eight thousand miles ahead of her, to search among the islands of the West Indies, a scientific expedition for the American Museum's department of

AT OXFORD, MARYLAND

The "Basilisk" drawn up at the shipyard where she was built, to be carefully overhauled before starting on her long voyage

A NEW COAT OF PAINT

The lengthy stay at Baltimore Harbor while thoroughly provisioning the "Basilisk" made an additional coat of paint necessary before the "Basilisk" sailed

FORWARD

Mr. Coleman studying the plans before leaving port

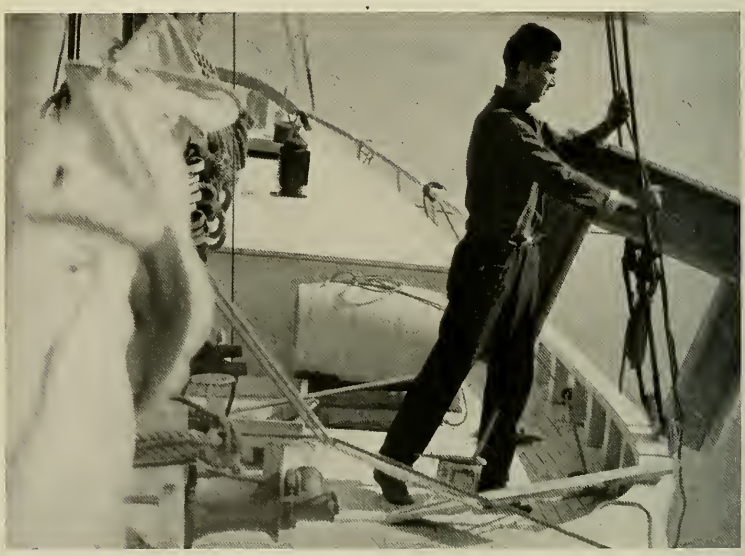
WORKING ON THE RIGGING

Captain Dave Pritchard, who made the sails, helped the crew to overhaul the rigging

herpetology and experimental biology and for the Natural History Society of Maryland.

It must not be supposed, however, that this new ship is a counterpart of the "Morrissey," the "City of New York," the "Carnegie," or of any other craft that has heretofore been sent out in the interests of science. She can be compared with none of them. Named the "Basilisk," after a West Indian lizard that has the ability to run across the surface of the water, this new ship is far smaller than any of her scientific sisters, and instead of being manned by a crew of seamen and officers to relieve the scientists of the responsibilities of navigation and seamanship, she is handled by two men only—Mr. Gilbert C. Klingel, and Mr. W. Wallace Coleman, the members of the expedition—and while during the cruise a third member of the American Museum staff will probably join the ship, at no time will the members of the "crew" be other than the scientists themselves.

Thirty-five years ago, a retired sea captain named Joshua Slocum, unable to resist the call of the sea, was given a sloop that had been christened the "Spray." She was not a new craft, and was not in the best of condition. As a matter of fact, for years she had been hauled up on dry land. But in Slocum's experienced hands she was entirely rebuilt, was painted, rerigged, and outfitted, and finally was ready for sea. Only 37 feet in length on the water line, and of 14 feet beam, this small craft could be handled by one man, and when the man proved to be Joshua Slocum, the voyage he proposed was far less foolhardy than many prophets promptly announced. For Slocum,



MANY SMALL DETAILS NEED ATTENTION
Captain Klingel is fixing a line to hoist the anchor aboard, while the freshly painted chain box is placed to dry between the stays

LINES AND HALYARDS
The new lines were carefully tested before the voyage was begun. The dark object on the left is the chimney of the galley stove

though such a thing had never before been attempted, had decided to circumnavigate the globe single-handed.

And what Slocum proposed, Slocum accomplished. Three years and two months after he had set sail alone from Fairhaven, Massachusetts, he returned safely to that very port, bringing with him, in addition to a crust of salt from five of the seven seas, proof of his excellence as a sailor, and equal proof that the "Spray" was capable of holding her own in any weather that the seas could bring.

Never before, as I have said, had such an adventure succeeded. Probably such an ambitious program had never before been seriously proposed. Since that time, however, Harry Pigeon, in the "Islander" and Alain Gerbault in the "Firecrest" have followed successfully in Captain Slocum's wake, and innumerable small boats with limited and even amateur crews have wandered here and there—almost at will—over salt water.

And now the "Basilisk" has gone forth in the interests of science—has gone forth to sail over thousands of miles of West Indian waters in the hands of two—and at most three—searchers after scientific fact. And the "Basilisk," built at Oxford, Maryland, more than thirty-six years after Captain Slocum's rebuilt "Spray" first slid into the colder waters of the Massachusetts coast, is, in her hull and her rigging, a replica of the older vessel.

When Captain Slocum first set sail on his forty-six-thousand-mile voyage, which led from Massachusetts to Gibraltar, to the Strait of Magellan, across the South Pacific, around the Cape of Good Hope, to the West Indies and home, his sturdy little craft was rigged as a sloop, but long before she had returned to her home port, her rig had been changed to that of a yawl. And it is as the "Spray" was later rigged that the "Basilisk" is rigged now.

Thus the American Museum and the Natural History Society of Maryland are

THE LABORATORY SIDE OF THE CABIN

The long work table is fitted with cabinets and drawers for equipment and charts, and a sink for photographic use

THE LIVING QUARTERS

The two fine bunks have space underneath for canned goods, Book racks were later fastened on the unused wall spaces

THE GALLEY STOVE
A coal-burning stove was decided upon as more practical than the many other types available

represented at sea by a little ship which, as sturdily built as it is possible to build such vessels, and designed as a duplicate of Joshua Slocum's "Spray," may reasonably be said to be as seaworthy and as staunch a boat as one is likely to find on any of the seven seas.

But although the new craft is a faithful copy of the old, so far as her hull and her rigging are concerned, the requirements of the expedition necessitated a re-arrangement of the interior. Thus, this little ship contains a laboratory, in addition to living quarters and stowage space. There are complete photographic facilities. Solution bottles occupy numerous racks. There is a refrigerator for cooling water, and this, strangely enough, is operated by heat. A library of one hundred and fifty volumes is set on shelves along the cabin walls. There is an instrument table nine and one-half feet long, with drawers beneath it to hold equipment and to provide suitable working space. Two comfortable bunks are installed, and there is a galley, complete to the last sea-going appliance, to cater to the demands of the crew.

In this sturdy, seaworthy craft, food supplies for one year have been stowed so that they are readily accessible, yet so they cannot shift with the motion of the ship. The edibles were chosen on a basis of a ten-day menu which gives variety for every meal as well as a balance of diet. Except for a few fresh articles the "Basilisk" should be entirely independent and free from the annoyances of taking on supplies from the merchants or the natives of the islands she will visit.

In every sense the "Basilisk" venture is a serious experiment to see whether two or three men can independently maintain themselves "in the field" for long periods of time and provide their own transportation when and as it is required. Added to this accomplishment, the cruise hopes to prove that under such conditions these cruising naturalists will still be able to produce work of value to herpetology and to the biological sciences.

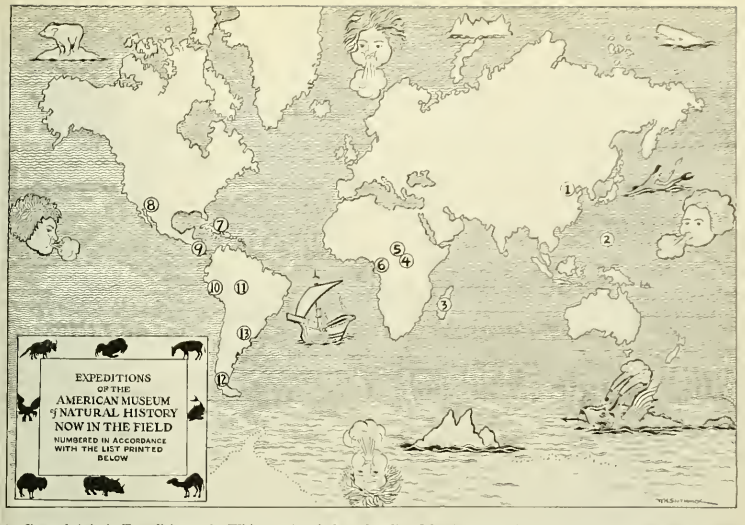
The expedition plans particularly to make a special study of the life-histories of lizards. There are many small islands in the Antilles and off the Central American coast which have never been visited by naturalists. The "Basilisk," drawing only about five feet of water, will be able to reach even the most reef-protected of these.

In building the craft, the requirements were exacting. A boat was needed that would be seaworthy, comfortable to live in, staunch, yet small enough for one or two men to handle in any weather. It must be able to carry water for a period of several months, and provisions for at least half a year, and yet allow space to work and live. Thus the construction is remarkably sturdy, with framing and timbers of white oak, planking and ceiling of heart of Georgia pine, decking and cabin of white cedar, and masts of Oregon pine. The rigging is much heavier than that used on most boats of similar size, and is designed to stand heavy wear and tear. Every seam in the sails is triple sewed, and the canvas is twice as heavy as is generally used on such boats.

In the regions she will visit it is likely than many species new to science will be discovered. Tagging experiments will be conducted in the field, and the movements of individual lizards will be noted from hour to hour. In this way the daily ranges of individuals and also the relations of one individual to another and to the colony as a whole will be worked out. On the expedition, for the first time, the experimental method will be applied to the study of lizard colonies, and the result should be of interest to both psychologists and naturalists.

Through the Lower Bahamas, along the coasts of Haiti and Santo Domingo, North and South Cuba and the Bay Islands off Honduras and Yucatan, the "Basilisk" will work her way. Equipped only with sails to propel her among the islands, this replica of Joshua Slocum's famous little ship may well take her place as one of the important craft built and operated entirely in the interests of science.

CAPTAIN KLINGEL AT THE HELM OF THE "BASILISK"



1. Central Asiatic Expeditions; 2. Whitney, South Sea, Caroline Islands, for birds; 3. Madagascar, for birds, mammals, and fossils; 4. O'Donnell-Clark, Africa, for mammals; 5. Chapin, Congo, for birds; 6. Columbia University-American Museum, to Africa for anatomical study; 7. Klingel, West Indies and Central America, for lizard studies; 8. Frick-Rak, Southern California, for fossils; 9. Chapman, Barro Colorado, for bird study; 10. Frick-Blick, Ecuador, for fossils; 11. Ollala Brothers, Brazil, for birds and mammals; 12. Scarritt, Patagonia, for fossil mammals; 13. Naumburg-Kaempfer, Southern Brazil, for birds

AMERICAN MUSEUM EXPEDITIONS AND NOTES

EDITED BY A. KATHERINE BERGER

It is the purpose of this department to keep readers of NATURAL HISTORY *informed as to the latest news of the Museum expeditions in the field at the time the magazine goes to press. In many instances, however, the sources of information are so distant that it is not possible to include up-to-date data*

CENTRAL ASIATIC EXPEDITIONS.—Dr. Roy Chapman Andrews, leader of the Central Asiatic Expeditions, returned to New York on the "Mauretania" January 3. He said that the large collections obtained by the Expedition in Mongolia during the past summer reached Peking in safety, and at the time of his departure were being packed for shipment to New York by the Second in Command, Mr. Walter Granger. Before this issue of NATURAL HISTORY goes to press, the collections, numbering ninety-one cases, should be on their way to the American Museum.

Doctor Andrews reports that the 1930 Expedition has been unexpectedly successful. The palæontological collections are larger than those of any previous year, and certainly as important. Half the summer was spent working in a great Pliocene deposit which had been discovered late in the season of 1928. It is in such a formation that the Expedition might hope to find the remains of primitive human types, if they existed in Mongolia, as is confidently believed. Almost immediately, extraordinarily rich deposits were discovered along the ancient shore land of a great inland sea which had existed in eastern Mongolia some three or four million years ago. Along the borders of this lake there were many quicksands and bogs. Animals both large and small were trapped in these deposits, and form an invaluable record of the life that existed in this region during those ancient days.

Perhaps the most spectacular discovery was a great collection of the shovel-tusked mastodon, *Platybelodon*. At least thirty or forty individuals of this extraordinary species had been trapped in what was obviously a bog. The bones lay

like a heap of jackstraws piled in a heterogeneous mass, one upon the other. Seventeen magnificent shovel-tusked jaws were removed as well as several skulls, and almost all of the other important bones of the skeleton of this remarkable mastodon.

A short distance away another death trap was filled with the skulls and skeletons of baby *Platybelodon*. In this deposit there was only one adult individual. Fortunately, that was a pregnant female, and part of the skull and bones of the unborn calf were removed through the skilful work of Messrs. Thomson and Granger. Six other baby skulls and jaws were taken from this pit.

Altogether we have an unrivalled aged series of shovel-tusked mastodon jaws ranging in size from the unborn baby only a foot in length to the old bulls with jaws five and a half feet long. Nowhere else in the world is there such a remarkable series of any fossil mammal, with the exception of the skulls of the dinosaur *Protoceratops*, which the Expedition discovered in Mongolia during 1923, and which are already on exhibition in the Central Asiatic Hall.

Although half a dozen other splendid deposits were in sight, the leaders of the Expedition felt that it was necessary to transfer operations to another and earlier formation which they knew to be very rich in fossils. Consequently, in August, camp was shifted only fifty miles away to strata of Eocene and Oligocene Age. These proved to be quite as rich and important as the former locality. Hundreds of specimens of great importance were discovered. Among them an amazing series of Amblypods—a huge skull was found in Oligocene strata. This extends the existence of the Amblypods for millions of years after they were supposed to have become extinct in Europe and America. A fine series of skulls and jaws of the remarkable Chalicothere, a clawed, hoofed animal allied to the *Maropus* of America, were obtained. Parts of the strange carnivore-like pig *Enteledon* and of a hyena-like carnivore of enormous size were also discovered.

In a future article Doctor Andrews will give a more detailed account of the Expedition's work and collections.

The good luck which has attended the Central Asiatic Expeditions throughout its explorations brought it back to Kalgan only two days before the country was closed by bandits. Mr. J. McKenzie Young, chief of motor transport, had a rather exciting fight with the bandits a month before the Expedition left the field. Mr. Young sustained no injury himself, although he inflicted considerable punishment upon the thirty brigands who attacked him.

THE CHILDS FRICK EXPLORATIONS.—Explorations with the object of securing added data as to certain of the extinct mammalian faunas of America are being conducted in six widely separated areas—three in the Late Tertiary and three in the Quaternary. The total shipments for 1930 from the six localities comprise some 121 cases. The material as received is carefully prepared by the museum laboratory staff and will be of great assistance in the several special studies now long in progress on the Carnivora, horses, camels, rhinoceroses, etc.

The three Tertiary explorations include Mio-Pliocene horizons in the vicinity of Barstow, California, Santa Fe, New Mexico and Ainsworth, Nebraska, which have been worked annually for some seasons past as representative respectively of largely contemporaneous faunas of the Pacific Slope, Rocky Mountains, and Great Plains areas. The three Quaternary explorations include deposits in northwestern Nebraska, and in Alaska in the north and Ecuador in the south.

(1) BARSTOW, MOHAVE DESERT, CALIFORNIA.—The party, under Mr. Joseph Rak, collected for the eighth consecutive winter in the steeply pitching beds of this difficult area, securing at three separate horizons additional important carnivore, horse and camel remains. A lower horizon, the Rak Division, has yielded two of the finest associated camel skeletons of Miocene Age yet encountered in any part of the world.

(2) SANTA FE, NEW MEXICO.—For a sixth May to November season the Joseph Rak party followed up its operations in the "Santa Fe Marls" of Cope. The discovery of incidental crania and other remains of camels and horses in great variety, rhinoceroses, mastodons, antelope, Oreodonts, and of an occasional carnivore or rodent, has continued with some of the success of previous years. The jaws and partial skull of a large and greatly aged bull mastodon (*T. pojuequensis* referred) comes as a companion to the beautifully preserved skull and jaws of an equally aged female obtained a year past. When the jaws are closed in this particular four-tusked form, the downward directed upper tusks cross the mandibular symphysis well posterior to the exposed bases of the lower tusks. The new specimen is remarkable in that the extremely heavy upper tusks, which are usually elongate, are worn to symmetrical fourteen-inch stubs. The lower tusks are unshortened.

Mr. Rak himself has been incapacitated by an abscessed foot so that the party the present season has been under the direct charge of his chief assistant, Mr. Jack Wilson.

(3) Ainsworth, Nebraska.—The work in this area has been continued for a fourth June to August by Mr. Morris F. Skinner. Among the more interesting material secured are two fine skulls of Leidy's *Procamelus*, a skull of the peculiar rodent, *Mylagaulus*, and the skull of a large species of the great wolf-creature, *Amphicyon*.

(4) Hay Springs, Nebraska.—Excavations carried on by Mr. Charles Falkenbach for a third partial summer in this vicinity have resulted in the securing of several crania of the typical Equus, dentitions of the giant beaver, *Castoroides*, and a considerable assortment of additional remains. But by far the most notable find is the skull of a great species of Lartet's strange bear-sized carnivore, *Hemicyon* (*H. nebrascensis*, n. sp.), discovered by Mr. Falkenbach in a pocket directly underlying the Pleistocene. The only other finds of this genus in America are the surprising series secured at Barstow by Mr. Rak and the unique skull, jaws, and partial skeleton found by Messrs. Falkenbach and Simpson in New Mexico in 1923.

(5) Fairbanks, Alaska.—Under the joint auspices of Alaska College and the American Museum and through the courtesy of Mr. N. W. Rice and the authorities of the U. S. Smelting and Mining Company, Messrs. Peter Kaisen and Otto W. Geist collected a second year in the wake of the gold mining stripping operations. Among the more striking trophies obtained the present season are partial skulls of all three of the musk ox genera—Ovibos, Symbos and Bootherium—additional series of skulls with the horns themselves occasionally preserved of bulls and the first two skulls of females of the great Super-bison, remains of a huge bearlike creature of the size of *Arctotherium* and the skull of a calf mammoth. Among several curiosities are well preserved leaves and a great oblong mass of minute and closely compressed seeds which suggest a winter's cache of long ago, and the little ground squirrels whose skeletons are now and again encountered. During the summer Mr. Kaisen by the use of local flying service obtained important small collections from areas to the northwest of Fairbanks. In connection with the collection President Bunnell of Alaska College has received from Mr. B. E. Douglass of Livengood a superb cranium of a male mammoth with a tusk measuring 8 feet 4 inches. This specimen is particularly valuable for comparison with the several fine female crania washed out the past year at Fairbanks.

(6) Punin, Ecuador.—Messrs. John Blick and Charles Falkenbach were cordially received by the authorities at Quito on their arrival in late December for the purpose of investigating deposits in the neighborhood of Punin which have lain largely undisturbed since the Branco explorations of 1881. It is recalled that Curator Anthony in 1923, while making a small collection in this area, had the fortune to discover a human cranium in place in the same beds apparently with remains of extinct ground sloths, horses and camels. It is hoped that more adequate knowledge of the Punin horizons will shed much welcome light on several Pleistocene problems.
—Childs Frick.

The O'Donnell-Clark African Expedition.—The rare giant eland is the desideratum of the O'Donnell-Clark African Expedition which started for the Sudan on January 10, under the leadership of Mr. James L. Clark, assistant director in charge of preparation at the American Museum and Mr. C. Oliver O'Donnell, associate leader. Landing at Alexandria, the expedition will proceed direct to Cairo, thence to entrain for a three-day journey to Khartum. Here the party will board a specially chartered river vessel for a sixty-day trip along the Upper Nile, allowing frequent stops and excursions inland for the purpose of study and observation before any attempt at securing specimens is actually made. The animals will be mounted and exhibited as one of the feature groups in the new Akeley-African Hall, now rapidly nearing completion.

The Chapin-Congo Expedition.—Franklin Edson, who has spent the past year in work for the mammal department of the American Museum, has just returned from the Belgian Congo, where he has been acting as assistant to Dr. James P. Chapin in the collection of specimens and accessory material for a proposed group of Congo bird life.

Although forced to return ahead of time due to illness, Mr. Edson reported that Doctor Chapin was in excellent health, that nearly all the necessary material had been collected, and that work was fast nearing completion.

Doctor Chapin was also able to add a number of very excellent specimens to his study collections, which will prove both rare and valuable additions to the general store of knowledge regarding a part of the Congo which up to the present has been little touched by the scientific collector.

In addition to the ornithological specimens procured, Mr. Edson was able to return with a number of interesting skins for the mammal de-

THE SOUTHERN PART OF SOUTH AMERICA

The dotted line shows the route of the Scarritt-Patagonian Expedition of 1930–31. The cootinuous line shows the route of the Princeton-American Museum Patagonian Expedition of 1898–99–1900

partment, among which are an unusually small fruit bat new to the collection, many scaly-tailed flying squirrels, bush babies, and elephant shrews.

Owing to the fact that the primary object of the expedition was the gathering together of the necessary materials for a group in as short a period as possible, any general collecting in other departments was largely restricted. However, a number of insects were added to the collection, as also were some specimens of the lower invertebrates common to the region. Specimens and photographs were obtained of the interesting froth frog nests of the Congo.

Other results include a number of valuable photographs and several thousand feet of motion picture films.

AMERICAN MUSEUM EXPEDITIONS TO PATAGONIA.—The following letter from Dr. George Gaylord Simpson epitomizes the results of the Scarritt-Patagonian Expedition during the first two months of field work in the Paleocene beds of northern Patagonia:

DECEMBER 1, 1930.

DEAR MR. BROWN:

Another necessarily hurried note and report of progress. We have made a flying trip in to Comodoro Rivadavia primarily to see a government geologist, Dr. Egidio Feruglio, and are profiting by it to restock supplies, leave fossils here, and get some mail off.

This week we are moving from Coli-Haupi farther back into the wilderness, up the Rio Senguer beyond the confluence of the Rio Mayo, west of the Sierra San Bernardo and not far from the Cordillera. I hope for good luck up that way as there are reports of Lower Tertiary and no one has been there since Ameghino, at least.

Our results in the region of Coli-Haupi have been very good. We have worked a long strip of land extending from the source of the Rio Chico (at Lago Coli-Haupi) westward to the Vuelta del Senguer, south of Sierra San Bernardo before the Rio Senguer flows into Lago Musters. We have about fifteen detailed geologic sections with good fossil collections from numerous fixed horizons in each, which should settle the very complex and misunderstood stratigraphy and succession of these early faunas, all of which occur here and some of which occur nowhere else.

In spite of the statements of Riggs and others that the *Notostylops* beds are almost completely barren or worked out, persistent search has revealed a large fauna and we have a really excellent collection already. We have jaws and skulls of mammals described by Ameghino from isolated teeth or single bones, and as nearly as can be judged in the field also have a number of quite new things. We are storing five cases of fossils here in Comodoro.

We continue in good health. The wind has been very bad lately, as it can be only in Patagonia, but it doesn't interfere greatly. I am encouraged by our results and am enjoying the trip and work very much. Everyone continues to give us excellent coöperation. Feruglio, for instance, has saved me days of work and possible mistakes by going over part of the field with me and by supplying me with further unpublished maps, geologic reports, data on fossil localities, etc.

Sincerely,
(Signed) GEORGE GAYLORD SIMPSON.

An excerpt from a letter from Coleman Williams, written on Christmas Day, says:

We have found an unexplored and exceedingly rich locality north of the Rio Chico from which we have taken more than 600 specimens of *Notostylops* fossils in the last week including skulls, jaws and skeletal parts.

This much desired collection from the little known Paleocene beds of South America is already of sufficient importance to insure the success of the expedition. It enriches the American Museum collection with the rarer early Eocene mammals ancestral to the fauna previously secured from southern Patagonia and much desired for comparison with the Paleocene faunas of North America.

The name Patagonia was formerly applied to the southern end of South America—south of the River Negro, but no longer has political significance. (See map on this page).

PREDATORY MAMMAL CONTROL.—Mr. George Goodwin and Mr. T. D. Carter returned to New York the latter part of December from the field investigation which they made in connection with the control of predatory mammals, cooperating with the United States Biological Survey in a study of the various problems involved. Mr. Goodwin covered about 2500 miles by automobile, and on horseback, spending most of his time visiting poison stations in the national forests of Idaho and Utah. Mr. Goodwin was surprised at the number of antelope he saw in the Pahsimeroi. He counted more than 200 animals.

Mr. Carter covered more than 4000 miles, interviewing ranchers, cattlemen, sheepmen, agriculturists, and trappers in Wyoming, Colorado, Utah, and New Mexico.

FIELD WORK IN FLORIDA.—Mr. Maurice K. Brady has been collecting during the past few months in North Carolina, Georgia, and Florida, for the new reptile house of the National Zoological Park in Washington and for the laboratories af experimental biology of the American Museum. He has sent to the Museum many rare frogs and salamanders, including a series of the West Indian piping frog (*Eleutherodactylus ricordii*) which, having become introduced into Florida, is now widely spread over the state. The new reptile house in Washington includes some fine research laboratories. Frequently species not suitable for exhibition are of great biological value, and the National Zoological Park is to be congratulated upon making provision for the study of both types of animals.

THE MADAGASCAR EXPEDITION.—A letter from Mr. A. L. Rand of the Mission Zoologique Franco-Anglo-Americaine in Madagascar, of which M. Jean Delacour is director, states that Messrs. Rand and DuMont have obtained a very interesting series of the ground roller (*Brachypteracias*) for the American Museum collections. The party expects to remain in the field until April.

NOTES

THE NEW VERNAY - FAUNTHORPE SOUTH ASIATIC HALL

THE opening, on November 17th last, of the South Asiatic Hall on the second floor of the American Museum was an event in the history and development of the institution. This hall will stand not only as an expression of the natural beauty and wild animal life found today in the highlands and lowlands, swamps and jungles of southern Asia, but also of the spirit of friendliness, generosity, and true sportsmanship of the two men who made it possible,—Arthur S. Vernay and Lt. Col. J. C. Faunthorpe.

President Henry Fairfield Osborn and Director George H. Sherwood were hosts on this occasion to a group of distinguished guests from England, India, and America, among whom were Sir Harry Armstrong, British Consul General of New York City, representing Sir Ronald Lindsay, the British Ambassador to the United States, Sir Harcourt Butler, former governor of the United Provinces of Agra and Oudh and of Burma, Peter Faunthorpe, son of Colonel Faunthorpe, A. A. Dunbar Brander, chief conservator of forests of the Central Provinces, India, and Arthur S. Vernay.

President Osborn opened the dedication ceremonies with an address of greeting in the auditorium of the Museum, where more than 200 invited guests had assembled. He recalled his first meeting, twelve years ago, with the late Colonel Faunthorpe, then Commissioner of Lucknow, when the Colonel, while visiting the United States, came to the American Museum. President Osborn told how they went over the Museum's collections of mammals together, and of Colonel Faunthorpe's admiration of the methods of taxidermy employed and the artistry with which the animals were mounted in groups against specially prepared backgrounds. Colonel Faunthorpe was impressed, however, with the fact that the fauna of India was represented by only a few unimportant specimens. From this fortuitous meeting sprang the great undertaking which has culminated in the remarkable and rare collections now housed in an architectural setting that reflects most appropriately the spirit of India.

President Osborn paid tribute also to Arthur S. Vernay, big game hunter, partner and companion of Colonel Faunthorpe, who had generously assumed the cost of the entire undertaking in the field, and devoted himself enthusiastically to the series of field expeditions and to the preparation of the exhibits. President Osborn signalized the results of the new hall as a symbol of the unity of ideals and aims which now unite the naturalists of England and America.

Sir Harry Armstrong, speaking for the British Ambassador who sent his greetings, said that the

interest of British sportsmen was as deep as that of Americans in the conservation of game, particularly of those species which are fast vanishing from the earth.

Sir Harcourt Butler was then welcomed by President Osborn, as one who from the first appeal by Mr. Vernay and Colonel Faunthorpe, put all the resources under his command at their disposition. He said in part:

I am representing, as far as one can represent him, one who is dear to many of us, as he was dear to Arthur Vernay and to me. In fact, no one could really represent John Champion Faunthorpe. He stood quite alone. He was a remarkable man and one of the greatest sportsmen of his time. . . .

I have been asked to talk on this occasion about British and American coöperation in exploration and science. No place in the world is more appropriate for such a topic, for no one has done more than President Osborn to promote it. . . . In many parts of the world it is being carried on in the quiet ways of science. Much interchange of thought and work goes on between this and British Museums. There has been no more thorough advocate and architect of this coöperation than Arthur Vernay. With him, American and British coöperation is more than an ideal, it is a burning faith. I have heard him expound in India and Burma, in London and in New York, in the depths of the jungle and in the heart of civilization. And he has proved his word by deeds in the great collection he has given to this Museum. I am told and I can well believe that there is nothing like it in the world. . . .

Arthur Vernay has asked me to say a word about the assistance that he received in India and Burma from the Viceroy, Lord Reading, a man honored here as in the British Empire, the Indian princes, generous sportsmen as well as rulers, the governors of provinces, officials and especially the members of the very efficient forest department. A distinguished member of that department, Mr. Dunbar Brander, is present this evening, and will lecture both here and at Chicago. Where all have been gladly helpful it is almost invidious to particularize, but mention may be made of the great assistance rendered by my old friend his Highness the late Maharajah, Sir Chandra Shumshere Jung Bahadur Rana, Prime Minister and Marshal of Nepal. I hope that all will help equally in the preservation of the fauna to which Arthur Vernay is now directing his attention and energy. He is particularly insistent on the appointment of game wardens in India. And this is most important. When Governor of Burma, I was able to get my government to appoint a game warden, Mr. Smith, with I believe most successful results. As cultivation spreads and the jungle line recedes, the protection of the fauna is one of the greatest services that can be rendered to posterity. In whatever way this can be done it is good work for science and for man. . . .

Tonight we are celebrating the gift of a generous large-hearted American City, which will also be an abiding contribution to science and good will. And I ask myself and I ask you, cannot this good will and companionship and coöperation be carried even further? The points of agreement among us are so many, the points of difference so few. The opportunity is here. Some work of noble note may yet be done for the greater happiness and peace and prosperity of mankind.

SIR HARCOURT BUTLER
Former Governor of the United Provinces of Agra and of Burma, who placed all the resources under his command at the disposition of Mr. Vernay and Lieutenant-Colonel Faunthorpe

Director Sherwood gave a resumé of the activities that crystallized into the achievement of completing the entire Vernay-Faunthorpe Hall of habitat groups and opening it as a whole. He told of the first conferences of Colonel Faunthorpe and Mr. Vernay with President Osborn and Curator H. E. Anthony to ascertain the scientific requirements for an Asiatic collection; the organization of the six great expeditions and their maintenance in the field; the weeks, months, and even years, of careful study of the problems pertaining to each species; the delicate diplomatic negotiations for permission to collect various species rigidly protected by law; the city's share in the erection of the Asiatic Hall; and finally, the Museum's share by the mounting and preparation of the groups.

The formal presentation of the collections was made by Mr. Vernay in the following words:

Mr. President, I have great pleasure in formally presenting to the American Museum of Natural History, in the name of my beloved friend, Colonel Faunthorpe, and myself, this collection of Asiatic mammals.

At the same time I would assure you we have deemed it a signal honor to have been thus associated with this great institution of Science and Education.

The new hall was then thrown open to the guests, and the latter part of the evening was devoted to the inspection of the Vernay-Faunthorpe collections.

The following evening, A. A. Dunbar Brander presented an illustrated lecture to the members of the American Museum on "Thirty Years Among the Wild Beasts of India." The hall was opened to public view on November 19.

The scientific direction of the Vernay-Faunthorpe Hall was in charge of Mr. Harold E. Anthony, curator of mammals of the world at the American Museum; the arrangement of the hall

and the preparation of the groups was under the supervision of assistant director in charge of preparation, James L. Clark, and the accessory work was performed under the direction of Albert E. Butler. The backgrounds were painted by W. R. Leigh, A. A. Jansson, F. L. Jaques, and C. C. Rosenkranz from studies made in the field by Mr. Rozenkranz.

An album illustrated with handsome etchings, made by the Rembrandt gravure process, of all the groups in the Hall, had been prepared for the dedication ceremonies under the direction of Mr. George N. Pindar, chairman of public information, and copies were distributed to the guests as souvenirs of the occasion.

ASTRONOMY

DURING December, four radio talks of the second series under the auspices of the Amateur Astronomers Association were given over Station WOR, from 5:30 to 5:45 on Saturday afternoons. This series will be continued during the winter and spring. In January Miss Jean Conklin gave five talks on "The Moon."

The special study groups of the Association, under Miss Conklin and Mr. Shogren, are being very well attended this winter. These are open to all members of the Amateur Astronomers Association. Miss Conklin's class is studying "Astronomy from the Modern Viewpoint," and Mr. Shogren's is studying the winter constellations, outdoors when weather permits.

On February 4 at the general meeting of the Association the film on Einstein's Theory of Relativity will be shown. Professor Einstein's presence in this country makes this a particularly favorable time to show this picture.

On February 18 Mr. John A. Kingsbury, secretary of the A.A.A., will talk on "Meteors." On March 4 Miss Henrietta Swope, of the Harvard College Observatory, will talk on "Variable Stars." On March 18 Dr. R. E. Lee, research director in Fleischmann's Laboratories, will discuss "The Therapeutic Value of the Sun."

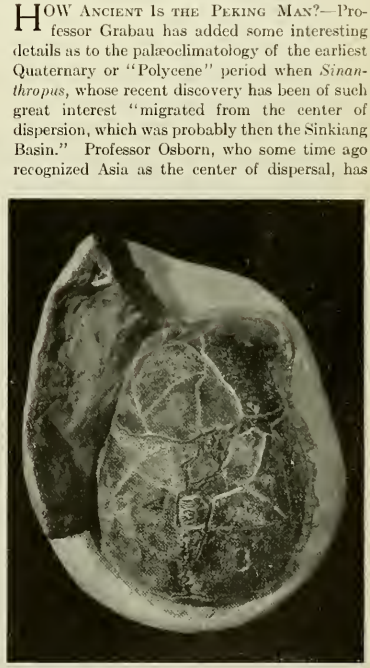
The Astronomy Department is proud of its new acquisition—the small mechanical planetarium which is on exhibit in the Eclipse Room at the American Museum. This electrical contrivance, in lieu of the Zeiss planetarium which the Museum hopes to have before long, gives a fine idea of the motion of the various planets, their relation to one another, the cause of the seasons, eclipses, and various other phenomena.

CONSERVATION

CENSUS SHOWS BIG GAME ANIMALS INCREASING IN NATIONAL FORESTS.—The latest "game census" by the Forest Service, U. S. Department of Agriculture, indicates that in the last five years the estimated number of antelope in the national forests has increased 35 per cent, of black or brown bears, 9 per cent, of deer, 32 per cent, of elk, 15 per cent, of mountain goats, 18 per cent, and of mountain sheep, 2 per cent, with decreases of 37 per cent in grizzlies, 86 per cent in caribou, and 15 per cent in moose. Unless more protection is afforded to the grizzly, says the Forest Service, other states will be in the class of California, where this animal is now extinct. The decrease in caribou is owing largely to the disappearance of the herd from one forest adjoining Canada, and it is assumed the herd has shifted its range to Canada. More reliable estimates account for the apparent lower number of moose, as early estimates were too high.

HISTORY OF THE EARTH

HOW ANCIENT IS THE PEKING MAN?—Professor Grabau has added some interesting details as to the palæoclimatology of the earliest Quaternary or "Polycene" period when *Sinanthropus*, whose recent discovery has been of such great interest "migrated from the center of dispersion, which was probably then the Sinkiang Basin." Professor Osborn, who some time ago recognized Asia as the center of dispersal, has



CAST OF *SINANTHROPUS PEKINENSIS*

With a part of the matrix still adhering to the specimen. It is owing to the wise direction of Dr. Davidson Black, honorary director of the Cenozoic Research Laboratory of the geological Survey of China, that this priceless specimen was discovered, and it is by his courtesy that the American Museum is enabled to place this cast on exhibition

been particularly interested in Professor Grabau's statement, for he has long felt that confirmatory evidence was sure to come to light. Among other interesting statements Doctor Grabau writes:

> . . . there is no reason to doubt that the migrations of early man, from the Tarim Basin, brought him not only to China, but to Mongolia as well. His wide dispersal across Eurasia . . . indicates conditions favorable to existence from the Atlantic to the Pacific. But when . . . the Pleistocene opened, these favorable conditions underwent a modification. For by that time, the great ice cap had begun to accumulate over northern Europe and eastern North America, and . . . sent its glaciers out in all directions . . . but on the other side of the earth, they barely reached the Arctic coast of Asia. . . . It was this ice accumulation over Europe that changed the climate of Asia, creating an area of high pressure, from which the winds . . . blowing across the Tarim Basin and the Gobi, both of which had been lands of more or less pluvial climates, changed them to deserts such as they are today. . . . And as the river plains of the Tarim Basin and Mongolia became desiccated . . . the clay and rock flour were . . . carried away and only the sand grains remained. . . . These finer particles were brought to China, where they formed the loess deposits, so characteristic of North China today. There is no other source from which this loess could have been derived, except the Tarim and the Gobi basins and these we know to have been deprived of their loessic dust, because today they harbor only sands and stones.

Another interesting item which Doctor Grabau has called to our attention is the difference in the strength of the Pleistocene winds in China as compared with those of today, and the probable influence of such conditions on early man. He writes:

> . . . The winds themselves come to East China dust-free. Not so in Pleistocene time however. Then they were strong enough to carry the Gobi and the Tarim dust to its present resting place in China. And . . . we can realize that the Pleistocene winds must have enormously exceeded in strength and velocity those that produce our fiercest modern dust storms. . . . It is not difficult to understand that Pleistocene man and . . . animals, found life almost insupportable in China during the loess period, and that such was the case is indicated by the scarcity of remains of Palæolithic man in China, when compared with their abundance in the dust free region of south Europe. . . . Migration in Pleistocene time was chiefly westward, and . . . not until the cessation of the dust-bearing winds could man come east. . . . That he did so in Neolithic time, is shown by the abundance, not only of his implements and utensils, but also of his skeletal remains. But that was in the last or Holocene period, the period in which we still live and which marks the continuous occupation . . . of most of Asia by the developing human race.

THE EVOLUTION OF THE TITANOTHERES.—At the Cleveland meeting of the American Association for the Advancement of Science Professor Osborn's exhibit illustrating the evolution of the titanotheres aroused much interest. The centerpiece of the exhibit was a large mural by Charles R. Knight. This shows an imposing herd of the latest members of the titanothere family as they appeared on the shore of an ancient lake in South Dakota in the Lower Oligocene epoch, about 37,000,000 years ago. Below this was a series of life-sized models of heads of titanotheres, mostly by the late Erwin S. Christman, representing successive stages in the evolution of the family. The recently published two-volume memoir on the evolution of these animals, by Professor Osborn, was not the least important part of the exhibit.

THE MOST ANCIENT ALGÆ.—Mr. Lincoln Ellsworth, the Arctic explorer, and a Trustee of the American Museum, has recently collected specimens of fossil algæ from the ancient rocks of Algonkian age in the Grand Cañon and Death Valley regions. He hopes that these very ancient types of fossil plants, which are some 600,000,000 years old, may shed new light on the geologic structure and early history of the southwestern portion of the United States. During the past summer he conducted similar studies in eastern Labrador.

Mr. Ellsworth's attention was first directed to these ancient forms of plants in 1929, by Dr. David White of the National Academy of Sciences. Extended explorations in the Grand Cañon region by Mr. Ellsworth afforded a collection of these rare silicified structures. This collection, which was transmitted to Doctor White in the early part of the year 1930, may, when fully studied, yield definite knowledge of the cell structure of the most primitive forms of life.—C. A. REEDS.

A NEW CRETACEOUS PLIOSAUR.—The fossil remains of Mesozoic reptiles in Australia and New Zealand are indeed rare, so the recent discovery of some fragmentary limb bones of a Cretaceous marine reptile is an event of considerable significance in the field of palæontological study. The fragments, consisting of the upper parts of two humeri, are noteworthy for their unusual size; it would seem that they represent the largest marine reptile yet found. To these bones the name, *Kronosaurus queenslandicus* is now given by Heber A. Longman, in Volume X, part I, of the Memoirs of the Queensland Museum. This animal, a relative of the European pliosaurs, evidently lived in the shallow Cretaceous seas of the south Pacific region, preying upon fish of various sorts, and offering a real menace to the smaller and less fortunate reptiles of that period. This pliosaur was not the only giant of his day, for certain ammonites, great cephalopods related to the nautilus, and marine turtles also were proportionately large. Thus it would seem that the Mediterranean waters of Australia were conducive to the development of unusually large animals during the Cretaceous period.
—E. H. C..

INSECT LIFE

STUDY AT BARRO COLORADO.—During November, 1930, Curator Lutz, Research Associate Schwarz, and Mr. E. I. Huntington studied the insect life of the Panama Canal Zone, making their headquarters at the laboratory on Barro Colorado Island in Gatun Lake. Mr.

Huntington secured an exceptionally good collection of butterflies which are adult at that time of year, the end of the dry season. Mr. Schwarz specialized on the biology of wasps and bees; and Doctor Lutz continued his studies of light as a factor in the behavior of insects. In addition to their research work, they brought back material for habitat groups of the army ant and the stingless honey-bee. On a former trip to Panama Doctor Lutz secured material for a group of the leaf-cutting ant but it is not yet on exhibition.

THE BASHFORD DEAN MEMORIAL VOLUME

THE late Dr. Bashford Dean, founder of the department of fishes in the American Museum, and at the time of his death in December, 1928, honorary curator of ichthyology, left behind him a number of sets of magnificent unpublished drawings illustrating the embryology of three of the lowest fishes. His materials and drawings are being worked up by certain of his associates and former students, and the resulting papers will be published by the Museum in parts as finished as *The Bashford Dean Memorial Volume—Archaic Fishes* in quarto size under the editorship of Dr. Eugene W. Gudger, bibliographer and associate in ichthyology.

The first article, a "Memorial Sketch" by Dr. William K. Gregory, a former student of Doctor Dean and his successor as curator of ichthyology, was published December 15 last. It consists of a twenty-two-page sketch of Doctor Dean's life and work, divided into sections to show on what subjects he was working at various times. This is illustrated by a photogravure and five half-tone portraits. Next there is a complete bibliography of Doctor Dean's writings comprising 315 titles. At the end are appendices containing lists of other memorial sketches, copies of resolutions and memorial minutes adopted by various organizations, and reports of the opening of memorial and research rooms and exhibits dedicated to Doctor Dean in both the Metropolitan Museum of Art and the American Museum of Natural History. This is illustrated by photographs of the memorial tablets in the two museums and by two other figures. Article I of the Memorial Volume comprises forty-two pages, and has eight plates and two text figures.

MUSEUM ACCESSIONS

A NEW METEORITE.—The most recent accession by the American Museum of celestial immigrants is a stone meteorite from near Miller, Arkansas, which was acquired November 11, 1930, through the generosity of Mr. J. P. Morgan. It is a heart-shaped aerolite some twelve inches across by six inches thick, weighing 36 lbs. 10 oz. It was seen to fall at 9:00 A.M., Sunday, July 13, 1930, on the farm of Mr. Julian Bailey. One of the near-by witnesses likened the appearance of the flight of the meteor to that of a white pigeon, but moving much faster. The specimen raised a cloud of dust as it made a round hole 18 inches in depth in a dry dirt road-bed, fifty yards distant from the house of Mr. Bailey.

The entire surface of the specimen is coated with a thin black crust, a feature, which is characteristic of all stony meteorites. In a few places the crust has been scaled off revealing a gray rock chondritic in texture. The specimen is unique in that the margins of the under surface are radially grooved. These markings, which were developed while passing rapidly through the earth's atmosphere, imply that the specimen did not turn over while in transit, but kept one face toward the earth.—C. A. REEDS.

MEETINGS OF SOCIETIES

THE DEPARTMENT OF ENTOMOLOGY was represented by Curator Lutz and Assistant Curator Curran at the meetings of the American Association for the Advancement of Science and affiliated societies at Cleveland. Since, of the approximately 450 zoölogical papers read at these meetings, 195 dealt with insects, it is particularly appropriate that Museum entomologists should be present. Doctor Lutz was selected by the Entomological Society of America to represent it in connection with the National Research Council.

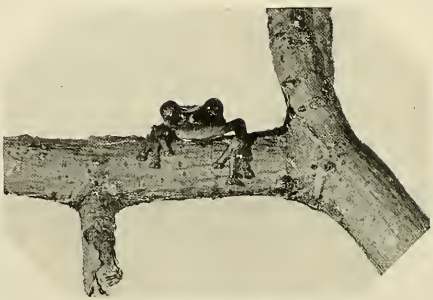
A MAP OF THE MAJOR EARTHQUAKES 1889–1923.—One of the features of the December, 1930, meeting of the Geological Society of America at Toronto, Canada, was the showing by C. A. Reeds of a map of the world on which had been indicated the epicenters of 1,783 major earthquakes for the twenty-five year period 1899–1923. This number represents the total of large earthquakes recorded on seismological stations distributed 91 or more degrees distant from the point of origin of each quake. The data for the map was assembled at the American Museum from various *Bulletins* of the British Association Seismological Committee, the International Seismological Summary, and the Journal of the Royal Astronomical Society of Canada.

The epicenters, which are represented by dots on the map, are distributed for the most part in two great zones, one circum-Pacific the other

about the world in the latitude of the Mediterranean. The submarine zone extending from Kamchatka to New Guinea is the belt of most marked concentration. Major earthquakes are caused by sudden adjustment of strains within the earth's crust. Their sites on the land and beneath the sea are indicated by displacements along fault lines. These features are most pronounced in the belts of the highest and youngest mountains and the greatly depressed troughs of the sea floor.

THE GALTON SOCIETY.—At the December 15 meeting of the Galton Society, Prof. G. Elliot Smith of the University College, London, addressed the Society on the Peking man (*Sinanthropus*).

The election of Prof. W. K. Gregory as president of the Galton Society, and of Mr. Frederick Osborn as secretary-treasurer was announced.



A STOWAWAY FROM JAMAICA

This tree frog was discovered in a shipment of bananas that came from the West Indies to New York City. Such stowaway animal life is now being studied at the American Museum

REPTILES AND AMPHIBIANS

A STOWAWAY.—Through the kindness of Mr. Louis Brody, the American Museum has been receiving a large number of stowaways which have arrived in New York in various shipments of bananas from Jamaica. Among them were two specimens of tree frog, *Hyla brunnea* (shown above), and three of the rare gecko, *Aristelliger praesignis*. The latter species occurs today in several West Indian islands. Since the Indians no doubt carried fruit and similar foods with them on their voyages, they may well have been responsible for the present distribution of the species. On the other hand, *Hyla brunnea* is confined to Jamaica and why this species has not a similar wide distribution is a subject for further investigation.

Through the coöperation of Mr. Brody a detailed study of the stowaway animal life arriving in New York is now in progress.

OTHER MUSEUMS

THE DEDICATION OF THE MUSEUM OF PRIMITIVE CULTURES, in Peace Dale, Rhode Island.—Many students of ornithology are familiar with the collection of birds' eggs made by the late Rowland Gibson Hazard and now housed in the Santa Barbara Museum of Natural History in Santa Barbara, California. Less well known is the fact that Mr. Hazard was also interested in archæology and ethnology, and that his collection in these fields was of considerable importance. In accordance with his wishes the estate has set aside a small hall in the new Peace Dale Offices to house the collection. Five large wall cases were especially designed to display the materials and to provide storage space for excess objects. The museum was dedicated on November 11, 1930.

The most important parts of the collection consist of archæological materials from New England (notably from Rhode Island and Maine), Missouri, and California. Small but representative collections from many other sections are also displayed, including the Mound Builder area, the Southeast, the Southwest, and Oregon. The European Palæolithic and Neolithic periods are also represented. The ethnological items consist largely of basketry from California, the Southwest, and Alaska, with a generous sprinkling of miscellaneous objects from various parts of the world. The installation was made by Dr. Ronald L. Olson of the staff of the American Museum of Natural History. The founding of this museum is another example of the growing acknowledgment of the educational value of the museum to the community.

NEW PUBLICATIONS

THE PERMIAN OF MONGOLIA.—A new volume bearing the above title will be issued in February by the American Museum. It will constitute Volume IV of the *Natural History of Central Asia*. This series of twelve quarto volumes constitutes the final reports of the Central Asiatic Expeditions of the Museum. The explorations in Mongolia on which these volumes are based were conducted in the years, 1919, 1922. 1923, 1925, 1928, and 1930, under the direction of Dr. Roy Chapman Andrews.

The present extensive volume, which is based on the Expedition's collections for the years 1922, 1923, and 1925, has been prepared by Prof. A. W. Grabau of the University of Peking, research associate of the American Museum, and formerly professor of palæontology in Columbia University. Professors Charles P. Berkey and Frederick K. Morris, the authors of Volume II of this series, published in December, 1927, have contributed a chapter to the new volume on the general relations of the Permian deposits in Mongolia. Professor Grabau's contribution deals primarily with the description of the new invertebrate species and the correlation of the various Mongolian horizons of Permian age with those of India, of China of the Ural Mountain region, of the ancient kingdom of Permia in Russia from which the name Permian was proposed by Sir Roderick I. Murchison of Great Britain in 1841, of Germany, and of North America. This volume, which contains a vast amount of new data on a hitherto unknown region and its significance, will be indispensable to those geologists, palæontologists, stratigraphers, teachers, and students, who wish to be fully informed on the Permian period and system of rocks, the last division of the Palæozoic era. It was during this period that great changes took place in the earth's crust, extensive glacial conditions existed in tropical regions, and warm-blooded animals began that existence which has continued to the present.—C. A. REEDS.

Growing Up in New Guinea. By Margaret Mead. Wm. Morrow & Co., New York, 1930; 372 pp. ills., maps etc.

ONCE more, as in *Coming of Age in Samoa*, Doctor Mead has bored into the soul of a primitive society. Having no preconceived opinions, she has come out with a mass of coördinated information which is not only of great intrinsic interest but also throws pitiless light upon problems to be faced at home.

For the Manus—salt-water folk of the Admiralty Islands—are the Rotarians of Melanesia. They are go-getters, worshippers of gilt-edged success, pillars of the established social and economic order. For all their faith in what is practical, materialistic and eminently respectable, they have neither shaken off the disadvantages of religion nor retained any of its benefits—unless the public confession of guilt, to which their rather threadbare spiritism occasionally forces them, may be extolled as a prop of their whole social structure.

Manus children grow up without restraint or responsibility, without oral tradition or imaginative guidance, without instruction except for that which assures high physical skill, prudery, and the cardinal virtue of respect for property. Training is mainly by example, and the father, rather than the mother, is the parent to whom the uninhibited young tyrants look for comradeship or indulgence. The barriers between father and son, which are so regrettably evident in our own society, are unknown in Manus.

Now the miracle that Doctor Mead records is the fact that the undisciplined, individualistic children are changed willy-nilly—when the proper time arrives—into the hidebound, conforming Manus adults. The mechanism of this transformation is highly interesting, and the author concludes that "When it is a question of passing on the sum total of a simple tradition, the only conclusion which it is possible to draw from the diverse primitive material is that any method will do."

Very challenging are Doctor Mead's findings on the precedence of environment over hereditary factors in the development of personality, as exemplified among adopted Manus children. The convincing data, like everything else in this delightful book, owe much of their strength to the always obvious fact that the author has no pet theories and no axe to grind.—R. C. M.

The Stir of Nature. By William H. Carr. Oxford University Press, New York, 1930.

IN the *Stir of Nature* by William H. Carr, assistant curator of education in the American Museum of Natural History, the author points a way to a better understanding of the wild life about us.

It is very obvious that Mr. Carr is a true lover of nature and that he treasures his experiences with mammal, bird, and reptile. He can discover some interesting bit of wild-life history regardless of place or season, for beaver are coming back to rear young at no great distance from New York City, and Nature stirs the year around if you know how to observe.

The book is not only an interesting account of the author's personal observations, but is written to serve as a primer for the young or unexperienced nature student who would like a hint or two as to how to begin. Mr. Carr has had the experience with the animals and with the students, and his training fits him for introducing the one to the other. He has been associated with the work of the American Museum at Bear Mountain Park where he has been in charge of the nature trails and the outdoor museum. In addition, he has been engaged on a special study of the life history of the beaver and has been making good use of his field contacts.

The *Stir of Nature* develops the theme of nature study by easy stages from the simple observations of sights and sounds to the deduc-

tions and analysis which they suggest to a trained student. The fifteen chapters touch upon a variety of subjects and give glimpses at various vertebrates. The illustrations, photographs chiefly but supplemented by drawings, are attractive and well chosen.

Mr. Carr's book can be recommended to nature lovers of all ages and should prove a useful text for classes in nature study.—H. E. ANTHONY.

"The American Museum of Natural History, Its History and Expeditions.." By George N. Pindar.

This comprehensive resumé of the inception and development of the American Museum of Natural History has been contributed by Mr. George N. Pindar to *Forschungs Institute, Ihre Geschichte Organisation und Ziele*. Vol. 2, a publication which appeared early in the fall of 1930.

THE COVER OF "NATURAL HISTORY"

The cover design of this issue, entitled "An Inca Background," is from a painting by Arthur A. Jansson. A modern Indian of the Andean Highlands—a descendant of the dymamic race which dominated an empire in the days before Pizarro—sits among the ruins of former grandeur and stares stoney-eyed into space. The splendid achievements of his ancestors are lost even to his memory. To him the ruins are simply the work of some forgotten people—"houses of the infidel gentiles."

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total membership 12,095.

Fellow

Mrs. WHEELER H. PAGE.

Life Members

Messrs. WILLIAM G. BROOKS, C. MERRILL CHAPIN, JR., ROY CURTISS, L. W. DOMMERICH, GEORGE EMLEN ROOSEVELT, JR.

Sustaining Members

Mesdames GEORGE B. DE LONO, C. DU PONT LYON, JAMES SULLIVAN.

Misses HARRIET E. DEVOE, ALICE R. PETERS, ISABEL M PETERS, ELVINE RICHARD.

Messrs. LOUIS G. ENGEL, JOHN A. HIRD, WALTER JENNINGS, JOHN B. MADDOCK, WM. FELLOWES MORGAN ZARK PRITCHARD, ROBERT C. ROEBLING, ROBERT SCBEY

Annual Members

Mesdames W. W. BAINBRIDGE, R. L. DUFFUS, ADAM K. GEIGER, R. WRAY HURT, E. LESTER JONES, CHARLES B. KAUFMANN, SIGMUND M. LEHMAN, R. J. LEWIS, GILBERT MONTAGUE, LAURENCE F. PECK, TESS R. STEIN, CARL J. ULMANN, F. C. WHITMAN, J. C. WORK.

Misses ROSALIE C. BODINE, JULIA R. FOSTER, ANN HARGREAVES, HELENA A. HULSKAMP, AUGUSTA KOVALEFF, JULIA LATHERS, L. H. LOW, ELIZABETH BARRETT PEABODY, JEANETTE E. PERKINS, MADELINE L. R. SATTERLEE, HARRIET S. SWAN, ALMA WHITE.

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77th STREET and CENTRAL PARK WEST
NEW YORK, N. Y.

NATURAL HISTORY

March-April
1931

Price Fifty
Cents

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JOURNAL OF THE AMERICAN
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VOLUME XXXI
NUMBER 2

NATURAL HISTORY

MARCH–APRIL
1931

The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor

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Published bimonthly by The American Museum of Natural History, New York, N. Y. Subscription price, $3 a year.

Subscriptions should be addressed to James H. Perkins, Treasurer, American Museum of Natural History, 77th St. and Central Park West, New York, N. Y.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

Entered as second-class matter April 3, 1919, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

THE INNER GORGE OF THE GRAND CAÑON OF THE COLORADO RIVER

From a Painting by Gunar Wildforss, 1930

LINCOLN ELLSWORTH COLLECTION

VIEW looking west-northwest across the mouth of Bright Angel Cañon from near the Kaibab Suspension Bridge. The Colorado River is in the left center, and flows here at an elevation of 2450 feet above sea level. The varied rocks of the north wall of the inner gorge appear in the foreground and in the mid-distance, with the isolated Tower of Set, 5997 feet, appearing in the background, left center. In the right center the towering mass of the Cheops Pyramid, 5350 feet, crowns the slope to the inner gorge. The twin peaks of Isis Temple form the highest elevation 7028 feet, in the right background. To the south of the river in the left margin appears a portion of the rocks in the south wall of the inner gorge with the isolated peak of Dana Butte, 5025 feet, prominently in the background.

The geological section, which is of special interest, is explained more fully in the article "How Old Is the Earth ?" P. 129.

VOLUME XXXI

NATURAL HISTORY

NUMBER TWO

MARCH-APRIL, 1931

THE FATE OF THE RASH PLATYBELODON

A Prehistoric Death Trap Yields Its Spoils.—Persistent Exploration by the Central Asiatic Expeditions in Eastern Mongolia at Last Reveals the Most Favorable Conditions Under Which Remains of Ancient Man Might Be Found

By ROY CHAPMAN ANDREWS

Leader of the Central Asiatic Expeditions and Vice-Director (in Charge of Exploration and Research) of the American Museum

I USED to believe that conducting explorations in the field was child's play in comparison to the difficulties of financing an expedition. But searching for the elusive dollar in the cañon of Wall Street is infinitely less nerve-racking than trying to steer a safe course for an expedition's ship between the rocks of Oriental diplomacy. Disturbed internal conditions and fluctuating politics present an almost unsurmountable wall to the foreign explorer. Weeks and often many months are required before permission can be obtained to go into the field.

The Central Asiatic Expedition was fortunate in being able to continue its work in 1930, after a year's delay due to Chinese objections. Official sanction, however, was not finally obtained until the middle of May, and we could not leave for Mongolia until the 20th of that month—just five weeks later than in previous years.

In 1928 we had continually heard reports from Mongols of a mysterious lake far to the eastward in the sand dunes. It was said that the shores were covered with fossils and that "bones as large as a man's body" had broken out of the surrounding cliffs. Selecting a Mongol who knew something about fossils, we sent him on horseback to report upon this strange locality. He lost himself in the sand dunes and, after wandering about with little water and less food, gave up the hunt in despair.

In 1929 I dispatched him again, on camel back this time, to see if he could find the spot. He reached it without serious difficulty and brought back a collection of fossil teeth and bones which indicated a new geological horizon and a new fauna. He reported other localities in the sand. Although we have learned to distrust native information, this indisputable evidence that fossils were there made us feel that we were on the verge of a great discovery. The sand was so heavy, the Mongol reported, that cars could not be used. Therefore, I organized the expedition to work on camels and took only four motors. We established a permanent base at the Swedish Mission station of Hatt-in-Sumu, where Mr. Joel

AN EXPEDITION CAR NEAR KALGAN

In a region in which, for centuries, camels have been the principal carriers, these motor cars have made possible a rapidity of movement which was formerly undreamed of

SORTING SUPPLIES IN CAMP

For an expedition operating in barren country which is almost or entirely uninhabited, an infinite variety of supplies must be transported, and the problem of "staying in the field" often revolves about the success of the transport system

CAMELS ARRIVING AT WOLF CAMP

It is not rare for the camels to be given spare tires to carry, and sections of worn casings are sometimes used as patches to protect cuts in the feet of these awkward burden bearers

ROY CHAPMAN ANDREWS

The leader of the Central Asiatic Expedition is shown here with his riding camel. Though the Expedition was dependent upon motor cars for many uses, camels continue to be essential for use in the most difficult regions

GOBI DESERT "BAD LANDS"

This photograph, taken in the vicinity of Urtyn Obo, shows clearly one of the barren and eroded regions in which the scientific work of the Expedition was carried on

Eriksson had been acting as the expedition's Mongolian agent.

Our Mongol explorer told us that he had discovered a new route and that he believed we could take our cars within twenty-five or thirty miles of the lake. We decided to make a reconnaissance before the whole expedition started out with the caravan. It was most fortunate that we did so. With the greatest difficulty we reached the lake only to find a dried mud bottom, white with alkali, surrounded by wave upon wave of yellow sand dunes. It was one of the most desolate spots I have ever seen. When the Mongol had been there first, the lake was full from heavy rains and he could hardly believe his eyes when he looked upon the lifeless basin. He led us to the former beach-line and to a still greater disappointment. True enough, fossils were there, but they had been so rolled and crushed long before the bones had been deposited that what remained were "badly broken fragments."

Granger knew at once that it would be hopeless to expect to find specimens of any value under such conditions. There was every evidence that nothing better awaited us at the other small deposits which the Mongol had discovered. We could only return to camp and charge up the sand dune region to the account of disappointments which every explorer has to face. A consultation decided us to send the camels northward to the place just south of the Outer Mongolian frontier, where we had discovered a jaw of the extraordinary shovel-tusked mastodon in the autumn of 1928. We had only partly explored that region and we hoped for great things in a more intensive study.

Some two or three million years ago in the Pleistocene period, a great lake had occupied this part of Mongolia. The shore-line was clearly delineated by masses of fresh-water shells. It was probable that along the borders of this inland sea there had been quicksand bogs and muddy river bottoms in those far distant days

when the shovel-tusked mastodon roamed the savannahs of Mongolia. Bogs and quicksands acted as traps then just as they do today. They are one of the most fruitful sources of well-preserved fossils and we began an intensive exploration of the lake shore.

On the first day I saw a few bits of bone and teeth exposed in a gray-white matrix. As Thomson was brushing away the loose sediment, Granger lifted a flat stone, exposing the great molar teeth of a shovel-tusked mastodon. It was difficult for me to restrain my patience while the deliberate palæontologists explored the deposit. Eventually we discovered that it contained the skulls, jaws, and parts of the skeletons of a mother and a baby mastodon. It is difficult to know just what caused their sudden death, because we found no other specimens near by. Possibly they had been trapped in a bog, but if so, it is almost certain that remains of other animals also would have been found. They may have been buried under a sudden avalanche from a near-by cliff, or have eaten some poisonous vegetable matter. Whatever was the cause of their death, there they lay side by side, and science will benefit greatly by their sudden demise.

We pitched our tents on a flat plain overlooking a great basin, cut and slashed by the knives of wind and frost and rain into a thousand gaping wounds. Behind us stretched a plateau which flowed away in great sweeping billows, a seemingly flat expanse. It was only when a horse or a running antelope disappeared suddenly from the eye that one could realize that the plain was not as flat as the top of a table. We knew from previous explorations that this was a dangerous place, because for many miles in every direction it was a waterless expanse. Mongols could not live there except in winter: it was

WOLF CAMP

Showing a part of the "bad lands." During the Expedition's stay in this vicinity, wolves were often seen, hence the name bestowed upon the camp

THE LEADER MEASURES A FIND

Doctor Andrews is shown in this photograph making a record of the measurements of a shovel-tusked mastodon jaw

inhabited only by antelopes, wolves, and desert birds. We named our camping place Wolf Camp, because, during two months' stay, we shot thirteen of these marauders which preyed upon the sheep and goats of the Mongols, in a village grouped about a marshy pond eight miles away on the lowlands.

One evening three wolves rushed into a flock of sheep and badly wounded a Mongol girl who tried to drive them off. Then they went through the herd like a pestilence, biting and tearing the throats of the terrified sheep. Thirty of these lay dead in less than ten minutes. "A wolf a day" became the slogan of the camp, and it was seldom that we did not see one of the animals returning in the morning from his nightly forays, or setting out just as the sun was sinking, for his hunting grounds in the lowlands. Early one morning I was enticed away from camp by two wolves which finally led me a chase of twenty miles. Without a compass, with only five gallons of gasoline in the car and half a bag of water, it might have developed into an uncomfortable situation, had we not been able to find our way back to camp.

Just below the tents on a narrow promontory, we discovered many outcrops of bones. When the deposit was opened, the skulls, jaws, and skeletal parts of baby mastodons far out-numbered all other animals. Evidently this had been a bog near the shore of the lake. Mother shovel-tusked mastodons with their babies had come here to drink or feed. The mud was comparatively shallow and, although both the adults and young doubtless became mired, the mothers, because of their superior strength, were able to extricate themselves and sometimes get out their babies also. But others were not so fortunate and many of them had been left to die. Our palæontologists recovered a dozen or fifteen jaws of baby mastodons, representing almost every age in size and development. The crowning specimen

was the jaw and part of the skull of an unborn baby. It lay in the pelvic bones of an adult female, the only adult which we found in the deposit. Albert Thomson delivered the child with Granger as consulting physician, while the rest of us in the clinic amused ourselves by calling them such insulting names as "palæontological midwives."

The most spectacular discovery of the year was made six miles to the south of Wolf Camp by Père Teilhard de Chardin. In an amphitheater, marked by a shining dome of pure white marl, hundreds of fossils were exposed upon the surface but all in a very restricted locality. Granger and Thomson, with their assistants, opened the deposit. They found great numbers of shovel-tusked mastodon jaws, skulls, and bones lying in a heterogeneous mass like a heap of giant jack straws. The enormous flat jaws were sometimes horizontal and sometimes standing straight on end or entwined with other parts of the skeleton. For six weeks the men worked in this one spot, taking out the most priceless specimens day after day. I used to sit on the edge of the escarpment just above them, drifting in imagination back to those past days when the waters of a beautiful lake filled the enormous basin. Where we worked, there had been a bay on the edge of which was a deep well of soft sticky mud. Probably it was covered by three or four feet of water on which grew a luxuriant mass of tubers and succulent aquatic plants—the favorite food of the shovel-tusked mastodon. One of these gigantic beasts plowed its way slowly along the shore of the bay, dredging up masses of trailing vegetation in its great spoon-

THE EXPEDITION'S PET ANTELOPE

This little creature was caught when it was only one day old, and with a goat as a foster mother, remained with the Expedition throughout the entire summer

AFTER TWO WEEKS OF WORK
A view of the mastodon quarry after the scientists had been engaged for a fortnight in uncovering and removing the accumulation of fossils

shaped jaw. Then with its trunk or mobile lips the beast delicately selected choice bits and pushed them far back into its huge mouth to be masticated by the molar teeth. The plants floating over the death trap of mud enticed the mastodon farther and farther into the water. Suddenly it found that it could not withdraw its feet. Struggling madly in the grip of the clinging mud, it sank lower and lower until the water covered its head and the last struggles were those of a drowning beast. The trap remained baited and still other mastodons were lured into the well of death. Their huge bodies sank upon those that had gone before, until the pit was choked with masses of decomposing flesh. Eventually the lake dried up, but the bones remained entombed until we came to open the grave on that brilliant day in 1930. Seventeen great spoon-shaped jaws were taken out of this single deposit. With those obtained from the "baby pit," the Museum has a superb age series representing almost every stage in growth from the unborn young to the adult bulls with jaws five and one-half feet long. This age series is only rivaled by that of the dinosaur *Protoceratops*, which demonstrates its growth from the egg up to the very old males.

The expedition spent two months at Wolf Camp, busy every moment on new and interesting discoveries. We might have remained all summer with increasingly important results, for half a dozen other places were located which doubtless would have proved as rich as those tombs we had already opened. It is only in such deposits and in the river drift of ancient stream beds that we may hope to find the remains of primitive human types. This entire region requires the most careful investigation, and should be combed from end to end. Even though the remains of primitive man were never discovered, thousands of other important

specimens would fill in many blank pages in the book of ancient world life. Walter Granger and I decided that we could not spend more time in this one formation, since it was uncertain whether work could be carried on in future years.

Fifty miles to the west was a great escarpment which Granger and others had discovered in 1928. They had spent only a few hours there but had had time enough to realize that it was a rich deposit. Their stay was shortened because of the great number of poisonous vipers that had made the bad lands their homes. Dozens of them crawled out from the rocks and from under bushes, and the men voted it a most unhealthy locality. However, we decided that the reptiles could not be left in possession even though it would be an uncomfortable place in which to live. The formation was Eocene and Oligocene, considerably older than the age of the shovel-tusked mastodon beds.

Camp was shifted early in August. Almost immediately things began to happen. Important discoveries of new titanotheres, of a giant pig called *Entelodon*, of rhinoceros and other interesting mammals, kept the men working every daylight moment. It was not until we had lived there for two weeks, however, that the crowning discovery was made by one of our Chinese collectors. This was the magnificent skull of an Amblypod—a gigantic ungulate of a group unknown in Asia until 1923. At that time I discovered a single premolar tooth and later in the year Professor Osborn himself found another premolar. These were the first indications that Amblypods had existed in Central Asia. Skulls were discovered in 1925 and the beast was named *Eudinoceros* by Professor Osborn. No Amblypods had been known in other parts of the world later than the Eocene. The new skull found within fifty yards of

THE EXPEDITION COOK TENT

Seated within are the three Chinese cooks. Under ideal conditions the meals prepared by this mobile culinary department left little to be desired. During the occasional dust storms, however, the food was often thoroughly impregnated by the sand and gravel that sifted everywhere

A PART OF THE PLATYBELODON QUARRY

Showing a skull in the foreground. Much care and experience are necessary before the fragile fossils can be properly and successfully removed from the rocks about them

TWO MASTODON JAWS

These shovel-tusked jaws lay in a heterogeneous mass that resembled a heap of giant jackstraws

THE MOLAR TEETH OF A SHOVEL-TUSKED MASTODON

So successful was the Expedition in finding many fossilized specimens of this animal that a complete series is now available for study, ranging from old males and females down through the scale in size and age, even to the fossil of an unborn baby lying within the pelvis of its fossilized mother

A SHOVEL-TUSKED MASTODON JAW

On the lower jaw of this extraordinary animal are two wide, flat tusks. With these the creature dug up the roots and plants from the mud along the lake shores, and from the collection thus made he picked out the edible portions with his trunk

"BUCKSHOT," ONE OF THE EXPEDITION'S CHINESE COLLECTORS
Engaged in removing fourteen fossilized soft-shelled turtle skeletons from the matrix of soft sand

our tents was from the Oligocene. Thus it is indicated that the evolution of these strange animals was carried on in Asia for several millions of years after they had disappeared from Europe and America.

Another discovery of enormous importance was a giant carnivore allied to *Patriofelis*. The teeth of this huge beast indicate that it must have been a carrion feeder. Only a few days before the Expedition left the field, Thomson and Granger found a deposit of *Chalicothere* skulls. This strange creature is a paradox of nature. It is a "clawed-hoofed animal" allied to *Moropus*, although its teeth and other parts of the body place it definitely in the order Ungulata. It has enormous claws on all four feet. What was the purpose of these appendages no one knows. We had never before found skulls in Mongolia but in the new deposit there was a mass of bones forming almost a breccia. In the remaining few days, a half dozen skulls were removed.

The summer's work indicated that this entire region was so rich and important that several years of additional work were highly desirable. Upon cabled instructions from President Osborn, I went to Peking on the 1st of September to open negotiations with the Committee for the Preservation of Ancient Objects. Mackenzie Young and I with one Chinese, Liu Shi-ku, drove down in two cars. During the summer the region had been remarkably clear of bandits, but it had been rumored that great quantities of opium were to be brought in from the west. This rich cargo had drawn bandits like flies to honey. A hundred and twenty miles from Kalgan the brother of one of our Mongols, Bato, told us that two Chinese cars had been robbed the night before and two men killed by thirty or forty brigands. He supposed that they

were still there awaiting other victims and advised us not to go on. Mack and I, however, were heavily armed and decided to go through. Either the bandits had left or they were reluctant to attack us, because we reached Kalgan without a shot being fired. A week later, Mack returned accompanied only by Liu who drove the second car. Before he left Peking I had a strong presentiment that he would have trouble. It had been raining hard and the trail was very slippery. A hundred and ten miles from Kalgan a Mongol child ran out to the trail and told them that bandits had just stopped a caravan five miles away. Mack had either to turn back to Kalgan or else proceed and take his chance. He decided to go on. At a tiny mud-walled house in the bottom of a valley, he saw the brigands dressed in Chinese soldier uniforms robbing a caravan of carts. He drove on as fast as possible, but when his car was opposite the house, the robbers opened fire with Luger pistols from behind a mud wall. Slowing up a little, Mack took a snap shot at one man who was doing the best shooting. His bullet struck a stone, went to pieces, and took off part of the bandit's face. Another struck a second man in the shoulder. A little farther on were a dozen robbers standing by their horses. They opened fire with rifles as Mack went by and then started to mount their ponies. He killed a horse and this so discouraged the brigands that they galloped away. It had been a neat little fight and the bandits had been taught a pretty severe lesson. Fortunately, neither Mack nor Liu were hit.

The whole Expedition returned a month later. Two days after they had reached Kalgan the entire region was taken over by bandits and all traffic on the plateau ceased. Had our people been delayed, the consequences would have been serious. It was only another evidence of the good luck which has been a constant factor in the success of the Central Asiatic Expeditions. The camels carrying our collec-

A SHOVEL-TUSKED MASTODON JAW READY FOR SHIPMENT
This excellent five and one-half foot specimen has been covered with burlap strips soaked in flour paste. Such careful preparation is essential in order to protect the easily broken fossil

tions were met at a village thirty-four miles from Kalgan by Young and Liu and the fossils brought safely to Peking.

I cannot speak too highly of the courage and loyalty of every man, native and foreign, of the Expedition's staff. Through their splendid efforts the season's work netted the largest collection of any year in Mongolia. Ninety-one cases of fossils were obtained. We all feel that in scientific importance, as well as in bulk, this year's collections will equal if not surpass those of any previous season. The new region of eastern Mongolia, which we have only partly explored, is very rich and, as I have already remarked, is the place where we are most likely to find the remains of primitive human types, if they existed in Mongolia. A systematic investigation of these thousands of square miles of Pliocene strata is of the utmost importance. During all the past years of our exploration, we have worked in central and western Mongolia where late Tertiary strata appear not to exist. Although we have opened a new volume in the history of the earth, the proper conditions under which human remains could be found were only discovered last year. It would be a scientific tragedy if lack of sympathy in China forces us to terminate our work.

BRINGING BOXES OF SPECIMENS TO EXPEDITION HEADQUARTERS IN PEKING

The U. S. Marine corps kindly lent their men and trucks to facilitate transportation

A PART OF THE COLLECTION AT PEKING

Specimens lying on the laboratory floor preparatory to being packed for shipment to the American Museum

The Colorado River at the Bottom of the Grand Cañon of Arizona

HOW OLD IS THE EARTH?

The Earth Reveals Its Age By Hour-glass Deposition of Sodium and Sediments, and the Atomic Disintegration of Radioactive Elements

By CHESTER A. REEDS
Curator of Geology and Invertebrate Paleontology, American Museum

It may be stated at the outset that nobody knows just how old the earth is. There are certain criteria available, however, which indicate that the oldest rocks are of the order of 2000 million years. There are data which imply that the upper limit of the age of the minerals is about 3000 million years. This may be considered the lower limit of the age of the earth's material. Iron meteorites have been analyzed which yield a maximum age of 2600 million years. These are stupendous figures. The lower figure of two billion years as a minimum age for the earth implies that it has encircled the sun as many times, and that during this period it has turned on its axis 730,500,000,000 times to afford as many days of light and darkness.

The presence of ripple marks, sun-crack impressions in muds, water-worn pebbles, rounded sand grains, seasonally banded clays, limestone deposits, and vestiges of primitive forms of life in rocks of very ancient origin, all point to physical conditions on the surface of the earth that are similar in every respect to those enduring today. Various folded gneisses and schists, without vestiges of life, much distorted and frequently impregnated with volcanic injections, constitute the oldest rocks exposed on the earth's surface. The earth, although very old, has a remarkable history. The various steps in its development are in some instances still obscure, but they are becoming more apparent with the growth of knowledge concerning the earth.

Spectroscopic analyses reveal that 49 of the 90 chemical elements found on the earth have been recognized in the sun. In fact, astronomy teaches that the 1091 members of the solar system have originated from the same material. Various theories as to the origin of the earth postulate that the earth and the other

planetary bodies in our solar system were born of our sun when it was in a giant-star stage. This transformation of the sun is supposed to have been induced by the close approach of a passing star several times more massive than the sun itself. The resulting effect of such a close approach was the setting up of great tidal stresses in the sun and the drawing out of two long filaments of gaseous matter from opposite sides of the sun's surface. After the large star passed on, the filament on the far side of the sun as well as a portion of that on the near side may have been drawn back into the sun; however, a considerable portion of the filament remained in space subject to the influence of the sun. In the course of time the matter in this filament was gathered together about certain nuclei to form the nine planets and their satellites. The material was originally in a gaseous state. Later it passed to a liquid state through loss of heat by radiation from its surface, and finally, as in the case of the earth, into a solid state, at least for the outer crustal portion which may be 40 miles in thickness or about 1/200 of the radius of the earth.

American Museum of Natural History

A STONE METEORITE, JOHNSTOWN, COLORADO, METEORITIC SHOWER

This stony meteorite weighing 42 lbs. 8 oz., was seen to fall following four explosions, at 4:20 P.M., July 6, 1924. It is coated with a thin black crust. The gray stony matrix of the interior is shown by the white spots where the crust has been peeled off

The meteors, which enter the upper levels of the earth's atmosphere in great numbers, estimated to be 20 million per day, may be remnants of the original filaments, or of like matter from outer space. Most of these meteors are small, one to two-tenths of an inch in diameter. Upon entering the earth's atmosphere they travel at planetary velocities varying from 9 to 47 miles per second. Due to the great resistance offered to their passage by the earth's atmosphere, which is estimated to be 90 to 100 miles in thickness, the solid portions of most meteors burn up before reaching the earth. In addition to the ash of burnt-out meteors a minimum of one meteorite per day reaches the earth's surface.

The portions of 700 meteoritic falls exhibited in various museums are composed primarily of either nickel-iron, or of stone specimens, or, of combinations of these two kinds of matter. The stony meteorites resemble the light colored felsitic lavas of the earth. There are differences in texture in each, however, which the skilled observer readily detects. The iron meteorites with nickel, troilite, carbon, and other inclusions are not found duplicated on the earth. Some 29 elements found on the earth have been detected in meteorites. On the other hand, six mineral compounds have been noted in meteorites, which have not been found on the earth.

It may be stated thus that the earth, the meteorites, the sun, the moon, and the stars are distantly related. The earth and its moon with diameters of 7918 and 2162 miles, respectively, are intimately related to the sun, which is 866,400 miles in diameter. Although their densities, as compared with equal volumes of water, vary, the density of the earth being 5.52, the moon 3.40, the sun 1.39, these differ-

THE MYSTIC POWER OF THE COLORADO RIVER IN ARIZONA

A view from the upwarped plateau rim, 7000–8000 feet above the sea, into the outer and inner gorges of the Grand Cañon where the river flows at a level of 2400 feet. This cañon is 217 miles long, from 8 to 20 miles wide, and more than a mile deep. It was eroded by the river during the last one million years

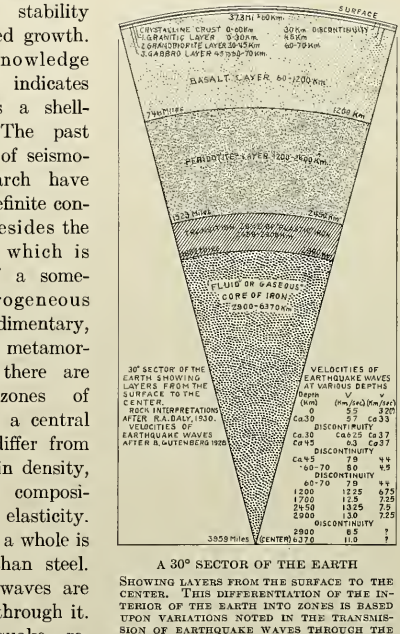
ences are explained by the different states of like matter, the earth and moon being solid and the sun gaseous. The fact that the earth rotates on its axis at a rate of 18.5 miles per second, and about the sun at a rate of 66,000 miles per hour, also implies that the mass of the earth, which weighs 6590 million million million tons, is controlled by the larger mass of the sun, which revolves once on its axis in 25 days, and weighs 1.983×10^{33} grams.

The various stages involved in the upbuilding of the earth are of interest in discussing its age. No two theories agree, however, on the number of steps involved, nor in the way in which it was accomplished, yet most of them assume that in the beginning the materials of which the earth is composed were in a gaseous state. The number of years required for a planet having the size and density of the earth to pass from a gaseous to a solid state is of course problematical.

According to the Planetesimal Hypothesis proposed by the late T. C. Chamberlain and F. A. Moulton of the University of Chicago in 1905, all but the central core of the earth, which is 4346 miles in diameter, has been built up by the infall of planetesimal matter. Since but a small amount of such planetesimal, or meteoric matter, is now added daily to the earth, the hypothesis implies a great age for the earth. Chamberlain held that at the present rate of fall it would require 1,000,000,000 years to form a layer of meteoritic material one inch in thickness on the earth. J. Barrell (1923) took exception to Chamberlain's views and argued for a molten condition of the earth at the completion of its growth. He assumed that the earth developed rapidly by the infall

of planetoid-like bodies rather than by the slow accumulation of dustlike particles. He was of the opinion that all of the near-by planetoids, even those several hundred miles in diameter, except the moon, had been gathered in by the time the earth attained a condition of stability and completed growth.

Present knowledge of the earth indicates that it has a shell-structure. The past thirty years of seismological research have led to this definite conclusion. Besides the solid crust which is composed of a somewhat heterogeneous mixture of sedimentary, igneous, and metamorphic rocks, there are successive zones of material and a central core which differ from one another in density, in chemical composition, and in elasticity. The earth as a whole is more rigid than steel. Earthquake waves are transmitted through it. Each earthquake records three principal kinds of waves on a seismograph, namely: primary, secondary, and main waves. The primary or longitudinal waves pass through all portions of the earth. The secondary or transverse waves, a kind developed only in solids, pass through only the outer portion of the earth; they do not pass below a depth of 2900 km. It is at this depth, 0.45 of the radius of the earth, that the inner core begins. Since this type of wave is not transmitted through the inner core, this portion of the earth is believed to be in a liquid or gaseous state. The main waves which are the largest and last to be recorded, are confined to the crust of the earth.



A 30° SECTOR OF THE EARTH

Showing layers from the surface to the center. This differentiation of the interior of the earth into zones is based upon variations noted in the transmission of earthquake waves through the earth. The inner core does not transmit the secondary or transverse seismic waves, a kind developed only in solids, hence, it is believed to be in a "liquid" or "gaseous" state

The velocity of the primary and secondary waves at various depths, V and v respectively, as determined by B. Gutenberg, 1928, and the nature of the rock in the respective zones, as interpreted by R. A. Daly, 1930, are given in the accompanying sketch of a 30 degree sector of the earth. The density of the various zones is noted in the text below.

It may be noted that the crystalline crust is 60-70 km. in thickness. In addition to the outer sedimentary layer, which varies in thickness from 0-5 km. with density 2.7, the crust is composed of three zones of rock each separated by planes of discontinuity as follows:

(1) granitic layer 0-30 km. in thickness, density 2.7

(2) granodiorite layer 30–45 km. in thickness, density 2.7+

(3) gabbro layer 45 to 60-70 km., density 2.9.

Below the crust lies a hot, vitreous, basaltic layer 60-1200 km. in thickness, density 3.3. This is followed by a layer 1200–2450 km. in thickness, which Daly believes may partake of the nature of peridotite, while H. Jeffries (1929) refers to it as the dunite layer, density 5.0. At a depth of 2450–2900 km. there occurs a zone composed perhaps of plastic iron,

density 9, where seismographic waves slow down. This would indicate that it is transitional in character from the more or less silicate layers above to the great inner core of the earth below. The inner core with great pressures and temperatures resulting from its superimposed load is believed by H. Jeffries (1929) to be liquid iron, by Daly (1930) to be in a "fluid" or "gaseous" state. Its average density is 11.5. It is probable that the inner core of the earth was originally composed of material resembling that found in iron meteorites. Iron meteorites have a specific gravity of 7 or higher. The idea of a liquid inner core is supported by present-day seismology, for the secondary or transverse wave of an earthquake, a kind appearing only in solids, is not transmitted through the inner core.

The methods of palæogeography afford theoretically a splendid insight into the successive geologic stages involved in the upbuilding of the earth. If one could visualize, even in the crudest fashion the changes in geography that have taken place at regular intervals, say 100,000 years, the sequential history of the earth would be in large measure solved. In accordance with the normal sequence of events such a series of pictures should begin with the birth of the earth, from the parent body, the sun. One hundred thousand years later a sufficient change would have taken place in the earth to depict the second scene. A large number of pictures would have to be sketched, 30,000 in fact, if the earth is three billion years old, before the present day is reached, with its magnificent panorama of continents, oceans, irregular coast lines, mountains, plateaus, plains, rivers, lakes, seas, snow fields, glaciers, deserts, and various forms of plant and animal life,

(c) E. H. Newman, Publishers Photo Service, N. Y.

HERMIT CAMP AT THE END OF THE HERMIT TRAIL, GRAND CAÑON

This tourist camp, 3700 feet below the south rim, is a half mile east of Columbus Point, the imposing central rock tower. This towering spur is composed of horizontal sediments that are green, mauve, red, and gray in color. The camp overlooks the inner gorge of the Colorado River, 700 feet deep

FOOTPRINTS OF A LABYRINTHODONT, COCONINO SANDSTONE, GRAND CAÑON

Footprints made by an amphibian of Permian age as the sands of the Coconino formation were being deposited 210 millions of years ago. The sands were moist when the impressions were made. The weight of the animal compacted them and the footprints were covered and preserved

not to mention the cities and other works of man.

No fault is to be found with the idea, for geologic processes are continuous and they have been so throughout the immensity of geologic time. The difficulty in preparing such a series of pictures arises from the fact that the records of past events, which are preserved in the earth itself, are somewhat fragmentary and, furthermore, they are not dated in terms of years, as man dates his present chronology.

The data most frequently used in estimating the age of the earth are those based on geologic processes such as erosion, sedimentation, and deformation. These processes are in evidence on the surface of the lands. For epochs, other than the present, these data are to be found in the stratigraphic record as preserved in the crust of the earth.

The rate of erosion of the lands is of value as a criterion. Samples of water from representative streams for various climates and topographic reliefs have been taken and analyzed. From more than 8000 analyses F. W. Clarke in his *Data on Geochemistry*, 1924, observes that taking the continents as a whole they are lowered by solvent denudation one foot in 30,000 years. From measurements of the suspended matter collected in the analyzed samples he concludes that the chemical denudation represents but 30 per cent of the total denudation. This gives a mean rate of total denudation at the present time of one foot in 8600 years.

The average height of all lands above sea level has been computed to be approximately 2300 feet. The average depth of the oceans is about 13,000 feet. If the land surface is lowered one foot in 8600 years and the average height of land above the sea is 2300 feet then it would take 19,780,000 years to erode the lands to sea level, assuming that the rate continued uniform to the end, which is not likely. Granting that the oldest rocks on the surface of the earth are approximately 2,000,000,000 years old, that the rate of erosion continued to be one foot in 8500

years throughout all this time, and that the lands were uplifted at the close of each complete erosion period, then the lands would have to have been uplifted 101 times to afford continuous erosion.

The American geologists, Powell, Dutton, and Davis, have shown that the lands have been base-leveled frequently during geologic time. To this level surface Davis applied the term peneplain. Each peneplain was developed as the result of a cycle of erosion. Many ancient peneplains lie buried and preserved as unconformities between different beds of sedimentary rock; others have been elevated and more or less destroyed by later cycles of erosion. These later cycles are uncompleted, since before any one of them could be finished the lands were uplifted and a new cycle inaugurated. In fact no extensive peneplains, not uplifted or dissected, are known to exist at the present time.

Nevertheless, it is apparent to geologists that the earth has been in repose repeatedly, as far as denudation is concerned; at such times shallow seas have spread far and wide over base-leveled lands; new areas of deposition have thus arisen; sedimentation accompanied by slow subsidence in well defined troughs followed; then folding, crumpling and overthrusting of the horizontal strata appeared as the result of lateral compression; this was followed by a general uplift of the folded rocks into high mountains by forces acting from beneath the crust. Such uplifts were frequently accompanied by the intrusion of igneous and volcanic rocks into the distorted mass. With the uplift of the region a new cycle of erosion was inaugurated, the agents of erosion again renewed their efforts to reduce the new landscape to a peneplain. This in brief is the history of various regions of the earth's crust, particularly where numerous old and young mountains exist.

While the rate of denudation in the various cycles of erosion has not been preserved, the sediments that were deposited in the shallow seas lying upon and about the margins of the continents and

FOSSIL ALGÆ IN A ROCK WALL, PHANTOM RANCH MESS HOUSE, BRIGHT ANGEL CAÑON, ARIZONA
The algæ in this isolated block of Bass limestone from the Unkar group, middle Proterozoic, led to the discovery, 1927–1930, by Dr. David White and Mr. Lincoln Ellsworth, of additional specimens of these ancient lime-secreting plants

in the depressed troughs have been preserved, except where erosion removed all or a part of the uplifted beds. Due to the shifting of the areas of deposition for different epochs the entire series of these sedimentary strata, which total some 529,000 feet or 100 miles in thickness, are not all to be found at any one place, but in different places upon the face of the earth.

Where the erosion of the lands by rivers proceeded in cyclical manner, the deposition of the transported land derived sediments in marine basins followed in accordance with cycles of sedimentation. Conglomerates and sandstones were laid down near shore and at the base of the series; shales and limestones were deposited farther out, or on top of the more coarsely bedded sediments as the rivers became longer or less active, with gentler grades and greater sorting powers.

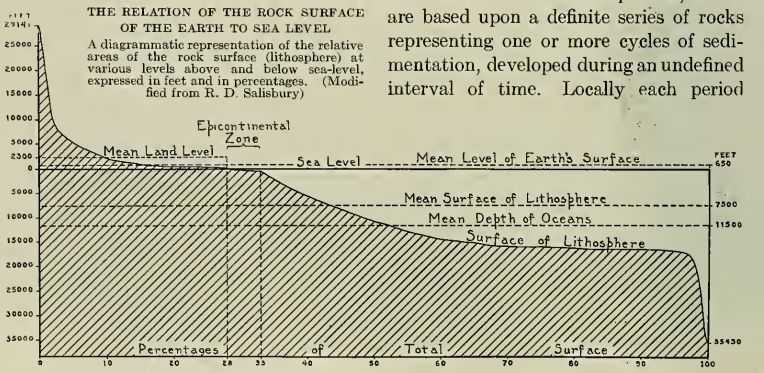
The various forms of animal and plant life which lived in the sea at the time the deposits were laid down were entombed, as they died, by the incoming sediments. Their remains constitute the fossils of the sedimentary rocks. Different species and different forms of life are found in rocks, not only where they were deposited in regular sequence, but in areas where a more recent formation extended over older rocks and a gap in time and in sedimentation was recorded thereby. Fossils are invaluable to the stratigrapher, for where a regular sequence of beds occurs the changes in the species, from bed to bed, permit the establishment of a faunal scale and this may be used elsewhere in deciphering the relations of beds where the sequence may be different or where the character of the rocks may have changed.

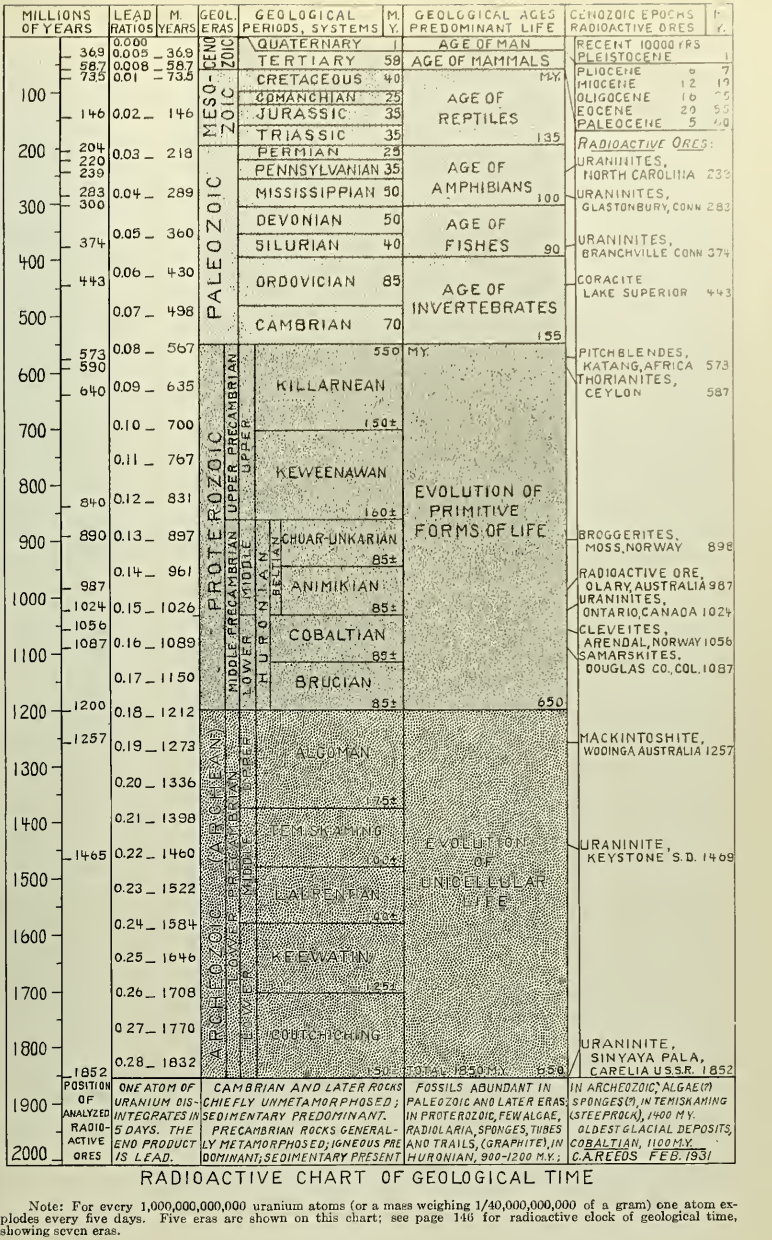
Beginning with William Smith in England in 1796, geologists have built up a geological time scale, the major features of which are applicable to the known rocks of the world. Smith, as a local surveyor, came to recognize beds of rock from place to place by the fossils which they contain. By continued observation over a number of years and much traveling, he was able in 1815 to publish a geological map of England and Wales on which he showed the distribution and succession of rocks of different ages. The local names which he applied to the beds have remained in use to this day.

The geological time scale, as now recognized, is the work of many geologists. It is a kind of chronological chart with various subdivisions, the oldest rocks appearing at the bottom, the youngest at the top. It is the geologists' alphabet. The terms ending in *zoic* refer to eras of life, which constitute major divisions. Each era is divided into periods, which are based upon a definite series of rocks representing one or more cycles of sedimentation, developed during an undefined interval of time. Locally each period

THE RELATION OF THE ROCK SURFACE OF THE EARTH TO SEA LEVEL

A diagrammatic representation of the relative areas of the rock surface (lithosphere) at various levels above and below sea-level, expressed in feet and in percentages. (Modified from R. D. Salisbury)





RADIOACTIVE CHART OF GEOLOGICAL TIME

Note: For every 1,000,000,000,000 uranium atoms (or a mass weighing 1/40,000,000,000 of a gram) one atom explodes every five days. Five eras are shown on this chart; see page 146 for radioactive clock of geological time, showing seven eras.

Ewing Galloway, N. Y.

INNER GORGE OF THE GRAND CAÑON, ARIZONA

View as in frontispiece. Looking down the Colorado River from the Kaibab suspension bridge. Rock section from river bed to top of Isis Temple: *Archeozoic:* V. Vishnu schist; *Proterozoic:* B. Bass limestone; H. Hakatai shale, Sh. Shinumo quartzite; *Palaeozoic:* (Cambrian) T. Tapeats sandstone, BA. Bright Angel shale; (*Mississippian*) R. Redwall limestone, (Permian) Ss. Supai sandstone and shale, C. Coconino sandstone

and system of rocks is further divided into epochs and formations of rocks. These local designations, which are numerous and variable from place to place, have not been included in this general chart.

To illustrate the meaning of portions of this chart the wonderful section of rocks exposed in the Grand Cañon of the Colorado River in Arizona may be cited. Across a plateau, the upper surface of which rises from 7000 to 8000 feet above sea level, the Colorado River has eroded a trench about 217 miles long and a mile deep at the western end. This trench consists of two conspicuous features, one, an outer cañon, which is 4600 feet deep from the north rim and from 8 to 20 miles across, the other, an inner gorge which is another 1000 feet deep, narrow, and V-shaped in cross section. The buttressed walls of the outer cañon are composed of a succession of horizontally stratified sedimentary rocks; limestones, sandstones, and shales representing the Permian, Mississippian, and Cambrian periods of the Palaeozoic era. Below these level strata the river has cut its inner gorge through tilted sedimentary rocks; quartzite, limestone, and shale, some two miles thick, which are of Middle Proterozoic age. Below this series the river has cut its way into a crystalline basement rock, without stratification,which belongs to the earliest era, the Archæozoic. While this great section is wonderfully impressive to those who visit the Cañon, the story has been but partly told.

The ancient basement rocks are separated from the overlying Proterozoic series by a great erosion interval. This interval is represented in the section by an uneven surface known as an unconformity. Prior to occupying their present position, these basement rocks in the bed of the river

which are 3000 feet above sea level, were deeply buried, crushed, smashed, and recrystallized by the processes of diastrophism as they lay at a lower level beneath a thick cover of rock. This cover was removed slowly by surface weathering, wind, and running water, acting throughout a complete cycle of erosion. The present erosion of the Grand Cañon is but a small beginning as compared with the great erosion period under consideration which was completed perhaps 1,200,000,000 years ago

On top of the gently subsiding peneplain thus established, sediments of the Proterozoic Chuar and Unkar series were slowly deposited. It was a long enduring period, for the deposits are more than 11,000 feet in thickness. The sediments were at least partly of marine origin, for Dr. David White and Mr. Lincoln Ellsworth have collected primitive forms of plants known as fossil algæ, from the Bass limestone, which appears just above the base of the Unkar series. These are the oldest fossils in the Grand Cañon.

Following the long period of deposition, diastrophism renewed its activities. The Proterozoic series was faulted and tilted, in fact, great block mountains thousands of feet in height were uplifted.

This epoch of mountain uplift was followed by a second long period of erosion, during which time the region was again worn to a smooth plain, except for a few low lying hills. In many places the thick Proterozoic series was entirely removed and the basement rocks again exposed except where a few downfaulted blocks of the Proterozoic rocks were preserved. These downfaulted blocks of sediments are all that remain of the great Proterozoic era in

SILICIFIED FORMS OF FOSSIL ALGÆ IN THE BASS LIMESTONE

Collected by Mr. Lincoln Ellsworth from the middle Proterozoic rocks, near the mouth of Bright Angel Cañon, Arizona. This specimen is of exceptional interest to students of the early remains of life. The Radioactive Chart of Geological Time indicates that it is about 940 million years old

this region. A second great line of unconformity separates the Proterozoic rocks from those of Palæozoic age.

As the land again sank, the seas of Cambrian time rolled in over the smoothed plain to inaugurate another great era of deposition in this region, the Palæozoic. Horizontally disposed sandstones, shales, and limestones were deposited. Amongst them may be found the fossil shells of various invertebrates, the tracks and remains of trilobites, et cetera. In the wonderfully impressive Palæozoic series of beds, the Orodovician, Silurian, and Devonian periods are missing. They are represented by an unconformity. We shall know more about what happened to them when the Grand Cañon is more fully explored.

As one views the Grand Cañon from the rim at El Tovar, it is difficult to realize that the rim rock, the Kaibab limestone, of Permian age, is not the top of the series of sediments. The great cliffs on the north and east that overlook the region are the higher strata that once extended over the whole district of the Grand Cañon. The distant strata represent deposits of Permian, Mesozoic, and Tertiary age. They are about a mile in thickness. Two major cycles of erosion are preserved in these rocks, one at the end of the Permian, the other at the close of the Mesozoic era. Each denotes prolonged erosion and a great interval of time. This Grand Cañon section, although extremely interesting and impressive, represents but portions of the geological time scale.

We have now suggested briefly the part played by the great geologic processes during the upbuilding of the earth. The question arises how long have these forces been acting? While various criteria have been used in the investigation of this problem, the data most frequently consulted are the sodium salts of the oceans, the thickness of the sedimentary rocks, and the radioactivity of the igneous rocks.

The sodium in the oceans has been derived from the land by the weathering of igneous rocks. It has been transported

GLACIAL BOWLDER OF VARVED CLAY OF MIDDLE PROTEROZOIC AGE

The seasonal layers of this compact rock were deposited in a glacial lake of Cobaltian time, 1100 million years ago, in Ontario Province, Canada. This specimen of the oldest known glacial period was carried by the ice of the last Pleistocene glaciation to Battle Creek, Michigan. E. M. Brigham collector

from the land to the sea by rivers carrying it in solution. As noted by J. Joly of Dublin in 1899, the mass of the ocean waters is 1,180,000 million million tons. The percentage of sodium in the oceans was calculated by him to be 1.08 per cent by weight, so that there are 12,600 million million tons of sodium in the oceans. The amount of sodium contributed by the rivers to the sea annually has been variously estimated. After applying certain corrections, A. Holmes, 1927, calculated that the yearly increment amounts to 35 million tons. The amount of sodium in the sea divided by this annual rate gives 360,000,000 years as the age of the oceans.

VARVED CLAY OF LATE PLEISTOCENE AGE
HAVERSTRAW, N. Y.

This partial section of Haverstraw brick clay, 30,000 years old, was deposited seasonally in fresh water as the ice of the last glaciation retreated northward. The space between pins represents a year. The lighter colored layers of fine sand are the summer deposits; the dark bands of clay are the winter layers

This calculation is based upon the present rate of denudation and delivery. It is most probable that the rate is much higher now than during many of the former geologic ages when the lands were less high, less extensive, and the seas more widespread. To account for these differences, J. W. Gregory (1921) recommends that the present estimates based upon sodium should be multiplied by five giving a total of 1,800,000,000 years as the age of the oceans.

The age of the earth based upon the thickness of the stratified formations is more difficult to apply since the average annual rate of deposition of sediments is not definitely known for the present or for past epochs of geologic time. A. Holmes, 1927, estimates the thickness of the sedimentary deposits of various ages as 529,000 feet or 100 miles. J. H. Bretz, 1926, on the basis of several estimates obtains an average rate of accumulation of one foot in 880 years. These figures give a total of 465,520,000 years as the amount of time required for the deposition of the sedimentary record.

This estimate does not include, however, the beds which were deposited in epicontinental seas, uplifted and subsequently removed by erosion, leaving only an erosion plane as a record of the events. Neither does it take into consideration those great gaps separating the five eras of geologic time when sedimentation was presumably confined to the margins of the continental platforms. Ocean waters now cover the margins of the continental platforms to a depth of 600 feet and embrace continental areas totaling 10,000,000 square miles. J. Barrell, 1917, notes that geologic processes, embracing erosion, sedimentation, and deformation recur in composite rhythms in which landscapes alternate with seascapes and geosynclinal areas of sedimentation with high mountains. The processes of sedimentation are complex and variable, defying rates of deposition. Areas of sedimentation alternate with scour and fill, the resulting product represents merely the balance between these two processes. In some areas sediments may not always have reached so far, in others they may have been carried

away to more distant spots, leaving small or large gaps in the horizontally disposed sediments known as disconformities. On the basis of these numerous deficiencies in the stratigraphic record it would seem that the above estimate of 465,520,000 years should be multiplied by a small figure such as 4, to account for the total time involved since sedimentation began, namely, 1,862,080,000 years ago.

Another line of evidence, which has yielded remarkable results as to the age of the earth is the radio-active method. It was first used in this connection by Boltwood of Yale in 1907. It is based upon the invariable rate of disintegration of the radioactive substances, such as uranium, thorium, radium and actinium, which possess high atomic weights and disintegrate with the continuous emanation of helium into substances of lower and lower atomic weights, terminating in lead. While chemists and physicists have analyzed but a comparatively small number of rocks of different ages containing radioactive minerals, the determinations so far made yield results which are in accord with the sequence of rocks as determined by geologists. The radioactive method affords age determinations which are more accurate than that produced by any other known method.

According to G. von Hevesy in *Science*, Nov. 21, 1930, single atoms of uranium and other radioactive substances explode. The number of particles exploding and decaying in unit time is strictly proportional to the number present. Thus where one atom of uranium out of 1,000,000,000,000 atoms, (or a mass weighing 1/40,000,000,000 of a gram) explodes and disintegrates every 5 days, 73.05 atoms disintegrate in like manner in the course of a year. If the mass and the number of atoms be 10 times as large, 10 atoms will decompose in five days. If the mass be 100 or 1000 times as large, 100 or 1000 atoms will decompose in the same time. Hence, whether the mass be 10, 100, or 1000 times larger, it disintegrates at the same rate.

Uranium disintegration is thus a strictly uniform process whose velocity has remained unchanged throughout geological time. Von Hevesy says that it is the nucleus which is involved in the decay, and nuclear processes proceed independently of temperature, pressure, and other external conditions. Hence, he asserts there is absolutely no reason to believe that the process has gone forward at any different rate than at present at any period in the earth's history.

To students of this subject it is a well-known fact that the disruption of a uranium atom is always accompanied by the radiation of an alpha-particle, which is a charged helium atom, or by the loss of a beta-particle, which is a free electron. The alpha-particles leave the atom with a velocity of 8800 miles per second and travel a distance of about 2.8 cm. in air and about 0.013 mm. in mica before they become powerless. The beautifully colored "pleochroic halos" seen in mica (biotite) under polarized light are produced by these alpha particles as they are emitted by the contained uranium and the decomposed products of uranium. The fact that the halos, corresponding to the various radioactive substances, have the same diameter, indicates that the rate of decay has remained the same throughout the ages. To apply the rate of uranium decay as a measure of time it is necessary as von Hevesy says to obtain (1) the total quantity of uranium that has decayed in some mineral since the solidification of the earth, and (2) the rate of that decay.

Accompanying the radiation of alpha-particles from uranium it is known that one atom of helium, an inert gas, rises from the decay of each atom of uranium. Although a small portion of this helium escapes, most of it collects in the uranium bearing rock, where its volume gives a

Photograph by Barnum Brown

STRATIFIED CRETACEOUS DINOSAUR BEDS, ALBERTA PROVINCE, CANADA

The man near the center of the picture stands on the contact between the marine Pierre beds below and the fresh-water Belly River dinosaur beds above. The contact denotes not only a change in the character of the sediments, but a lost interval of time occurring about 65 million years ago

measure of the age of the rock. Lord Rayleigh noted that one cubic centimeter of helium may be produced from one gram of uranium in 9,000,000 years. Since a small portion of the helium gradually escapes, this method gives but a minimum age. On this basis, age determinations of ancient rocks have been made to the amount of 570,000,000 years.

Uranium has an atomic weight of 238, helium 4. Hence, as the decay proceeds and helium is liberated, the products of the decay have atomic weights, 234, 230, 226, 222, 218, 214, 210 and 206. The atomic weight of a beta-particle is 1/1800, hence, when it is lost, the atomic weight is decreased by an insignificant amount.

The atomic weight 206, which is lead derived from uranium, is of special interest in radioactive determinations, since it is a solid product and does not disintegrate. It may be observed that 238 parts of uranium produce 206 parts of lead as 32 parts of helium are developed. Hence, from the known rate of the production of helium from uranium, A. Holmes, 1927, calculates that a million grams of uranium give rise to 1/7400 of a gram of lead every year. Holmes also presents formulæ for making age determinations from the various radioactive minerals. Thus after determinating the lead content of the uranium minerals it is possible to calculate what proportion of the uranium has decomposed since the mineral was formed.

In the *American Journal of Science* for March, 1927, A. Holmes and R. W. Lawson reviewed the methods of determining the radioactive disintegration of 18 samples and presented 22 determinations, the results of which have been incorporated in the left margin of the geological time scale on page 137. In the same journal, Aug., 1930, A. F. Kovarik described two additional analyses of ancient rocks, one for 1,465,000,000 years, the other for 1,852, 000,000 years. These have also been added to the chart.

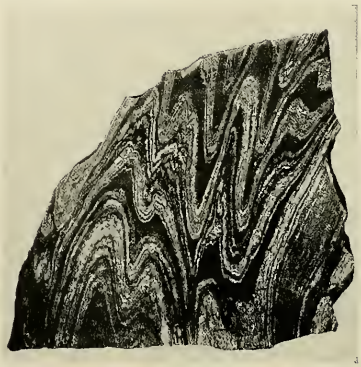
The radioactive method, which is based upon the natural disintegration of uranium to lead, is of great importance for it enables us to determine the following interesting things about the earth:

1. The age of the oldest igneous rocks containing radioactive minerals, that is, the minimum age of the earth.
2. The date of various events in the later history of the earth.
3. The nature perhaps of various transformations in the gaseous and liquid stages of the earth's history.
4. The maximum age of the earth.

As to these various points it may be said that the oldest radioactive mineral so far determined is a specimen of Uraninite from Sinya Pala, Carelia, in northwestern U.S.S.R., and that its age is 1,852,000,000 years as determined by A. F. Kovarik, Sloane Laboratory, Yale University, August, 1930. Another specimen of the same mineral from Keystone, South Dakota, as determined by Prof. Kovarik, gave 1,465,000,000 years. It is probable that other specimens yielding an even greater age may be found and that the minimum age of the earth, that is, the formation of the crust, may be considered to have begun approximately 2,000,000,000 years ago.

The age determinations of various events in the later history of the earth have been entered in the geological time scale on page 137.

The third and fourth points are of special interest, since the early history of the earth is still obscure. According to von Hevesy, 1930, the uranium-lead method is not only of value in determining the lower limit of the age of the earth's materials, but of the chemical elements. As a chemist he considers that the transformation of uranium into lead had already progressed to a certain point while the earth's material was still gaseous. He asserts that this lead with atomic weight 206 did not remain isolated, but mixed with lead (208) formed by the decay of thorium and as a result common lead (207) was produced. He goes on to say that approximately half of our common lead was formed from uranium before the earth's materials had solidified. He cites F. W. Aston as having proved recently that ordinary lead is a mixture of uranium-lead and thorium lead. He considers that lead formed in uranium minerals has had no opportunity to mix with thorium lead and consequently it has remained fixed as uranium-lead. Thus the ratio of all the uranium to about half the common lead (plus the uranium-lead) present in the whole earth must give the age of the earth's material. His considerations give about 3000 million years as the upper limit of the age of the minerals; it is also the lower limit of the age of the earth's material. He draws a distinction between the few radioactive elements, which have altered according to accurately known laws during this long time, and the other elements which built up the earth's constituents and have undergone no change.



SECTION OF FORDHAM GNEISS, ARCHÆOZOIC AGE
NEW YORK, N. Y.

The folded and contorted bands of light and dark colored minerals represent lines of segregation of the mineral matter, and folding when in a plastic state. It is typical of many Archæozoic rocks. Specimen from excavation, eastern abutment of Fort Washington bridge over Harlem River. Age problematical, perhaps 1800 million years

MUD FILLINGS OF "SUN CRACKS," SUPAI FORMATION

A specimen of lower Permian age that is some 215 million years old. It exhibits the same physical phenomenon as is found in the Hakatai shale specimen 935 million years old of middle Proterozoic age. From the Grand Cañon of Arizona. Lincoln Ellsworth Collection, 1930

The foregoing determinations have had to do with the crust of the earth. Since the earth's interior is inaccessible, the geochemist turns to the meteorites and assumes that the iron meteorites correspond to the core of the earth, and the stony meteorites to the more or less silicate-like material lying between the core and the crust.

F. Paneth of Berlin developed in 1926 the methods for determining the helium content of meteorites. He notes that the iron meteorites when heated to a red heat loose no trace of helium. According to von Hevesy, 1930, Paneth has found for the iron meteorites a maximum age of 2600 million years.

These data are significant. It lends support to the theory that the original materials of the earth and of meteorites may have come from a common celestial source. It also implies that the youthful earth, which grew presumably from the inner core outward by the addition of layers of planetoid and planetesimal matter, began its development 2,600,000,000 years ago. The oldest surface rock so far analyzed yields an age of 1,852,000,000 years. The difference in age between the oldest rock and the oldest meteorite is 748,000,000 years. May not this difference, or some 600,000,000 years, represent the time consumed in the upbuilding of the primeval earth?

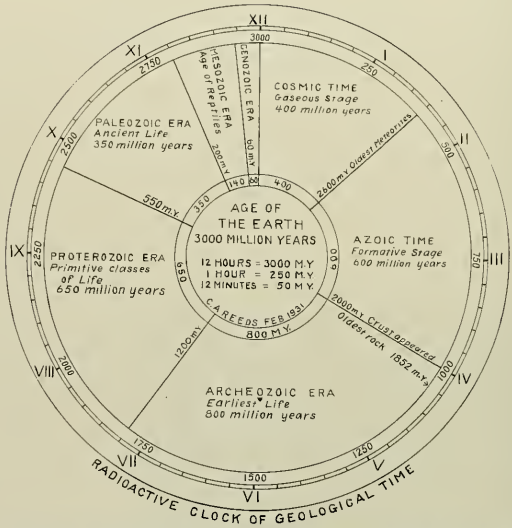
In conclusion it may be stated that these radioactive determinations are not only astounding, but remarkable. Al-

PROTEROZOIC RIPPLE MARKS AND "SUN CRACK" IMPRESSIONS

This slab of red Hakatai shale of middle Proterozoic age is some 935 million years old. It shows that the same physical phenomena were in force during the early eras of the earth's history as are in evidence today. Specimen from the Grand Cañon of Arizona. Lincoln Ellsworth Collection, 1931

though the method is still young the results are dependable. The method is based upon the natural rate of disintegration of the atoms of the few radioactive elements. This rate cannot be changed by any known human or physical agency. It is thus a reliable and thoroughly scientific method. When its application has been extended to numerous samples of radioactive rocks and minerals from all parts of the world, embracing rocks of all ages, then we shall know, in all probability, how old the earth is.

Upon the basis of knowledge for 1931, we may consider the crust of the earth to be 1,852,000,000 or about 2,000,000,000 years old; the inner core, 2,600,000,000 years old; and the upper limit of the minerals, or materials of the earth, as 3,000,000,000 years old, as noted below in the radioactive clock of geological time. The radioactive determinations and the oldest fossils indicate that primitive life was present on the earth one and one-half billion years ago; stone implements and human remains in Pliocene deposits imply that the human race was on the earth about one and one-half million years ago.



This clock face of 12 hours shows how 3000 million years may be allotted to seven stages in the geological history of the earth. The first and second stages representing the gaseous and formative eras respectively, are not shown on the preceding more detailed radioactive chart of geological time, page 137.

The Adler Planetarium and Astronomical Museum, Chicago, Illinois

THE DRAMA OF THE SKIES

As Projected by the New Zeiss Planetarium, a Remarkable Instrument that Exhibits, with the Illusion of Reality, the Motions of the Heavenly Bodies

By CLYDE FISHER
Curator of Astronomy, American Museum

If the stars should appear one night in a thousand years, how would men believe and adore and preserve for many generations the remembrance of the city of God which had been shown."—EMERSON.

VISUAL aids in education have been appreciated by great teachers at least as far back as the beginning of the Sixteenth Century when Leonardo da Vinci convincingly set forth the value of these means. How much more effective than the printed page is the diagram or drawing or photograph in making clear many principles or laws of nature! And where there are movements, as in the case of the heavenly bodies, suitable apparatus is much more effective in visualizing natural phenomena than flat pictures in books.

In no field of science-teaching is well-devised apparatus of greater value than in astronomy. Devices have been made to illustrate eclipses of the sun and moon, others to show the causes of the changes of seasons, and still others to portray the movements of the planets in relation to the sun. In the latter half of the Sixteenth Century, the great Dutch astronomer, Huygens, and the great Danish astronomer, Roemer, built a planetarium to represent the solar system, as it was then known, according to the new Copernican system, and doubtless this invention had much to do with the general acceptance of the sun-centered theory of our system of worlds.

A great variety of instruments was made for the purpose of showing the relative motions of the then known bodies in our solar system,—many of them very crude, but for the most part very helpful. Some were limited to the earth and sun and moon, others just to the moon and the earth, and still others to the sun and all the known planets and satellites.

One of the most interesting and complicated of these early inventions was built in England for Charles Boyle, the fourth Earl of Orrery, and thus originated the name "orrery" as now applied to these old types of planetarium.

In America the most famous orrery every built, according to Prof. David

Todd (*Popular Astronomy*, August–September, 1925), is that constructed by America's first practical astronomer, David Rittenhouse. It is now one of the most highly prized astronomical trophies of Princeton University.

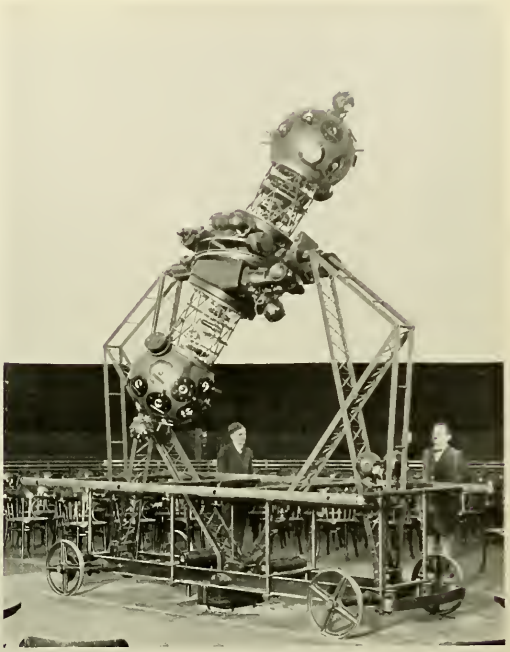
The best of these mechanical planetariums or orreries ever constructed was designed and built by the Carl Zeiss Optical Works of Jena, and is installed in the German Museum in Munich. It may be described briefly as follows: A lighted globe in the center represents the sun. The six planets nearest the sun, with their satellites—the planets and satellites all revolving at their proper relative speeds—are shown. The diameter of Saturn's orbit is about forty feet. Uranus and Neptune are left out, I presume because their tremendous distances would make the rest so small proportionately, and Pluto of course was not known when the apparatus was made. There is no light except from the central sun, and the walls, ceiling, and floor are painted black. Consequently, the change of day and night is well shown on the planets, and so are the phases of our moon. For the lecturer or demonstrator, a car travels around under the earth, which goes around the central sun in twelve minutes, the apparatus being propelled by an electric motor. The phases of Venus and Mercury can easily be observed through a periscope on the car under the earth, which makes it possible to see these planets from the level of the plane of the ecliptic. The constellations of the zodiac are shown in a belt on the wall, with their names in white letters and with the degrees of the circle marked. The principal stars are shown by lights back of small, round holes in the black wall. This Copernican planetarium is so valuable that it should

ENTHRALLED BY THE ARTIFICIAL NIGHT SKY OF THE NEW ZEISS PLANETARIUM

When the lights of the planetarium are gradually dimmed and the stars are "turned on," an involuntary "ah" always sweeps the audience. It is indeed a breath-taking experience

by all means be included in the proposed Hall of Astronomy at the American Museum.

Two other smaller mechanical planetariums in the German Museum in Munich are worthy of note. One is a Copernican or sun-centered mechanism enclosed in a spherical glass globe about five feet in diameter. On the inside of the glass sphere are shown in gold the principal stars of the most conspicuous constellations. The apparatus proper consists of globes of various sizes to represent the planets and their satellites and the central sun. A unique and valuable feature of this exhibit is a crank on the outside of the sphere, which may be turned by any visitor, and which propels the heavenly bodies in their proper motions. Naturally this instrument attracts much attention. Dr. Philip Fox has shown his appreciation of this type of planetarium by placing one in the new Adler Planetarium and Astronomical Museum in Chicago.



THE PROJECTION APPARATUS OF THE ZEISS PLANETARIUM
This apparatus is more than twelve feet high and built with the accuracy of a watch. The set of stereopticons at one end projects the stars of the Northern Hemisphere, and those at the other end, those of the Southern Hemisphere. The projectors between represent the sun, moon, and visible planets

The other small planetarium in the German Museum, referred to above, is a Ptolemaic or earth-centered instrument, of the same size and of similar installation, and it also has the valuable feature of an external crank, which the visitor may turn. In this apparatus one may see the heavenly bodies revolve around the earth, the planets on their epicycles, as they were believed to move before the days of Copernicus.

The value of these instruments, it is hoped, will not be under-estimated. And yet perhaps no one realized how inadequate they all were, until some one produced a much greater invention from an entirely different viewpoint. The old types were built on a small scale, and the observer must watch the various movements of the heavenly bodies from the *outside* of the solar system, and not as one naturally would observe them from the earth. And in all cases the comparative sizes and distances were more or less extremely distorted. And again, the fixed stars, which so enthrall us in the night sky,

were always left out, except that a few were sometimes shown in an inadequate manner by being painted on the surface of an outside sphere, or by means of lights back of small holes in a zodiacal zone.

The nearest approach to the modern projection planetarium with regard to the stars is the Atwood Planetarium in the Museum of the Chicago Academy of Sciences in Lincoln Park. In that the most conspicuous stars are shown by lights back of holes in a hollow sphere, and they are shown in their apparent rising and setting, but so many astronomical features have not been included in this apparatus, that it cannot compare with the projection planetarium, although it must be looked upon as an important step in the evolution of apparatus for visualizing the subject of astronomy.[1]

[1]The writer has since learned that a very similar apparatus was buit at Pembroke College in 1758 by Roger Long, Lowndes Professor of Astronomy at Cambridge. The globe was 18 feet in diameter and seated 30 persons. Described in "A Cycle of Celestial Objects," by Smyth and Chambers, pp. 208-209, Oxford, 1881.

But now we come to something new under the sun, an apparatus that shows every object in the sky that is visible to the unaided eye, and in a most realistic manner. The rising and setting of the sun, moon, and stars are shown just as they occur in nature, due to the rotation of the earth on its axis. The moon is shown going through its phases. The planets are shown wandering among the stars. Even the wobbling of the celestial pole around a curve, which in the sky takes 26,000 years, is cared for in this apparatus.

In this new projection planetarium there are no globes to represent the heavenly bodies, but everything is shown on the inside of a dome by projection of light from a central apparatus. The optimum size for this inverted bowl is about seventy-five feet in diameter. This hemispherical dome, which is white inside, becomes our artificial sky, and since there are no pillars or posts to inter-

THE PLANETARIUM AT DÜSSELDORF

The planetarium at Düsseldorf, housed in this attractive building, has been visited by about 400,000 people. The dome is ninety feet in diameter. For projectional and acoustic reasons this is now considered to be larger than the optimum

cept the light, the illusion of the immensity of space is perfect. One feels that he has been suddenly transported outside under a clear night sky. The realistic appearance is beyond belief.

The central projection apparatus, which rests on the floor of the dome, is a dozen feet high and is built with the accuracy of a watch. One set of projectors arranged in the form of a sphere shows the stars of the northern hemisphere of the sky and another similar set portrays the southern hemisphere. In all the sky there are shown 5400 stars, which is all that can be seen by the best unaided eyes. Although some other parts of the apparatus presented more difficult problems, the representation of the fixed stars including the Milky Way is most impressive.

THE PLANETARIUM IN HAMBURG

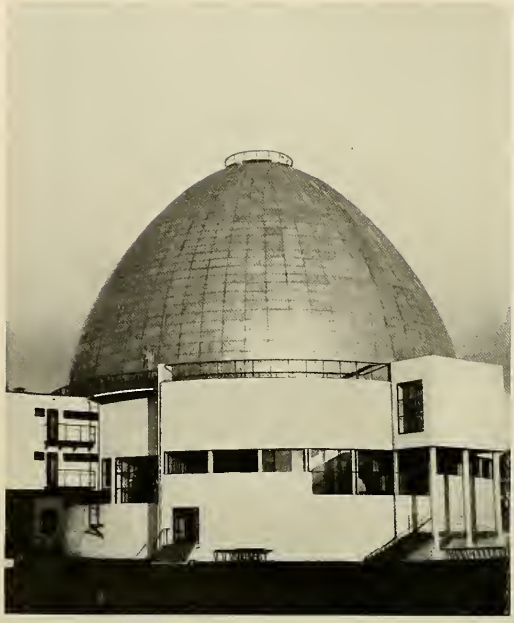
In the city of Hamburg a former water tower has been utilized to house the planetarium, thus saving much of the cost of constructing a new building

In fact, the inventor admitted to me that the illusion of the immensity of space, and the realistic representation of the fixed stars including the Milky Way had exceeded even his expectations. Due to some subconscious imagination, perhaps,—at least for some psychological or physiological reason, this artificial sky seems to possess the deep night blue seen in the real sky, and yet there is no blue color on the inside of the dome and none in the projection apparatus.

By means of a special set of projectors the names of the constellations may be shown on the sky, and this is quite an advantage over outdoor star-gazing in learning the constellations. With a flashlight showing an arrow-shaped light, the lecturer can point out any star, planet, or other body in the sky.

Between the assemblages of stereopticons showing the stars are seven special projectors, one for each of the five planets visible from the earth to the unaided eye and one each for the sun and the moon.

The whole apparatus has several speeds, and by running the year through in a few minutes one can get a very clear notion of the wandering movements of the planets, which would require a long time in careful actual observation to acquire. In fact, under New York City conditions



THE PLANETARIUM AT MOSCOW

Even Moscow, in the midst of the unsettled conditions of Soviet Russia, has its planetarium. During the first nine months it has had nearly 600,000 visitors

of clouds and haze and smoke and buildings and artificial lights, it is practically impossible to make many of the most elementary observations out of doors.

With the new projection planetarium, one can change his latitude at will. He can go in his imagination to Argentina and study the southern constellations. Or, he can change the time. He can set it back for thousands of years, if he wishes, or he can set it forward say 12,000 years when Vega will be the pole-star, and the Southern Cross will be visible from the latitude of New York.

Shortly before the World War Dr. Oskar von Miller, director of the German Museum in Munich, commissioned the Carl Zeiss Optical Works to undertake this project. After more than ten years, the first Zeiss Projection Planetarium was installed in Dr. von Miller's museum. The credit for the invention of the apparatus goes to Dr. Ing. W. Bauersfeld of the Zeiss Works. The Munich planetarium was opened in 1924, and in 1925 it was my good fortune to be sent to Germany by the President and Board of Trustees of the American Museum of Natural History for the purpose of examining the new invention with a view to its suitability for our proposed Hall of Astronomy.

After a careful investigation, I brought back as enthusiastic a report as I could prepare, and yet after nearly six years New York still awaits a realization of this dream.

It has been a source of great satisfaction to have my own judgment universally corroborated. It is surprising but true that the new planetarium impresses professional astronomers as well as amateurs and laymen. Following are the statements of a few professional astronomers:

Dr. R. G. Aitken, Director of Lick Observatory.—"The Zeiss Planetarium is the most remarkable instrument that has ever been devised to exhibit impressively, and with the illusion of reality, the motions of the heavenly bodies and the phenomena which result from these motions. It has, therefore, deservedly won the attention of all who are interested

in the diffusion of astronomical knowledge."

Dr. Walter S. Adams, Director of the Mount Wilson Observatory.—"The Zeiss Planetarium with its realistic and rather dramatic presentation of the celestial objects would prove of great educational value, fixing in the minds as no description could do the simple astronomical principles which everyone should know."

Prof. Elis Strömgren, Director of the Copenhagen Observatory.—"Never was a medium of demonstration produced as instructive as this, never one more fascinating in effect, and certainly never one which appeals to everybody as this does. It is a school, theater, and film all in one, a lecture hall under the vault of the heavens, and a drama in which the celestial bodies are the actors. No description, no photograph, no drawing can possibly reproduce the overwhelming impression made by a demonstration in a Zeiss Planetarium."

Since the opening of the first planetarium in 1924 in Munich, the number has grown to nearly a score. About a dozen are in operation in cities of Germany. There is one in Vienna, one in Rome, one in Milan, one in Moscow, one in Stockholm, and one in Chicago. One has been ordered for Philadelphia and one for Los Angeles.

Chicago deserves the credit of bringing the first projection planetarium to America. This was made possible by the generosity of Mr. Max Adler, the apparatus being installed and the astronomical museum being organized and developed by Dr. Philip Fox, formerly head of the department of astronomy and director of the Dearborn Observatory at Northwestern University. In less than five months the Adler Planetarium in Chicago

THE ZEISS PLANETARIUM IN ROME

This planetarium was contracted for by Mussolini and was set up in the Aula Minerva of the Diocletian Baths,—a striking contrast, one of the most modern steps in education in the oldest of settings

passed the half-million mark in attendance. A few weeks ago, in a lecture before the Amateur Astronomers Association, Doctor Fox threw down the challenge to New York. Will we accept it?

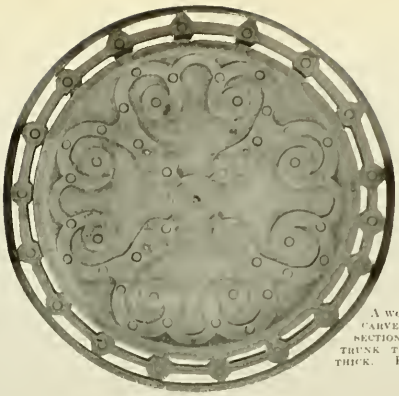
The new planetarium in Philadelphia is to be installed in the new building of the Franklin Institute. It was donated by Mr. Samuel Fels. Philadelphia has beaten New York in placing an order for a planetarium. We used to tease Philadelphians with the old Pullman advertisement, "You go to sleep in Philadelphia and wake up in New York." And now comes California! This is too much.

The new planetarium in Stockholm has had so large a number of visitors that by charging a small admission fee, it has paid for itself within four and a half months.

Since we have more than a million public school children in New York, in addition to several million adults who would be interested, and an enormous transient population besides, our city would immediately eclipse all records for attendance. With a small admission fee, school children exempted, a planetarium in New York would soon pay for itself in money, while no one would be able to measure its educational and inspirational value to the boys and girls and men and women who would visit it.

THE NEW PLANETARIUM IN STOCKHOLM

This planetarium, installed at the Exposition of 1930, has been visited by so many people, that, with a small admission fee, it has paid for itself within four and a half months



A WOODEN TRAY CARVED FROM A SECTION OF TREE TRUNK THREE FEET THICK. BONI TRIBE

ART OF THE DUTCH GUIANA BUSH NEGRO

A Craft which Survives in a Highly Developed State among the Descendants of West African Negro Slaves Deep in the Jungle of Dutch Guiana

By MORTON C. KAHN
Department of Hygiene, Cornell University Medical College

Under the patronage of Myron I. Granger, Doctor Kahn has made several journeys to Dutch Guiana to study the Bush Negro groups dwelling there. The work has been carried on with the coöperation of the department of anthropology of the American Museum, where Doctor Kahn has deposited his ethnological collections and the data on their culture. He has granted to NATURAL HISTORY MAGAZINE *the courtesy of pre-publication of the chapter on the art of these jungle inhabitants, which will appear in his new book "Djuka—The Bush Negroes of Dutch Guiana," to be published early this spring by Viking Press.*
—THE EDITORS.

DEEP in the jungles of Dutch Guiana live the Bush Negroes or Djukas as they are locally known. They are descended from West African Negro slaves who revolted against their masters, the Dutch colonial sugar planters, as early as 1650. The wild and almost impenetrable jungle into which these slaves fled made it impossible for the Dutch to subjugate them. After a series of long and bloody wars, the Dutch realizing that recapture of the escaped slaves and their offspring was an impossibility, granted them their freedom, to insure the plantations from further attack. The Djukas are unique, for in the civilization which they have established in the South American jungle they have borrowed but little from the white man or Indian, having kept alive, instead, most of the customs and practices which the slave ancestors of the present-day Djukas brought with them from West Africa. Among the most outstanding of these characteristics is the highly developed art of wood carving.

The sense of beauty is not absent. The Bush Negroes have definite æsthetic feelings and in their wood carving they have a well-developed and conventionalized art form. Art is highly socialized and universally appreciated among them. There are definite artistic conventions and common conventionalized forms.

INTERIOR OF A BUSH NEGRO VILLAGE
Today these descendants of West African negro slaves live a peaceful, contented, and primitive life in their little jungle villages of thatched huts

Among ourselves the production of artistic objects is confined to a small group of especially gifted individuals, whereas among the Bush Negroes it is a regular part of the life of proportionately many more individuals. Common objects of everyday use, which among ourselves are designed for utility alone, are developed by the Bush Negroes into elaborate objects of art. They represent one of the most characteristic features of any Bush Negro village. One is sure to find in every village the carved plates and long-tined combs and pierced decorations that constitute the art of the Bush Negroes.

In the combs, paddles, and other pieces of wood carving illustrated in this article, the most casual observer will discern a great beauty of form and design. The sense of line, the feeling for balance, combined with elaborate conception and execution, compare well with the productions of the highly sophisticated artists of our urban civilization. All of the wood carvings, collectively known as *sanni* or *timbeh*, follow certain traditional patterns. The individual motifs, however, are products of the individual imagination, and, judging by the variety and originality of the designs shown herewith, that imagination is evidently quite fertile.

All the wood carving is done by men. There is a ceremonial significance to this. These wooden pieces are tokens of love.

Love in the jungle is not the etherealized sentiment portrayed by Victorian novelists. When a man and woman want each other the satisfaction of their desire is easy and immediate. The people are largely promiscuous among themselves. Under such conditions the existence of romantic sentiments is an impossibility.

Individual preference does, of course, exist, and this implies courtship. A man may want a woman who does not want him, and this implies wooing. The wooing

consists in presenting the woman with specimens of sanni. Thus, every piece of wood carving is a token of love and affection, presented by a Bush Negro to his woman. The woman who accepts sanni from a suitor accepts his love along with it. The man naturally stores up a quantity of sanni in expectation of falling in love, and the woman is inordinately proud of her pieces of wood since each one betokens the affection of a male. A great part of the love-life among the Djukas is wrapped up in these carved household implements.

Those few unfortunate natives who are not clever at handling a knife must trade fish or game or some other personal possession for sanni produced by a more deft handicraftsman. Almost any Bush Negro can hunt, fish, and care for a wife, but a man's value is enhanced in the eyes of the woman when he can carve artistically. The women appreciate him and the men respect him. Wood carving, therefore, is assiduously cultivated by the Bush Negroes from early childhood.

As sanni is a prized commodity everywhere, exchangeable for female favors, a great deal of time is spent on each individual piece. A single comb may take weeks to carve. The women are very good judges of sanni, and can tell a good piece at a glance. With such a critical audience, the Djuka artist is careful of his skill, and few awkward or ill-formed designs are seen. Boys between the ages of eight and ten years may be proficient carvers, and critical elders preside over their work, ready to point out any minute mistake. The father or uncle who is expert with the knife will train his son or nephew in the same tradition, so that certain families are known for their beautiful work.

This erotic significance of the wood carvings makes them difficult to obtain. The woman who sells one is not parting with a domestic utensil so much as with a treasured memento. Sentimental attachments are bound to appear. As one woman said:

PREPARING PALM FRONDS FOR THE CONSTRUCTION OF A HUT

The huts of the Djukas are usually made from woven palm fronds and thatch, and are weather-tight even in the severe tropical storms

"He gave me this piece when we were first married. I won't part with it now."

Usually an elaborate parley is necessary. The women are undecided whether to sell or not. They laugh, giggle, put their fingers coyly in their mouths, joke bashfully with bystanders, and cannot make up their minds as to the price. They never know how much to ask for a piece. Sometimes they will mention a preposterous figure, hoping like a naïve child that the strange *bahkra* (white man) will pay that much. But on such occasions a rebuke will make them more reasonable. Once an arrogant witch doctor intervened in a transaction with a Bush Negro woman, demanding angrily that she receive an exorbitant payment. His anger was squelched with a few sharp words, and, contrite, he sat up all night to carve an ornate implement to present to the *bahkra* as a peace-offering.

The Bush Negro implements are carved out of jungle wood. Some are made of lignum vitæ, the hardest wood known. A few of them are made of soft wood, light and spongy, but these are not popular. The small paddles are used for stirring in the cooking pots, and the combs are actually used for the hair. They are never worn as personal ornaments, and when not in use are hung up on the walls of the hut. The utensils are all made with common trade jackknives and compasses which are used as dividers. It is principally with these dividers that the serpentine motifs are executed. After the carving is finished the piece is smoothed off by rubbing it with matted grass and river sand. A few chisels and carpenter's tools can occasionally be found. Where compasses or dividers cannot be obtained, a nail and piece of string are often used.

A TYPICAL BUSH NEGRO COUPLE

Almost perfect physical specimens are not uncommon among the Djukas. Note the elaborately carved canoe paddle held by the man. Similar specimens are in every-day use along the rivers. A number of these are in the collection at the American Museum

Bush Negro sanni is not used for trading purposes. A few pieces find their way down to the coast, of course, but they are never articles of commerce among the Djukas. In some villages, and particularly among the Paramacca tribe it is practically impossible to obtain many carvings, but the willingness to

A DJUKA MOTHER PREPARING CASSAVA BREAD FOR HER FAMILY

The root of the bitter cassava forms the main carbohydrate food of the Bush Negroes but upland rice is also cultivated and in daily use. The cassava squeezer is the most elaborate of the Djuka basketry

part with these objects naturally varies with the village and the individual. Being known to the natives greatly facilitates trade.

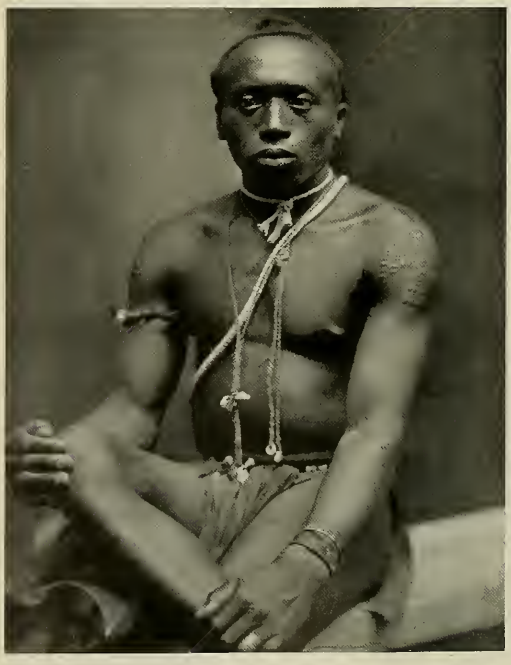
One outstanding feature of this work is the complete absence of color. The finished piece shows the natural hue of the wood, and rarely anything more. An occasional variation is obtained by inlaying with racuda wood, brownheart, or purpleheart, but tints and dyes are seldom applied. A different shade is also obtained once in a while by branding or burning the wood with a hot iron. The men of the Aucaner tribe who paint red and black clan devices on their large canoe paddles, represent exceptions to the general rule of showing only the natural wood shades.

Nearly all the pieces are utilitarian in origin and purpose, but some of them are so highly carved as to be of little practical use. These are much prized as gift pieces. The trays are actually used for carrying food, also for winnowing rice, and the stirring paddles dip into the food pot every evening. After being used they are washed with river water and hung up on a peg. The canoe paddles are actually employed every day on the river, and the beautifully carved flails beat the day's wash of soiled togas and *coyos* (woman's cloth).

Since it is taboo to sit on the ground, a large number of stools are made, pierced and decorated, with now and then a tiny cabinet inside them. Wooden locks that actually work are seen on the doors, especially in Aucaner villages, guarding the treasures inside. These are West African survivals; the same type of device can be found in several parts of the Old Continent. They are huge affairs often two feet in length. Door sills and

THOSE FOR WHOM THE WOODCARVING IS DONE

A woman's favor is bestowed upon the man whose gifts are carved with the greatest skill and artistry. The unfortunate suitor who does not possess this skill must purchase his love tokens from an expert



A TYPICAL DJUKA TRIBESMAN

Note the scar tissue decoration on the face and arms. This custom of cicatrization is a direct West African survival. Many of the Bush Negroes are even more liberally decorated than this man. The custom is practiced by both sexes

Photograph by Klein

Photograph by Klein

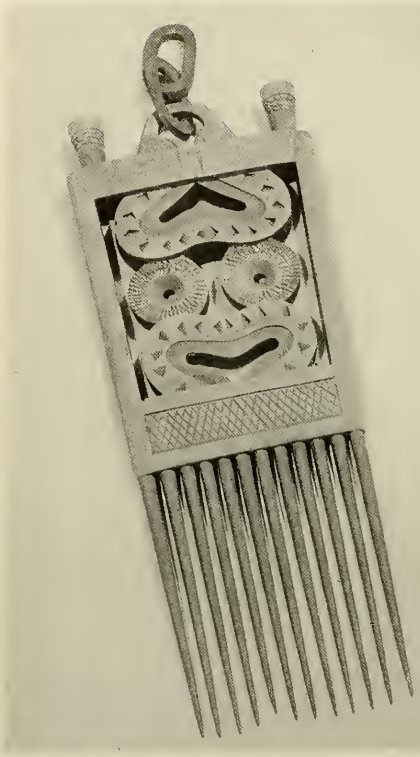
HOME AND COMPANY CLOTHING

The man on the left is dressed in a manner typical of the up-river tribesmen. He is wearing simply a loin cloth and the toga-like garment known as "camissa." The man on the right has just rented a pair of trousers and a shirt in preparation for a promenade about the streets of Paramaribo, the capital city of Dutch Guiana

GRAN-MANS AND CAPTAINS

Assembled in Paramaribo for their annual parley with the Governor. Each Bush Negro tribe is headed by a Gran-Man, while each village headman is known as a Captain. Costumes of this type are traditional, and have been worn on state occasions for many years

Photograph by Curiel



A COMB CARVED FROM A SINGLE PIECE OF WOOD

Human face motif. These combs are not worn as ornaments but are used for making the coiffure. Boni Tribe

door posts, bows and sterns of canoes, canoe seats and calabash gourds (occasionally decorated by a woman) are all embellished with ornamentation of great intricacy. It is amazing that these designs could be wrought without preliminary designing, which would seem to be necessary, but so far as we were able to observe there is no conscious planning before the carving begins.

The symbolism employed in these pieces of sanni is limited to a few conventionalized motifs. Moreover, there is a variation in the symbolism peculiar to the individual artist, which is not comprehensible solely from an examination of the piece itself. Unless one can locate the original carver, it is impossible, for the most part, to be certain what the symbols mean. The same motif will be differently interpreted by different natives, and often has no objective meaning. It is therefore impossible to undertake an elaborate interpretation of Djuka symbolism.

There are a few outstanding designs found on a large number of pieces. The first of these is the snake motif. It takes the form of serpentine coils and twists, fancifully involuted and superimposed. The same general design is also interpreted as a liana motif, referring to the twisted tendrils of the jungle vines, convoluted and snarled. These twists and curves may be carved in such a way, however, as to represent human figures. The second most important is the chain motif, an attempt to duplicate the links of iron chains.

The vulva motif is commonly found, and is consciously employed as a love symbol. The natives have no hesitation in interpreting this design as referring to the female genitalia; it is impressed on articles as a symbol of desire. The bill-bird, or toucan, provides another motif

A PLATE AND SPOON CARVED FROM A CALABASH GOURD

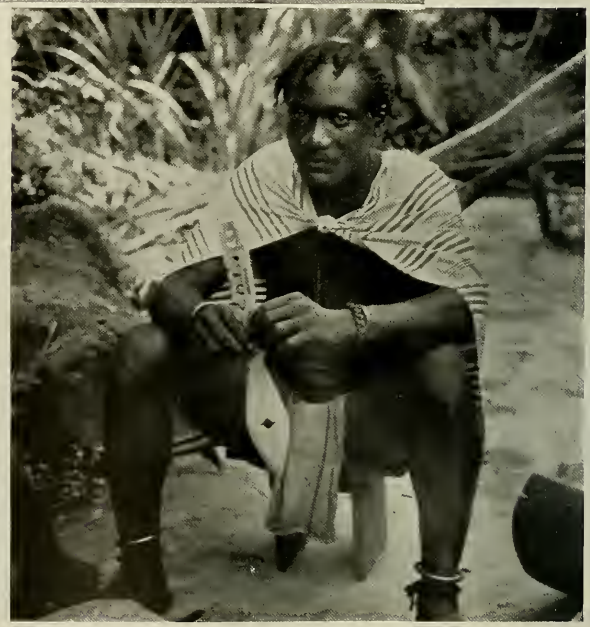
These articles are in every-day use and are sometimes decorated by the women, while the wood carving is solely in the hands of the men

A CARVED WOODEN BOARD USED FOR MASHING PEANUTS

Note the brass upholstery tacks. These tacks are often employed by the Bush Negroes for decoration of their wood carvings. Saramaccaner Tribe

A HOUSE FETISH

This fetish is constructed to keep evil from the occupants of the hut. As among most primitives, the environment of the Djukas is peopled with many evil spirits. Fetishes to the spirits are usually very crudely carved



A BUSH NEGRO ARTIST

This man is named "Ahmekimoi" (He makes nice things). Note the carved and inlaid wooden pot stirrer that he has just completed for his wife. Such gift pieces are highly prized by their recipients

AN ANCESTOR SHRINE

While the Bush Negroes recognize a great divine spirit ("Gran Gadu"), they also have a number of other dieties. It is usual for them to pray to their ancestors to intercede with the spirits on behalf of those still in the realm of the living.

PLAYING DANCE MUSIC ON THE APENTI

This type of drum is also used for signaling from village to village. The signal codes used by the Djukas, as well as the construction of the drum, follows the traditional West African pattern

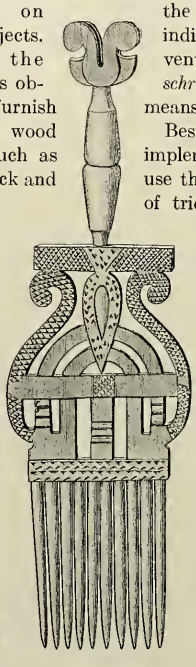
A CARVED FOOD-POT STIRRER

Highly Stylized. Snake Motif. Aucaner Tribe

that can be recognized on a variety of pieces. Another West African survival is the bone motif, for the human scapula is frequently seen conventionalized on calabash objects. A few of the white man's objects also furnish themes for wood carvings, such as the rifle stock and anchor.

Other motifs are entirely without symbolic intention, and are for symmetry and proportion only. The cross-hatch and notch motifs are African in origin, and can be found on West African objects. Other details of execution vary widely, without especial significance. The tines of the combs may be rounded or square. The food paddles may have two handles and one blade, or two blades and one handle. The size of the pieces varies considerably, from small combs a few inches long to the great six-foot canoe paddles. Aside from the vulva and phallus motifs there is little erotic symbolism.

A peculiarity of Aucaner tribe wood carvings is the system of sign language imprinted thereon. If some of the pieces are examined closely, it will be seen that they have odd symbols apparently placed at random, not conforming to the general pattern of the piece. These marks represent personal messages from the giver to the recipient, special indications or signs of affection, comparable to the marks at the ends of Victorian *billets doux*, indicating the place to kiss. Conventionalized letters are known as *schriefie*, a Bush Negro word that means "writing."



A CARVED COMB

Lizard Tooth and Notch Motif. Saramaccaner Tribe

Besides the practical implements in everyday use there are a number of trick pieces apparently made for no other purpose than to show the virtuosity of the artist.

Thus in some pieces a loose bauble is placed in a cup from which it cannot be forced. Some of the stools have tiny doors which open, and some of them are folding stools which close up like camp stools, yet are made from one piece of wood. An identical specimen of one of these folding stools which was collected in Africa is to be seen in the African Hall at the American Museum. There are stirring paddles

A CEREMONIAL WOODEN SWORD THREE FEET LONG

Motif: Two Mannikins on a Parrot Head Surmounted by Two Phallic Symbols. Aucaner Tribe

with loose rings around the handles, carved from the same piece of wood and undetachable. Some have chains of wood attached, with separate links, all from one piece of wood. The Bush Negroes are also fond of making bush-knives in wood, or ornamental swords to be worn on ceremonial occasions. Small knives ordinarily seen in metal are also carved out of wood.

There are two general types of decoration, with one or two subsidiary devices. The commonest consists of pierced ornamental work, made from a single piece of wood. Except for benches, no pieced specimens are ever found. Because of the practical necessity of having a large number of benches, and the difficulty of executing both legs and seat out of a continuous piece of wood, benches are commonly made of several pieces of wood fitted together. A number of them, however, are made from a single piece, and this continuity is preferred by the Djukas.

Photograph by Herbert Heller

A GIFT CARVING FOR A BUSH NEGRO BELLE

Four combs carved from a single piece of wood. Sometimes the wood carvings are so highly stylized as to serve no practical purpose save that of illustrating the skill of the artist to the object of his affection. This and other specimens pictured in this article are from the Kahn-Granger collection of the American Museum of Natural History

Relief work is the second form of decoration. It occurs in the form of high relief on the plates and trays. It can be found to a modified degree on door-posts and other carved objects. Ornaments in low relief are represented by the calabash pieces, which are cut when green and allowed to dry.

Branding is done with a hot knife or wire, or else the piece may be charred by holding it in the flames. Circles are burned into the pattern by heating empty cartridge shells red hot and pressing them against the wood. Brass upholstery tacks, obtained in the white settlements of Paramaribo and Albina, are in especial favor, and some pieces are heavily laden with these. They fit in very well with the general spirit of Djuka art, and although the material is anachronistic, the effect is not.

Religious carvings, unlike the practical implements, are executed with a crudeness that is surprising. The fetish to the gods Aflamu and Cromanti which were brought back to the Museum are nothing more than a rough sections of pole with a crudely hewn face and seeds for eyes. Other religious pieces are likewise roughly done. The reason for this seems to spring from the general nature of primitive religion as it occurs among the Bush Negroes. Two explanations of this were given by native informants. If the god is a good

god, and well disposed toward the black man, he doesn't care whether his fetishes are well executed or not. If he is a bad god he is going to continue to be bad, regardless of whether much time is spent on his fetishes or not. Another Bush Negro, questioned about this, said:

"Me no sabby de Gadu luku"—"I don't know what God looks like."

The primitive æsthetic feeling, apparently, is bound up with practical ends. There is absolutely no care or pains taken with religious objects whereas erotic objects are finished with great skill.

There seems to be considerable variation between the tribes of Djukas in the character of their art work. The Aucaner wood carvings have, in general, a more refined and delicate cast than the wood carvings of their neighbors, the Saramaccaners and Boni. There is a difference in treatment of the motifs among the Bush Negro tribes, which space does not permit me to detail.

The combs vary from two and a half inches to twenty-four inches in length, and even these more immense combs see actual service. They are always made of a single piece, including the tines. For the most part they are made of harder woods, with occasional inlays. A number of them are trick pieces, with little ingenious devices that catch and hold the imagination of the primitive.

The arts of weaving and basketry are not as highly developed among the Djukas as is the carving of wooden implements. The Bush Negroes do not weave the cotton cloth they wear. It is obtained, instead, by trading at the white settlements. The only weaving among them consists of cotton leg and arm bands —things that do not count for much so far as industry is concerned, but which expand the wearer's ego and add enormously to his or her self-esteem. Unornamented circular baskets, varying in size from a foot to a yard in diameter, can be seen in all the villages. They are used for carrying yams, rice, and foodstuffs generally. The finest basket work does not occur in these baskets, however, but in the cassava squeezers, those elongated tubes for producing cassava flour. These are beautifully woven of uniform rattan, and decorated with darker strips to form a simple pattern near each end. The finished product is an admirable piece of work, of which the owner must indeed be proud.

Pottery is made by the Djukas for utilitarian purposes only, and the solid black, absolutely undecorated clay ware has no particular element of beauty. The pots are black, stolid, and unimaginative. They are simply necessities.

But when the necessities of life have been provided for, and leisure is at hand for more beautiful and tender endeavors, the Bush Negro, seated before his evening fire, sharpens his knife and begins marking with fine, deft lines, the graceful outlines of another paddle or comb to please his woman.

A part of the Vernay-Lang Expedition Camp near the Kuke Pan

THE GREAT KALAHARI SAND VELDT

Experiences of the Vernay-Lang Zoölogical Expedition in the Vast Arid Plains of Southern Africa Known as the Kalahari Desert

IN TWO PARTS—PART I

By ARTHUR S. VERNAY

THAT great section of Africa known as the Kalahari Desert is one of the interesting geographical problems of the world today. A great deal of thought has been given by the Bechuanaland Government to the possibilities of this area, but a mammalogical, entomological, and botanical survey right through the center of the Kalahari had never been attempted, although the adjoining countries, Angola, Southwest Africa, Northern and Southern Rhodesia, and South Africa, had all been fairly well covered. The accomplishment of such a survey would therefore be of great scientific interest and value. Accordingly during 1929 plans were made in England, America, and South Africa, to organize an expedition for this purpose.

The first necessity in the organization of a serious expedition is to make sure that official help will be forthcoming and the required facilities granted; next, one must get together the personnel necessary to accomplish the best results; and the arrangements for transportation and commissariat must be carefully made.

It was most gratifying to receive, from the first, the unstinted help of His Excellency the Governor-General, Lord Athlone; the Imperial Secretary, Capt. The Hon. B. E. H. Clifford; and Lt.-Col. C. F. Rey, the Resident Commissioner of Bechuanaland, and the success the expedition achieved is largely due to the assistance received from official quarters.

Mr. Herbert Lang, apart from being a scientist of world-wide repute, is, I believe, one of the most able field managers that one could find. In addition to possessing a temperament which enables him to put up with the many difficulties that must necessarily arise on a large and somewhat lengthy expedition. he is an expert in photography and taxidermy, and apart from his own scientific field, mammalogy, he has a vast store of knowledge of the other scientific branches in which

MEMBERS OF THE EXPEDITION AT MOTHEDI PAN
At certain seasons of the year these "pans" are filled with water, forming shallow lakes, which dry up during other seasons

THE STAFF OF THE VERNAY-LANG KALAHARI EXPEDITION
Fourteen white men, all of whom, with the exception of Mr. Lang, are shown here, and sixteen natives made up the personnel of the expedition

GOMODINO PAN

The collectors are shown here at work in the shallow waters of this seasonal lake. Except for a few "pans" there is at present no drainage in the central Kalahari

THE EXPEDITION NEAR GOMODINO PAN

The expedition was equipped with five motor lorries and one touring car. One lorry would break the trail, the others following in its wake

COLLECTORS AT WORK
From the waters of these little "pans" and near them collections of bullfrogs, turtles, and snails were obtained

the expedition was especially interested. In 1925 Mr. Lang and I had been together in Angola on an expedition made for the department of mammals of the American Museum of Natural History, with which Mr. Lang had been connected for twenty-three years. The Angolan expedition was a complete success, and we obtained an important collection of the fauna and flora of the country. Consequently Mr. Lang was approached about another African expedition, and he immediately replied that he would be delighted to join me in this enterprise. Thus the "Vernay-Lang Kalahari Expedition" was formed, and upon Mr. Lang's shoulders fell the greater part of its organization.

To many friends it seemed a somewhat optimistic enterprise to lead a large scientific expedition, consisting of fourteen white men and sixteen natives, through the heart of the Kalahari Desert. The scientific staff was made up of scientists well-known in their particular fields: Mr. Austin Roberts, ornithology; Mr. Vivian Fitz Simons, reptiles; Mr. George Van Son, entomology; all these were members of the staff of the Transvaal Museum, Pretoria. My part of the work was general organization and collecting large mammals.

Captain Clifford, the Imperial Secretary, had made in 1928 a somewhat rapid trip across the Kalahari for the particular purpose of looking over the country and trying to ascertain its possibilities. Owing to many difficulties and to the overheating of his motor-trucks, he had found it necessary to travel chiefly at night. We owe to Captain Clifford a debt of gratitude for having so helped us with our preparations that we were cognisant of the various contingencies with which we would have to contend, and it was Captain Clifford's route across the Kalahari that we decided chiefly to follow.

As for transport, this required careful consideration. The great difficulty of providing an adequate supply of water for the radiators was of paramount importance, for to carry large quantities of water would necessitate using valuable space in the lorries; also, we had to guard as much as possible against punctures, for Captain Clifford had had to handle between twenty and thirty punctures a day, and to deal with punctures so numerous would have interfered considerably with our objective, using up the energies and trying the tempers of all connected with the expedition. We decided, in order to transport the necessary supplies and personnel, to have five 1½ ton lorries, specially equipped, and for rapid transport, when possible, a Dodge Victory Six, from which the interior fittings, such as cushions, etc., had been removed, leaving the bare steel body. Three of the lorries were equipped with wire sides, which could be let down, forming beds; in this way twelve people could be accommodated, six on the wire mattresses, and six on stretchers underneath the wire mattresses. On one lorry we erected a radio receiving set, and on the running boards on the sides of each car we placed two twelve-gallon tanks for water. A tube connected the top of the radiator to the near-side tank, which we used for radiator water, with the result that, although the radiators were boiling nearly the whole time on account of the heavy going through the sand, owing to condensation only two per cent of the water was lost. Consequently, when starting, we had 72 gallons of drinking water, and 72 gallons of radiator water. The tanks were refilled at every opportunity.

The tires we used were heavy, with special "air container" tubes. These proved of inestimable value, for we had only one puncture, and that on the Victory Six.

We knew what to expect so far as the

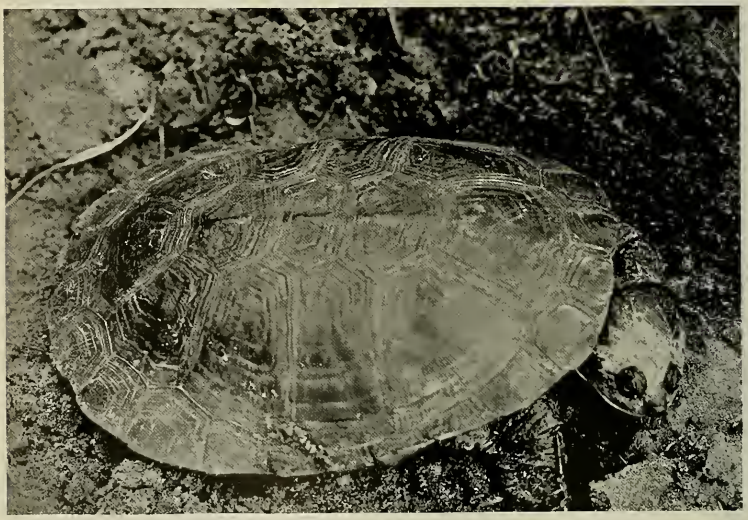
THE KALAHARI DESERT IS ONE OF THE INTERESTING GEOGRAPHICAL PROBLEMS OF THE WORLD TODAY. ITS LOCALITY IS SHOWN ROUGHLY BY THE CROSS-HATCHED SECTION ON THE ADJACENT MAP

A BURROWING SNAKE

This blunt-nosed reptile is here shown thrusting its head from the sand through which it is able to burrow

A TURTLE OF THE KALAHARI

As an indication of the amount of humidity available in the central Kalahari, types generally associated with moist conditions were found

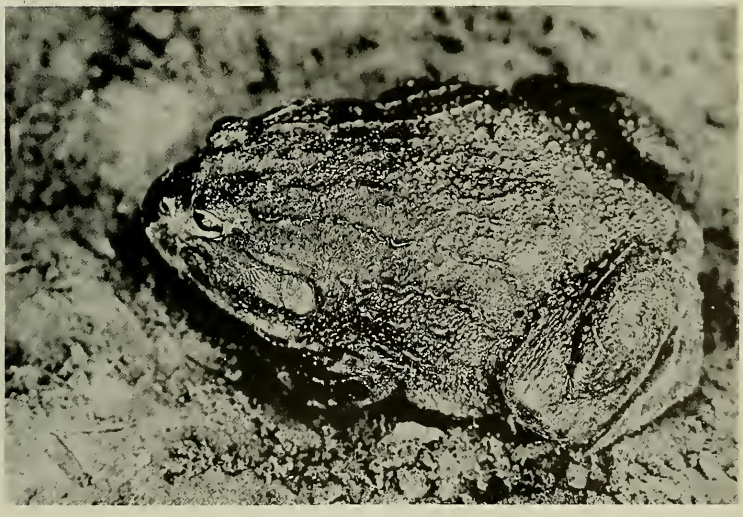


A KALAHARI TOAD
(*BREVICEPS*)

This rotund and short-legged citizen of the Kalahari sand veldt is one of the region's many strange inhabitants

A BULLFROG OF THE KALAHARI

This frog (*Pyxicephalus Adspersus*) despite the aridity of the region, is able to find the necessary water and humidity in which to live

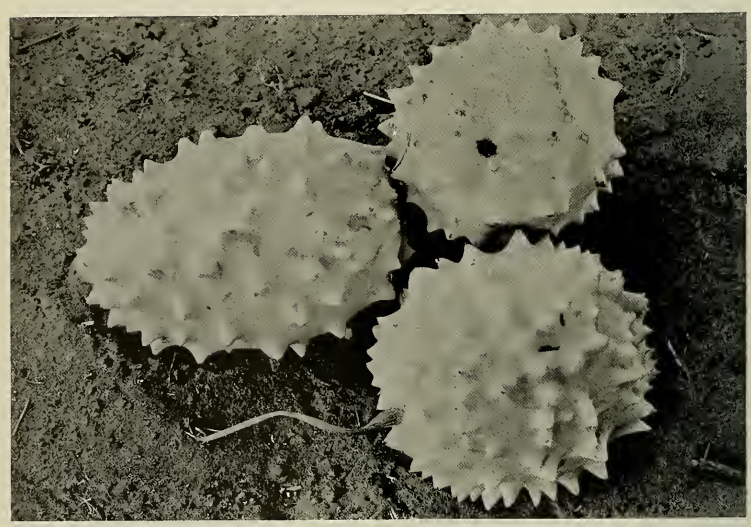


general type of country was concerned,—in fact, the conditions here were practically the same as those in the part of the Kalahari over which Livingstone went. Doctor Livingstone describes the part of the Kalahari which he traversed as follows: "The quantity of grass which grows in this remarkable region is astonishing; even to those who are familiar with India. It usually rises in tufts, with bare places between, or the intervals are occupied by creeping plants, which, having their roots buried far beneath the soil, feel but little effects of the scorching sun." He goes on to describe the various wild plants found in this particular part, but he does not mention such quantities of acacias as we encountered. As far as water was concerned, there were a few pans which still contained a small quantity. These, and one or two rainstorms, were of the greatest assistance.

Our method of traversing this country was for the leading lorry to break spoor (make tracks), the others following. The first lorry made from 2½ to 5 miles an hour, the others from 6 to 8 miles an hour. In one instance only five miles were covered in twelve hours by the leading lorry.

I invited Dr. A. W. Rogers, F.R.S., director of the Union Geological Survey of South Africa, to accompany the expedition, and eventually, on account of the relays which it was necessary for us to make, Doctor Rogers finally crossed the Kalahari three times. Owing to this, he was able to make a very thorough preliminary survey of the geological conditions of the country through which we passed.

Captain Beeching, of the Bechuanaland Protectorate Police, who had been detached from his official duties to assist us during the duration of the expedition, joined us on March 18, 1930. The entire expedition assembled at Gaberones, north



GEMSBOK CUCUMBERS
These form an important food for certain of the antelopes of the Kalahari

CULTIVATED TSAMA MELONS
In the arid Kalahari region such juicy articles of diet as melons are important to the natives. This picture was taken in a garden patch at Gomodino-Makapan

of Mafeking, on the Cape-Rhodesian Railway. Here it was decided to traverse the center of the Kalahari from Gaberones in the east, to Gobabis, the railhead in the Southwest African Mandate, continuing in a northwesterly direction from Ngamiland to the Okavanga swamps at Maun, and to move along north of the Kudumane River to the Chobe and Zambezi rivers, finally emerging at Victoria Falls.

It was a journey full of surprises and contrasts, but our observations may be rapidly summarized. The "Kalahari Desert" is really an arid grass veldt, not a desert. It is inhabited, although sparsely. It is not by any means treeless, and at certain times of the year there is water in the pans.

All of us expected, in vain, to meet real desert conditions in the arid central Kalahari. Sand is predominating, seldom as soft as ashes, but rarely hard enough to carry the truck wheels without a deep spoor. Not only on the surface, but often more than a hundred feet below the surface, there is still the same fine sand. Wells and borings have proved this. In Post-Cretaceous times enormous masses of sand made the Kalahari a howling desert, with probably no plant or animal life. Slowly it became an enormous peneplain. Only a few river beds have been eroded, and now they are nearly effaced, but they are important as representing the vestiges of great pluvial periods, probably in the Pleistocene.

In recent times climatic changes have gradually fostered a dense mantle of vegetation over the real desert of ages past. Today this so-called "Kalahari Desert" is no more a desert in the strictly geographical sense. Nowhere are there any active sand dunes, nor even bare, windswept spaces in the center of the Kalahari, nor do desert conditions exist anywhere in the south or north of the

FLEDGELINGS IN A BUFFALO WEAVER BIRD NEST

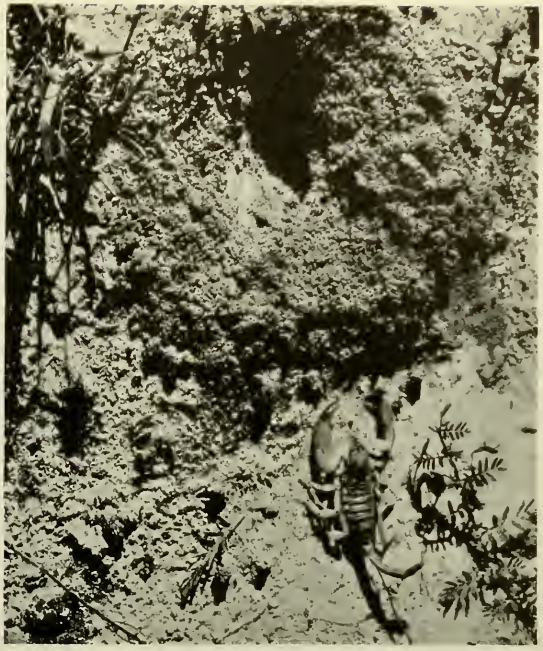
These nests are communal affairs, sometimes of large size. This particular structure measured five feet by three

WEAVER BIRDS' NESTS

Mr. Roberts of the scientific staff is shown examining a group of nests near Gomodino Pan

A SCORPION AND ITS NEST

This picture, taken near Damara Pan, shows freshly excavated material at the half-moon-shaped entrance to a nest of scorpions



A SNAIL FAMILY OF THE KALAHARI

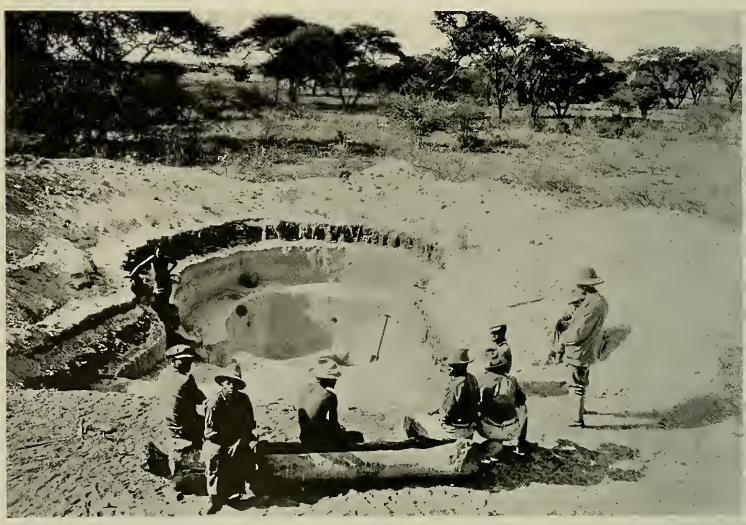
The eighty young of this snail (*Ackatrua*) were born after the parent was collected by the expedition

Kalahari. Far more correctly it may be called the "Kalahari Sand Veldt."

Aridity prevails. The solitude is well-nigh as great as ever. All this territory is subject to the periodical droughts common in subtropical regions. It is forbidden land for settlers hoping for continuous prosperity. The well-borings now carried on by the Bechuanaland Government in certain reasonably accessible places may change this to some extent, but there are good reasons to believe that ranching in the Central Kalahari will always be subject to great vicissitudes.

The relatively small amount of game furnishes a fair criterion. Even if hunted at times by Bushmen and Kalaharis—and there are comparatively few of these natives—there would be many more antelopes in certain areas, where large quantities of Tsama melons and gemsbok cucumbers are present. Probably the reproductive powers of game animals are greatly reduced if at particularly difficult times the creatures can eke out only a meagre existence.

The rainfall and the peculiarities of the sandy surface create interesting conditions for the support of plant life. Except for a few pans, there is at present no drainage in the central Kalahari. Of greatest importance is the fact that all rain is retained where it falls for a considerable period; thus it is kept from rapid evaporation. This rather uniform distribution of humidity reaches only to a certain depth not exceeding a few feet below the surface. Only in this manner can the relatively slight amount of rain support so great a quantity of vegetation. Naturally it is rather uniform over wide stretches. In general the greater looseness of sand fosters bigger trees, denser and more varied vegetation. A much larger percentage of rainfall is thus utilized than under ordinary conditions



A WELL IN THE SAND
This well, dug at Bodiberr, was carried down forty-two feet before water was reached

A SCENE NEAR "LAKE" NGAMI
The enormous seasonal lake called Ngami is fed at certain seasons by this and other flood channels

of drainage, where most rainwater rapidly flows off.

As a further indication of the amount of humidity available in the central Kalahari, I cite types generally associated with moist conditions. Foremost among them are the big south African bullfrog (*Pyxicephalus*); the snub-nosed toad (*Breviceps*); the large land-mollusc (*Achatima*). Specimens of all of these have been secured for the Museum. Remarkable also is the fragile snail *Physa*. It activates under dead stems of trees, and its shells are numerous in many localities. In the pans the common water-turtle is not rare.

Lake Ngami, some two hundred miles southwest of Victoria Falls, offers an interesting problem. On August 1, 1849, Doctor Livingstone, accompanied by his friends, Mr. Oswell and Mr. Murray, discovered "Lake Ngami." The date, August 1, bears out the conclusion that our scientists came to; that this would be the time of flood, when the so-called lake would be at its highest point, and it is quite probable, had Doctor Livingstone gone on to Mababe Flats at that time, he would have found existing the same type of "lake." Lake Ngami is, to all appearances, a lake at certain flood periods. However, as I have said, it offers an interesting problem. One of our scientists called it "a wash-out," and stated it had never been a lake. Only a foot below the surface of the "lake" bottom is to be found the same fine, yellowish-white, wind-blown sand of the desert of Post-Cretaceous times. The present grass-lands pass imperceptibly into those of the "lake" bottom. Nowhere is there a definite or well-defined shore-line, much less a bank. "Lake" Ngami is apparently a depression which is inundated at exceptionally high floods. The old shells are found scattered only in places, but never offer an indication of a shore-line. Dead, relatively fresh, specimens of

fresh-water snails (*Melania*) are common near the southeastern end. During the last few years it has been only partly inundated from time to time.

Oswell and Livingstone, as we have seen, made their discovery when Lake Ngami presented a respectable sheet of water, evidently seen after a heavy flood. The water obviously is always rapidly absorbed and evaporated, and soon the "lake" bottom, chiefly grass-covered, offers the best ranching facilities to the natives. On these same fertile fields they plant their Kaffir-corn, maize, melons, and pumpkins. Local rainfall has only a slight effect in maintaining a few reed-covered patches.

One of our Dodge lorries was the first to cross this Ngami depression near Matlhatlogo from south to north without any difficulty.

Wells sunk by natives reach water here at twenty feet; at Bodiben digging to forty-two feet becomes necessary, and at the southwestern end ninety-five feet. The water in such wells is slightly brackish.

If Lake Ngami were taken as a geographical criterion, thousands of periodically inundated parts would have to be styled "lakes." Already the southwestern end is called "Dautsa Flats." Here are large herds of springbok and also troops of ostriches. "Ngami Flats" is the correct term. The more northern Mababe Flats form also a depression which was flooded in 1925 in the same manner, as Dr. A. du Toit discovered.

A SWARM OF RED-BILLED WEAVERS (*Sanguini rostris latham*) AT GOMODINO PAN

THE LARGEST KNOWN LAND TORTOISE

The Siwalik Hills of Northern India Yield the Complete Shell of a Fossil Tortoise that Weighed a Ton When Alive

By BARNUM BROWN
Curator of Fossil Reptiles, American Museum

LAND tortoises of enormous size are found living today on the Galapagos Islands off the coast of Chili and on several of the small islands near Madagascar off the east coast of Africa—tortoises that weigh up to four hundred, five hundred, six hundred, and even seven hundred pounds, representatives of which are to be seen in many of the great zoölogical parks of the world. They are huge, lumbering, docile creatures that in captivity will follow one around for bananas or lettuce, their favorite foods, and their chief concern is food and warmth. But none of the largest examples of any of the living species, approach in size or weight the enormous giant fossil tortoise recently placed on exhibition in the American Museum of Natural History.

India is justly celebrated for two unique and unusual kinds of fossil animals, both of which are represented in the American Museum collection; a mammal with massive antlers like a moose, named *Sivatherium* (for the Hindu God Siva), and distantly related to the giraffe, and the giant land tortoise (*Colossochelys atlas*).

This giant fossil was collected by the writer in 1923, in the Siwalik Hills of Northern India, and it is the first and only complete shell of its kind known. Previous to the discovery of this specimen, in fact since the early part of the last century, fragments of many specimens have been collected by British officers, or members of the Indian Survey, in the same general locality, and are now deposited in the British Museum, but no complete shell had ever been found.

Dr. Hugh Falconer, a British scientist, first called attention to these extinct giants in 1837, and from fragmentary remains computed the shell to be twelve feet in length over the curve—applying the specific name Atlas in reference to the Hindu tradition.

Our specimen ranks in size with the fragmentary remains in the British Museum, and was probably even larger than the huge fossil sea turtle exhibited in the Yale University Museum, found in the Cretaceous rocks of South Dakota. These two specimens are undoubtedly the record examples of turtle life, and the Indian land tortoise when alive was probably the heavier.

This specimen was discovered during my first few days' work in the Siwalik Hills, but it was broken into pieces no larger than one's hand and scattered over a large area, as it had weathered down with time and the disintegrating rocks—a mute testimony that "dust thou art and unto dust thou shalt return"—there were literally thousands of pieces. At the time I fitted together the border plates, but it was doubtful whether there was sufficient material to form a complete shell.

All pieces were gathered and piled with the expectation of taking them only as a last resort, as in other parts of the world where turtles are numerous one usually finds many complete shells. This, however, did not prove to be the case in India. After a year and a half of exploration in the Upper Siwalik beds, always searching for a more perfect shell, I failed to discover any other as complete,

WHERE THE GIANT FOSSIL WAS COLLECTED
Alternating clays and conglomerates of Pleistocene Age in the Upper Siwalik beds near Chandigarh

and it was necessary to return and collect this individual.

The Siwalik Hills are a fringe of low elevations bordering the plains at the foot of the majestic peaks of the Himalaya Mountains from which they are separated by a narrow valley, and the hills are cut up into long ridges and short, narrow, cañon-like valleys that are impassable to all wheel vehicles. Consequently all fossils were taken out on the backs of mules or camels.

This specimen was carried in one load on the back of a large camel; an unusually heavy burden for a camel, as it weighed not less than 800 pounds, but under the circumstances the load could not be reduced. One of my drivers, who owned a very large beast, protested that his camel could not carry such a load, and it was only through military coercion that he was persuaded to attempt it. After much urging, the load was put on and the camel was helped to rise. With bending knees and stumbling footsteps he began the short but arduous journey down out of the hills—reminding me of many tortoise legends.

There are traditions connected with the cosmogonic speculations of almost all eastern nations having reference to a tortoise of gigantic size associated with their fabulous accounts of the elephant. In the Pythagorean cosmogony the infant world is represented as having been placed on the back of an elephant which was sustained on a huge tortoise.

It is in the Hindu accounts, however, that we find the fable most circumstantially told, and especially in what relates to the second Avatar of Vishnu, when the ocean was churned by means of the mountain Mundar placed on the back of the king of the tortoises, and the serpent Asokee used for the churning rope. Vishnu was made to assume the form of the tortoise and sustain the created world

on his back to make it stable. So completely has this fable been impressed on the faith of the country that many Hindus even today believe the world rests on the back of a tortoise.

Sir William Jones gives the following as a translation from the great lyric poet Jyadeva:

> The earth stands firm on thy immensely broad back which grows larger from the callus occasioned by bearing that vast burden. O Cesava! assuming the body of a tortoise, be victorious! Oh! Hurry, Lord of the Universe!

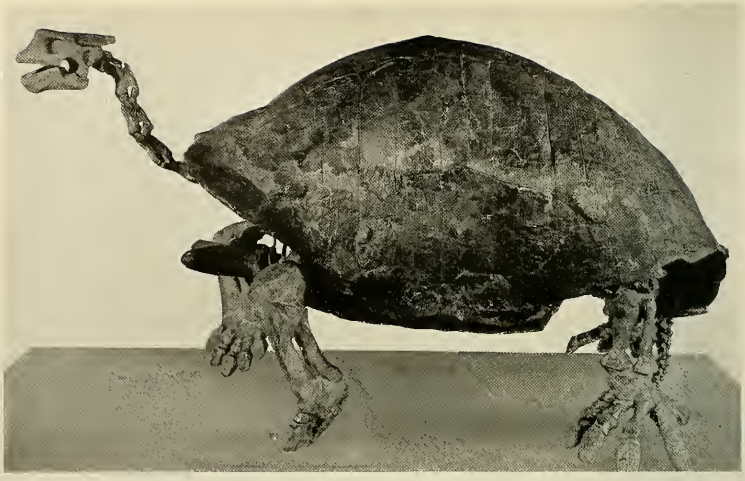
If camels think, ours was no doubt praying for a broader back or a shorter journey that day, for his load came near being the "straw that broke the camel's back," but camel and tortoise finally reached the railway without mishap.

When the specimen reached the American Museum it was spread out on three large tables and it still seemed very doubtful whether there were sufficient pieces to reconstruct the complete shell—with the thousands of pieces it was literally a picture puzzle. One preparator worked on this specimen a year with the frequent assistance of the entire laboratory force, and when all pieces with definite contacts were fitted, the shell was found to be badly distorted. It was again broken and the pieces were refitted in their normal position.

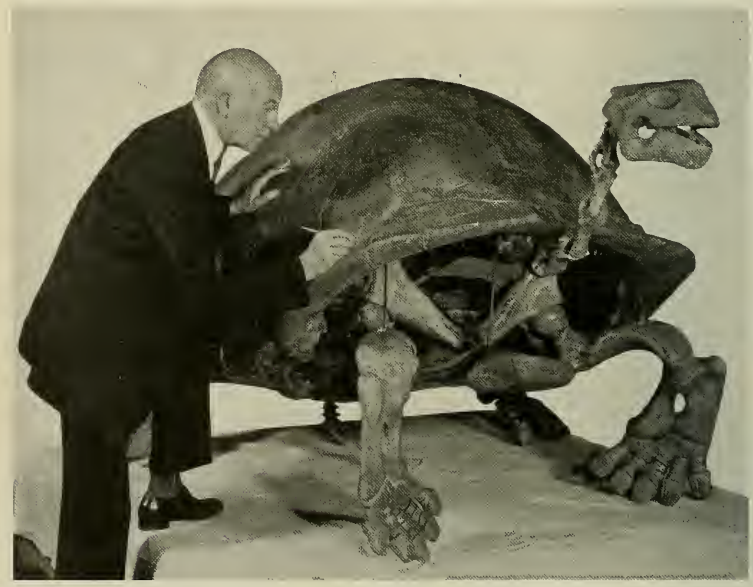
When reconstructed, this tortoise proved to be an old male whose shell is 7 feet 4 inches in length over the curve, 5 feet wide, and 2 feet 11 inches in height —in form resembling more nearly the species of living Galapagos tortoises that inhabit Abingdon Island. In order to compute its weight when alive, an exact model was made to scale and the weight determined by displacement. By this method it was estimated that it weighed

ASSEMBLING THE SPECIMEN IN THE LABORATORY

Mr. Otto Falkenbach is fitting the final sections after the distortion of the shell had been corrected. The limb bones and internal skeleton are on the table—and beneath it is a 200-pound Galapagos tortoise shell



THE MOUNTED SKELETON PRACTICALLY COMPLETE
Missing parts of the plates are shown in lighter colored plaster. The plastron is complete.



FINISHING TOUCHES
Mr. Brown tracing suture lines on the carapace before placing the specimen on exhibition

during life approximately 2100 pounds.

During the last 200,000,000 years of the earth's history since the Triassic period, turtles have existed in some parts of the world, and during all of this very long time they have changed so little that even a child would recognize the earliest known representative as a snapping turtle.

America is the home of the earliest known land tortoises, and, curiously, our Indian fossil resembles his living American cousins more closely than any of the Old World species.

Some of the large living tortoises are known to be very old; one on the Island of Mauritius was specifically mentioned in the treaty when France ceded the Island to Great Britain in 1810. At that time he was thought to be a juvenile of more than a hundred years, but today he lumbers about his restricted domain, stretching out his wrinkled neck in an appeal for lettuce and apparently no less active than he was when Napoleon provided for his future.

Among the larger species of tortoise, size depends on the quantity and quality of food quite as much as on the age of the individual. I hazard a guess that our Indian fossil was three or four hundred years old when he died.

Years are dissipated when we compute the remote period in which Atlas took his cumbersome journey across the Plains of India—at least a million years ago. Restored to form, through the skill and untiring patience of the laboratory staff, this aged, ancient reptile brings to mind the Æsop fable of the "Hare and the Tortoise," for in truth Atlas has won a race, and posterity has the privilege of viewing a masterly finish.

HER FAVORITE STEED IN THE PARK

This 300-pound Galapagos tortoise carries a grown man as easily as he does the young lady. Photograph by courtesy of the New York Zoölogical Society

The King Rail in Its Summer Home

A PHANTOM OF THE MARSHES

A Bird Photographer Observes the Nesting Habits of the Shy King Rail

By ALFRED M. BAILEY
Director, The Chicago Academy of Sciences

Photographs by the Author

IT is springtime. The marshes are clear of ice, and green tips are showing through the brown masses of tules and cattails which have been flattened by the winter's snows; the joyous songs of the redwing blackbirds are heard above the musical voices of many frogs, in sharp contrast to querulous, complaining notes which occasionally come from the dense stands of vegetation.

We know the author of the complaining voices. The rails have arrived from the south,—dropped in to their summer homes during the night, when the full moon lighted them on their way. They make their long treks from their wintering grounds to their nesting places after darkness is over the land; they wait until the sun has dipped below the western horizon, and then rise from their places of refuge and make their way northward on rather slow and awkward wing. Their arrival is unheralded and, except to the few peculiar humans who take pleasure in slopping about the marshes, is unknown, for the rails are of retiring disposition. These birds dwell in uninviting, wet areas, and as they skulk from one stand of vegetation to another, they are rarely seen. But they make their presence known by high-pitched calls, and, if too closely pressed by an invader, they will flutter awkwardly into the air, and with dangling legs, skim above the weeds only to flounder out of sight again. They run rapidly through the grass, however. The tangled web of interlaced vegetation is their natural habitat, and they prefer to wind their way through the tangle rather than to fly.

Spring is a busy season. All the birds of the marshes are interested in their

household cares, and each species searches the region for conditions suited to its liking. For, though the marsh seems all alike to the casual observer, the explorer who slops about, prying into the home affairs of the birds, soon learns where to find the nests of the various species. Early in the season, when new tules have barely thrust their green heads from the brown masses, he finds the homes of several pied-billed grebes in open water; the nests are masses of floating vegetation and the birds cover the eggs with moss and decayed vegetable matter when they leave them. When the grasses have become a little higher, the coots build their bulky platforms, well hidden, and then, still later, the blackbirds and American bitterns build nests among the rank growths.

Now we find conditions suitable for the rails; the various marsh plants are from six to eighteen inches in height; the cover is good, the plants are strong enough to bear the weight of the nest, and high enough to allow for a rise in the surface of the marsh. There are six species of rails in the northern states, and three forms are found commonly,—the sora, Virginia, and king rails. The latter, as the name indicates, is the leader of them all. He is the ruler of his domain, the largest of his tribe. His nesting habits are more or less similar to his smaller relatives, and as he is not an unfriendly fellow, in spite of his complaining voice, let us pry into his housekeeping.

* * * *

On May 29 all was activity in the marsh. The redwings were in full song, and as we walked along the shore a dozen of them hovered overhead, darting down with open beaks, so we involuntarily "ducked" to evade them. The glossy, black plumage of the male, with the red

THE HIDING PLACE AMONG THE WATER PLANTS
The nest was in a dense mat of tangled marsh vegetation. One of the adults settled upon the eggs while the other stood motionless behind the growing screen and eyed the blind intently

GRADUALLY THE BIRD BECAME MORE TAME
When the mother returned to her nest, she paused momentarily to see that all was well. The brown of her plumage blended with the dark background

shoulder chevrons, was in striking contrast to the drab, inconspicuous plumage of the females. But the females of the species were no less aggressive than the gaudy fellows in their determination to drive the invaders from their midst.

Along the muddy shores of the marshes were many small mounds a few inches in height with holes an inch or so in diameter which led to the water below.

"Snake holes!" my little daughter exclaimed as she saw them for the first time; but a near-by carapace of a "crawdad" was pointed out to her and she learned that it was the burrow of a crayfish. Other shells of the crayfish were found and we knew that king rails had been taking toll, for the crayfish is a favorite food.

We waded into the water and examined all the dense clumps of vegetation. The blackbirds were nesting plentifully, and in each well constructed nest of dried grass were four blue eggs which were crossed with an intricate network of brown lines. And then, as we neared a mass of dark green growth, we had a glimpse of a brown creature darting from sight and heard the patter of splashing feet. The grass was parted and we found a surprisingly large nest, considering how well it was concealed, with six large, light-colored, brown-speckled eggs. We examined the nest and eggs without disturbing them, then carefully pushed the water plants in place and left; we had found what we were searching for,—the nest of the king rail, in order that we might make records of the life history of these birds for the film library of the Chicago Academy of Sciences.

We returned to the nest each evening, and gradually the rail became more tame.

SOLICITUDE

She slid upon the nest, with breast feathers parted, and rolled the eggs until they suited her fancy

SEEKING SECLUSION

The vegetation had been tied aside so that a clear view of the nest might be obtained. This did not meet with the bird's approval, and she started pulling the leaves in place

She would delay leaving the nest a little longer each day, until we could occasionally see her crouching, fluffed out with neck outstretched. But she would always dart away when we started to move the surrounding plants. An egg was laid each day until June 3 when the set of eleven was completed. Often, as we examined the nest, the rail would circle about within six feet of us, scolding and scuffing the water with feet and drooping wings, in her efforts to draw us away.

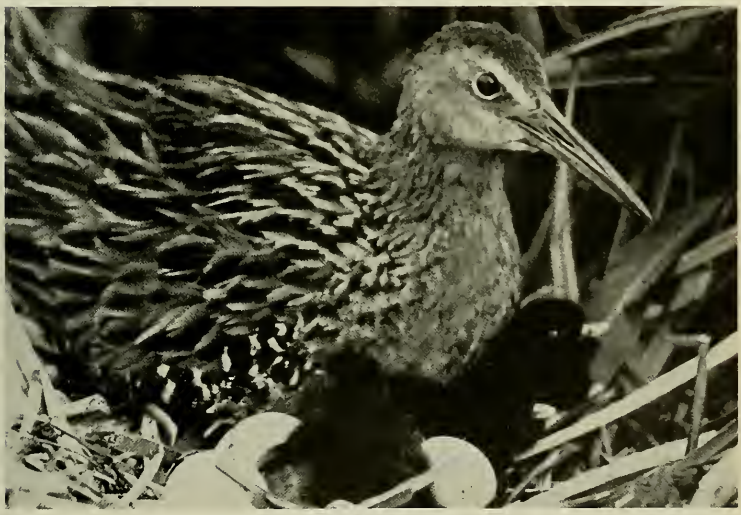
We left the rail undisturbed for a week; then, on a warm afternoon we again invaded the marsh and erected our photographic blind. It was not a pretentious affair, as blinds go, merely a tent of heavy burlap which was placed ten feet from the nest,—a weather-stained cover which was inconspicuous from a distance. We have found, after many experiments, that any blind will do, so far as the bird is concerned, but that if we wish curious-minded passers-by to leave things unmolested, the hiding places must be as inconspicuous as possible. Another week passed before we visited the blind. My little daughter carried camp stools for us to sit upon, and I lugged photographic equipment which pushed me ankle-deep into the mud of the marsh. It was a quiet day and we made a great commotion as we splashed through the water, so we did not obtain a glimpse of the bird; the eggs were warm, however, so we were assured that the bird had not deserted them.

The vegetation was carefully tied aside and a clear view of the nest obtained. The tripod and camera were put in place, the blind was drawn together, and we were prepared to spend a couple of hours in silence while the rail remained away from her nest. But the bird was back in ten minutes. We could see her as she stood beside the nest with one brown eye

THE RAIL WAS AN IDEAL PHOTOGRAPHIC SUBJECT
She would seize a wiry blade of marsh growth and attempt to weave it across the front of the nest

ALL'S WELL

The mother settled over the youngsters and eggs, with wings half spread, and brooded contentedly



A GROWING FAMILY

The small black chicks with ivory-colored beaks, and the unhatched eggs filled the nest. The old one kept one eye on the blind as she crouched beside the young

turned toward the tent; she would stare for minutes at a time, and then, drawing down her head, would move silently through the thick grass to another opening and repeat the performance. After surveying us for half an hour, she concluded that all was well, apparently, for she jumped upon her nest, stopped for a moment to eye the blind, and then settled slowly upon the eggs, with wings half spread over them. I started cranking and the rail paid no attention to the clicking of the movie machine, but instead, attempted to draw back in place the vegetation which had been tied aside. As the bird upon the nest attended to household duties, we heard the mate scolding, and soon he came alongside and carefully preened his waxlike, brown feathers.

We made many trips to the nest during the next two weeks, sometimes to take photographs, and other times merely to make notes. There was little variation in the performance, for after the rail became accustomed to being disturbed, she would return to her eggs within a short time.

At the end of three weeks of incubation, however, the rails were more solicitous, and they complained bitterly when we invaded their stronghold. The reason was evident enough, for we found small, long-legged, black chicks with ivory-colored beaks hatching from the speckled eggs. The young appeared as animated shadows; newly-hatched fellows were kicking feebly, but the older ones were able to run about the nest. We entered the blind quietly without disturbing the young, but the adults darted away swearing heartily. One of them soon returned, however, climbed upon the nest, scolded and cursed, and then settled upon the few remaining eggs. We could hear the mate calling, and a couple of the fuzzy fellows jumped over the side of the nest and paddled lustily through the weeds toward the coaxing parent. We ground out film of the nesting bird with the chicks about her—made portraits to our hearts' desire, and then backed quietly out of the rear of the blind without alarming the little family, and made our way homeward. We could return another day for the canvas shelter.

LIKE ANIMATED SHADOWS
The youngsters were coal black, with long legs, and occasionally one would tumble over the edge of the nest and paddle lustily away

An Ainu Man of Hokkaido

THE MYSTERIOUS NATIVES OF NORTHERN JAPAN

The Disappearing Aniu Who Formerly Inhabited Most of the Japanese Islands and Now Are to Be Found in Limited Numbers Only on the Islands of Hokkaido, Saghalien, and the Vicinity—A Race that may be a Detached Caucasian Remnant, Almost Lost Among the Races of Eastern Asia

By SHOICHI ICHIKAWA

THE land of the Mikado presents many a fascinating problem in the study of anthropology and archæology. The origin of the Japanese is a puzzle in itself, but it is equally puzzling to know why they inhabit the great central group of the Japanese archipelago while the brown headhunters of Formosa (who have recently killed more than a few of their Japanese overlords and have carried many Japanese heads away into the almost inaccessible mountains) live just to the south, and the so-called "hairy" Ainus, who are probably Caucasian in origin, dwell on the islands of Hokkaido (or Yezo) and Saghalien in the north.

As the curtain rises on Japanese history, we find the Ainu—then called "Emishi"—fighting hard against the Japanese, who were busily engaged in pushing northward from the southern island of Japan. This suggests that the Ainu preceded the Japanese in possession of the archipelago—or of most of it—and that the Japanese, coming later, were able, in the course of time, to drive the Ainu farther and farther to the north, until the remnants of a once much more numerous people now find themselves limited to the small areas which they occupy at the present time.

Again, the Ainu are sometimes said to have been allied with a tribe called "Kunitsukami," who are now regarded by archæologists as being of the same stock as the Japanese and who inhabited Japan in middle or late Neolithic times.

These Kunitsukami, who may once have fought against the Ainu too, were probably living alongside them at that time. Since that time, however, the Ainu have lost their hold on most of the territory they once inhabited, and are to be found today only on Hokkaido, on Saghalien, and on a few of the smaller islands in the vicinity of these two. Furthermore, even where they are still to be found, their numbers are small. Most of them are on Hokkaido, where they are principally confined to the province of Hitaka. Here they number about 16,000, while, according to the census of 1925, about 1500 more live in the southern part of the island of Saghalien, and a few hundred more are to be found on the Kurile Islands. By natural amalgamation these numbers are growing smaller. Furthermore, being low in the scale of humanity, the Ainu retain many of their barbarous customs, some of which are harmful to themselves, though the Japanese government is doing what it can among them educationally.

The visitor among the Ainu is instantly conscious of the light color of their skin, their deep-set eyes, high-bridged noses, fine beards, wavy hair, and full-chested, thick-set bodies. They were once regarded as one of the most hairy of existing people, but investigation has shown

THE PACIFIC ISLANDS IN THEIR RELATION TO THE AINU

The portions of the Japanese Islands shown in black are approximately those in which the Jyomon type of pottery has been found. From this distribution of a product of the early Ainus some idea of the former occupation of the islands by this people can be determined

A TYPICAL AINU HOUSE ON THE ISLAND OF HOKKAIDO

These houses, small and crude as they are, are nevertheless built to withstand a rigorous climate. The house is merely a framework covered with reeds. On the islands of Saghalien and in parts of Hokkaido a different form is sometimes used, that is hardly more than a "dugout," or a pit, roofed with poles and covered with earth

that the Saghalien Ainu is not much more hairy than the Hokkaido Ainu, among whom many individuals are no more hairy than the average European. The present Ainu, of course, are not uniformly pure in type, for in the course of time they have mixed not only with the Japanese but with other near-by peoples as well.

Japan has an old record that tells of the Orokko, from northern Saghalien or Siberia, and the Aleuts from the Aleutian Islands, coming down to Hokkaido and the Kurile Islands where they came in contact with the Ainu during the Tokugawa period (1603 to 1867 A. D.). In the folk lore of the Hokkaido Ainu also we find stories of contact with other races. This history and folk lore, while it gives us little or no positive evidence of racial intermixture, suggests it as a probability. Furthermore, the Ainu who live on the island of Saghalien, while they are obviously and closely related to those who dwell on Hokkaido, are nevertheless quite different in appearance as well as in head form, which presents still further evidence of the infusion of alien blood.

The present Ainu are neither nomadic nor agricultural. They live in villages and are mainly engaged in fishing and hunting. Fish, marine animals, and wild animals of the land constitute their staple food, which is seasoned with rice, sweet potatoes and a limited few other vegetable dishes.

The typical Ainu house of the present day is a rectangular structure that is usually entered through a low passageway with a gable roof. The framework of such a house is made of rough beams, sturdily set up and thatched with reeds, which form not only the roof but the walls as well. In order to hold the reed thatch in place, numerous poles are lashed down over them, with the result that these poles become what is probably the most obvious architectural detail of most typical Ainu structures.

There is a small opening just below the

AN AINU MOTHER AND HER CHILD

The costume worn by this woman is made of cotton cloth that has been imported. The native cloth is made of the inner bark of the elm tree

TWO ELDERLY AINU WOMEN

These people are usually unkempt. They rarely bathe, and pay but the slightest attention to the orderliness of their hair or their costumes

MAKING BAGS OF MATTING

The arts of the Ainu are few. Even their earlier ability to make pottery seems to have been lost. They are, essentially, hunters and fishermen

AN AINU BEAUTY

The outstanding feature of the ornamentation of the women is the tattooed decoration about the mouth. The design about this girl's mouth is typical. Tattooing is also used on the arms, hands, and foreheads of the women

JYOMON POTTERY

The commonest of the designs of this prehistoric pottery are made up of free and easy curves. Though this early pottery is often very beautiful, the Ainu of today do not make anything similar

houses, without bathing or washing, the Ainu naturally present a most unkempt appearance. Their hair and beards are permitted to grow to full length without ever being combed or brushed, and it is obvious that they are both ignorant and superstitious. Yet, despite all this, they do not present a savage or a barbarous appearance. Their manners are gentle. Their voices are soft and rather pleasing, and if only they could be prevailed upon to bathe, to comb their hair, and to put on clean clothes, they would present a fine appearance.

apex of the roof in front, through which the smoke is supposed to make its escape. To prevent the wind and rain from entering this hole too readily a sort of chimney is built in front of the opening. Naturally, in such a house, soot, in the course of time, covers everything.

The floor of the entrance passage is of packed earth, but the floor of the house itself is made of boards, raised a few inches above the ground, but covered with accumulations of dirt. The fireplace, which is located about the middle of the floor, is a rectangular depression filled with ashes, and here the fire is kept burning. The fire smokes constantly, and the smoky, sooty, dirty interiors are usually gloomy in the extreme. The only light from the outside, save what little enters through the outlet for the smoke, comes through a rectangular window at the back of the house. The beams and rafters, the latticed shelf that usually hangs well above the fire, and almost everything else that is kept permanently within the structure is covered with layer upon layer of soot.

Living, as they do, in these dingy, sooty

The style of clothing worn by these people may have been adopted from the Japanese, but the ornamental designs used on their costumes are probably their

A JYOMON VASE

From the northern part of Japan where most such finds are made

own, and seem to have come down from remote times. In recent years manufactured textiles have come into use among them, but formerly their clothes, when they were made of textiles, were woven of a fiber obtained from the inner bark of the elm tree. In the winters, which, in Hokkaido and Saghalien, are apt to be severe, they tend to wear clothes made of the skins of animals.

JYOMON POTTERY

Such bits of pottery as are illustrated on these pages are found throughout most of Japan, while no related types have ever been found by archaeologists on the adjacent continental mainland

Although tattooing may in general be considered a southern practise, it is in common use among the Ainu women. About the mouth tattooed designs commonly appear, and various patterns are to be found tattooed on the backs of their hands and on their arms. Less often, tattooed designs appear on feminine foreheads. These attempts at beautification or decoration, however, do not prevent the women from doing almost slavish household drudgery.

A JYOMON BOTTLE

The farther one goes south in Japan, the fewer of these early Ainu pots one finds

The language is simple and harmonious, but aside from some words obviously borrowed from the tongues of near-by peoples, it stands entirely isolated. They have no written language, with the result that their folk lore and their religious beliefs are handed down entirely by word of mouth.

They are polytheistic worshippers of Nature, and practise certain shamanistic rites. The bear festival is one of their outstanding religious celebrations. In its ritual a grown bear cub that has been kept in captivity and carefully nursed is killed and served at their feasts. Another custom that seems strange to the outsider is the use of "Inao" as an offering to the gods. In this rite a willow stick is accurately whittled with a sharp knife until it has a considerable cluster of long, slender shavings adhering to it. Its exact meaning seems to be lost even to the Ainu

A STRANGE POT FORM
No satisfactory explanation has yet been offered for the uses to which these oddly shaped pots were put

strangely fascinating people, but it is even more interesting and important to attempt to trace their origin. Facts, however, concerning their origin are for the most part lacking, and we consequently are forced to fall back upon the hypotheses offered by many of the noted authorities who have given their attention to this baffling problem. So numerous are these hypotheses, and so conflicting, that it is easy to understand how difficult it is to determine accurately the prehistory of this relic of a very old human stock.

The following are some of the principal views held by authorities outside of Japan:

1. That the Ainu are Semitic in origin.
2. That they are of the same origin as the Indo-Europeans.
3. That they resemble the American Indian.
4. That they are peculiar to themselves, and that their original habitat was Sumatra, the Philippines, and their vicinities.

themselves, but it is regarded by them in the most sacred possible light. These two customs, however, are not confined to the Ainu alone. Both the Giliak and the Orokko of Saghalien Island do the same.

A favorite drink among the Ainu is "sake," a fermented Japanese beverage, and they are especially free with its use during the bear festival. This potent beverage brought about much degeneration among the Ainu in the past, just as whiskey formerly did among the American Indians.

One might continue through many pages to discuss the ethnology of these

AN AINU CUP AND A MUSTACHE STICK
The carved stick lying across the top of this cup serves much the same purpose as did the "mustache cup" of forty years ago in America. With the stick the male user of this cup held his flowing mustache away from the liquid he was drinking

5. That they are Caucasian in type and resemble the Russians.

6. That they are Caucasian in type and are affiliated with the Kubu in Sumatra and the Toda in India.

7. That they resemble the Tungus of the Amur River Valley.

8. That they belong to an original Asiatic race and were driven to the Japanese islands by Mongol tribes.

9. That they belong to the old Proto-Nordic race that was once widely spread over Asia, and are akin to the modern Scandinavians.

10. That they are allied to the Giliaks of the Ainus River region.

11. That they are affiliated with the Negritos of the Philippines.

12. That there is a possible relationship with the pre-Dravidian tribe of India, or even with the natives of Australia.

With all these hypotheses from which to choose it might seem possible to satisfy almost anyone, but only in recent years have Japanese archæologists been adding to the information concerning these detached people. Now, however, many prehistoric remains have been uncovered telling something of the Ainu, and these remains are being found not only in the islands of Japan, but also in Korea and Manchuria. It is true that as yet no Palæolithic remains have been located, but the recent discovery of the "Peking Man" has encouraged the archæologists who are working in these portions of the world, for this location is not far from Japan. Thus many of the Japanese archæologists who are working in this field, basing their investigations on the theory that Japan was connected with Asia during the Tertiary Period, believe that it is possible that Japan was then a part of the same land mass of which Java was a part. Thus the land in which *Pithecanthropus erectus* was found may have borne much the same relation to Asia as did a part of the land that is now the archipelago of Japan, and that possibility opens up still others fascinating to those who are interested in the study of early man.

AN INAO

These strangely carved bits of wood, with the flowing tassels of shavings still adhering to the parent stick, have an important religious significance, and are considered by the Ainu as offerings to their gods. They are often called "god sticks," and seem to have some symbolic uses almost as if the sticks themselves represented the god or gods

All this, however, still remains entirely within the realm of theory. However, Neolithic remains are numerous in Japan, and have been found in many places. Among these, the stone implements are noteworthy, both as to variety and workmanship, probably ranking next to the early Egyptian work. The pottery, on the other hand, is of two different types which Japanese archæologists have named the "Yayoi" and the "Jyomon" types.

The Yayoi type of pottery is plain, and is obviously made with the aid of the potter's wheel. This is supposed to be the work of early Japanese and is found almost everywhere, from Saghalien, in the

A GROUP OF HOKKAIDO AINU

These people have often been called "Hairy Ainu," but they are no more hirsute than many Caucasians. The group shown here has been somewhat influenced by the Japanese, as is demonstrated by the Japanese character of the kimonos and wooden clogs of the two children

north, to the Riukiu Islands, which lie near Formosa, in the south. Furthermore, pottery of somewhat the same type is found in Korea, in a part of Manchuria, and along the eastern coast of Siberia, which evidence, in the minds of Doctor Torii and Doctor Hamada, two of Japan's leading archæologists, suggests the probability that these ancient pottery makers were all racially affiliated.

The Jyomon type of pottery, on the other hand, is very ornate, and is probably next to the older American Indian work in its excellent technique. Furthermore, it was made without a wheel, and there is little doubt that the makers of this type of pottery were not ancestral Japanese.

A hypothesis originally propounded by the late Doctor Tsuboi, was to the effect that a race called the "Koropokkuru" settled in Japan prior to the coming of the ancestral Ainu. Now, however, this hypothesis has been almost entirely discarded, and the "Koropokkuru" are regarded as the ancestral Ainu themselves. Furthermore, Doctor Torii attributes the Jyomon pottery to these early Ainu, and both Dr. Waldemar Jochelson and Doctor Koganei agree with this view.

It is only in the northern part of Japan, however, that this ornate pottery is commonly found. As one goes south, one finds its distribution growing thinner and thinner. Furthermore, in Korea, Manchuria, and other parts of the continent of Asia it is utterly unknown. Only in certain prehistoric shell mounds in New Guinea has any similar pottery been found, and even this has not yet been proved to be the same work. It may be that the resemblance is accidental, and that the makers of this New Guinea pottery will ultimately be proved to be entirely separate from the Ainu.

The latest hypothesis to be advanced in reference to the origin of the Ainu is the one offered by Doctor Kiyono of

Japan. After having made a thorough study of many hundreds of the skeletons of the makers of this Jyomon pottery, he contends that these people are not closely related either to the present Japanese or the present Ainu, but that they resemble both these races, and show, as well, certain great differences.

Recent studies of the blood of the Ainu suggests a relationship with Europeans. Finger print studies, too, show that the Ainu tend to have the "loop type" finger markings, and this, also, is a physical characteristic of the European peoples. Moreover, the cross section of the hair of the Ainu shows an oval form, and this prevails among the peoples of Europe. From these facts it seems logical to reason that the Ainu, long resident of the Japanese islands though they have been, and surrounded though they are by peoples of another race, are actually related to the race that dwells in Europe. It is a strange fact that the Lapps, who are representatives of an old Asiatic stock, should be found today only in the extreme northwestern corner of Europe, surrounded by peoples of another race, while the Ainu, in type European, are living in isolation, so far as their racial relatives are concerned, on a few of the islands of Japan.

In presenting all this information and these hypotheses, it is obvious that we are presenting still more puzzles. What extraordinary migrations could have taken place to separate Asiatic folk from their kin and leave them in Europe while

AN AINU AND HIS WIFE

The Ainu, who are now to be found in Hokkaido, Saghalien, and the Kurile Islands, are only a remnant of a once more powerful race. Slowly civilization is making itself felt, as is shown by the axe that leans against the reed wall of this Ainu house. Schools, too, that have been set up by the Japanese among these people are gradually changing their simple habits, and the time seems near when the Ainu will merge with the people who surround them and more or less disappear as a distinct people

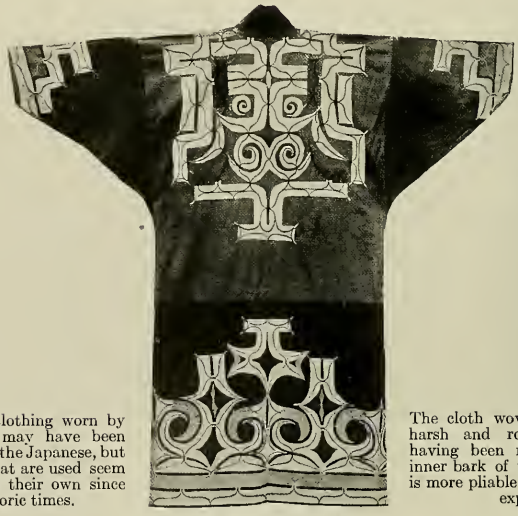
European folk, equally separated from their relatives, linger on in the archipelago off the coast of Asia?

And while we are puzzling, the Ainu are gradually disappearing. Only within a comparatively short time have they been studied at all, but now, before their complete disappearance, why not study them more thoroughly? Why not keep permanent records—motion pictures—written observations?

Geographically, of course, Japan is placed in Asia, but a glance at the accompanying map will show clearly that the Japanese islands are in reality a part of that long chain of Pacific islands which form so vast a semicircle with Hawaii as a center—a semicircle beginning with the Aleutian Islands off the coast of the Alaskan Peninsula, and continuing through Saghalien, Japan, Formosa, the Philippines, the East Indies and the islands of Oceania, and ending finally with Easter Island off the coast of South America. That movements of peoples have followed these islands we know positively, but how much these movements have affected the races now inhabiting them is still largely unknown. That Japan has been affected racially and culturally by influences from both the north and the south we have good reason to believe, but many questions remain still to be answered.

The late Prof. Edward S. Morse began the study of archæology in Japan in 1878, and Japan has honored this American scientist by erecting a monument to him near Tokio. He it was who was the pioneer in the field of modern scientific Japanese archæology. At present, however, few Americans are interested in the study that he began.

Why should not their attention be attracted in this direction? Certainly both the Japanese and the Chinese would welcome their coöperation.



The style of clothing worn by these people may have been adopted from the Japanese, but the designs that are used seem to have been their own since prehistoric times.

The cloth woven by them is harsh and rough, although, having been made from the inner bark of the elm tree, it is more pliable than one might expect

AN AINU COSTUME

Photograph by Frederick P. Browne

An Arawa Plantation

TRAILS AND TRIBULATIONS OF BOUGAINVILLE

Bird Collecting Adventures on the Mountain Slopes of a South Sea Island

The trip into the mountains of Bougainville was an incident of the Whitney South Sea Expedition. This project was financed by the late Harry Payne Whitney, Esq., and has been continued for the present by his estate. After nine years under the field command of Mr. Rollo H. Beck, the work was carried on by the late Dr. Frederick P. Browne, and Messrs. Hannibal Hamlin and William F. Coulter. The visit to Bougainville was made by Doctor Browne, Mr. Hamlin, and Mr. Richards, the author of the following article.—The Editors.

By GUY RICHARDS

"Isles Solomon dont l'existence
et la position sont douteuse."
Narrative of de Bougainville.

IN JUNE, 1768, Louis Antoine de Bougainville, French navigator and adventurer and captain of "La Bondeuse" and "L'Etoile," cruised northward along the coast of an island lying between 5° and 7° south of the equator and 154° and 156° east of Greenwich. French, British, and Spanish seamen for two centuries had broken their hearts attempting to make this short sail, which could not have taken de Bougainville more than three days. Mendana, who sought to rediscover what he had stumbled upon twenty-seven years before, died in 1595 a few hundred miles from his goal. And the fortune of others after him had been no better.

On December 18, 1927, the schooner "France" of the Whitney South Sea Expedition, coughing four knots an hour through a flat calm, rounded Punanapa Head and came to anchor in Kieta Harbor. Although a hundred and sixty odd years had passed by, it is doubtful if de Bougainville's maneuvers and the maneuvers of the "France" appeared much different to the natives of Mawara Bay. The hulls of the ships were of a different color and the rigs were of a different plan, but the men on board were white men, and all white men were crazy, and only Heaven knew what would be stirring now!

The harbor of Kieta is a wistful harbor. On the west the half-moon of Bougainville's coast with the District Officer's residence, the store of Messrs. Ebery and Walsh, and the four stores of the Chinamen, all widely separated along the Old German Road, face outward toward the sea. Around the point a still farther semicircular curve of the road leads to the

residence of the doctor and the outbuildings of the hospital. Dominating all the other buildings of the port are the masts of the House Wireless at the summit of a ridge in the cocoanuts; and beneath them are the red-roofed civil dormitories.

The great mountains of Bougainville, continually immersed in clouds, rise so abruptly from the sea, that the harbor of Kieta, which, with its buildings and its Old German Road, is a considerable one for this part of the world, remains always an incident in its own panorama.

As an island port Kieta has a certain insincerity about it. It is a village that was begun by one nation and finished by another. And although it is a long time since the termination of the war, and the improvements and progressions of the Australians are everywhere in evidence, the Old German Road still remains the most eminent landmark on the shore.

The Australians have had possession of Bougainville for a decade, and it is still the enigma it was when the Germans abdicated. There is an area of, roughly, 350 square miles which no white man has ever entered, and about which nothing at all is known. The interior of the island has not yet been even superficially surveyed, and aside from the knowledge that in the unknown area columns of smoke have occasionally been seen from the distant mountain ridges, no information is available.

Mr. Samson, a patrol officer whom we met in Kieta while he was recovering from a spear wound gave us some valuable information anent the back country, Kanaka. From his advice and from the advice of Major McAdams, the District Officer, we completed plans for our expedition. On Monday morning we weighed anchor from Kieta and set out for Arawa Plantation. Four hours later Frederick P. Drowne, Hannibal Hamlin, and I bade farewell to the "France" and dumped on the shores of Bougainville three shotguns, a case of mutton, a case of assorted meat, forty tins of beans, twenty

Photograph by Hannibal Hamlin

THE EXPEDITION MOVES

Whirl is king and confusion reigns when the expedition gets under way in the morning. Everybody talks at once, every carrier personally takes charge of every other carrier, and pretty soon, with all boxes lashed, the expedition moves

tins of jam, eighty tins of sardines, twenty tins of salmon, a side of bacon, a lantern, kerosene, six axes, two cases of trade tobacco, two bolts of calico, two cases of ammunition, duffle bags of clothing, corn meal, cotton, twine, scalpels, photographic material, arsenic, alum, oil, cotton, blankets, hunting coats, a case of canned fruit, a gross of butter, flour, salt, sugar, tea, cocoa, corn, and ship's biscuits.

Doctor Browne, accompanied by a member of the community of Kino, set out at an early hour next morning to stir up the carriers from Kupei, while Hamlin and I remained behind to repack the boxes. At noon-time the carriers, in the midst of a heavy rainstorm, appeared with a note from Doctor Browne, and after a few minutes the parade took to the trails.

The trail from Kino is scarcely wider than one's foot, and as it had been raining, it was nothing more than a steep mud trough. The manner in which the carriers climbed was nothing short of miraculous. Hamlin and I, with nothing at all to carry had all we could do to make any headway. The beauty of the country increased with the trail. We passed several heavy waterfalls, dank and eerie-looking places, and three dim grottos, where the thick foliage, steep cliffs, and moss-covered rock combined mysteriously.

Just before sunset we arrived at the "House belong Kiap" in Kupei and found Doctor Browne in sound diplomatic standing with the native dignitaries. He was bartering tobacco, calico, and salt for taro, bananas, poi poi, and spears. He was very cold and wet and seemed glad to see his belongings on the backs of the carriers.

Photograph by Hannibal Hamlin

"WHERE ALPH, THE SACRED RIVER RAN"

All the poetry of earth is wrapped up in these mountain rivers. A curious overtone of sounds seem to echo from the rocks. A kingfisher will flit past and a tree-frog occasionally lend his voice from the jungle

Our camp was, even at first glance, one of the most beautiful places I have ever seen. It stood on a knoll at an elevation of 2200 feet, overlooking the whole of the great Arawa Valley. Immediately behind it the mountains rose to 5250 feet. It appeared at first, as it proved later, to be the *summum bonum* of a bird collector's jumping-off place.

Our cook-boy, Bakki, stirred up a more than adequate supper of tinned mutton and fresh fried tomatoes, the latter of which to the quantity of one leaf basket, were purchased in Kino for a stick of tobacco.

Hamlin and I had arranged a schedule to mount the trail on alternate days, so on New Year's Day, he and Doctor

Drowne stayed in camp to write up their notes, while I set out up the mountain.

Ona, the son of the chief or "kukurai" and Cumbai, a bushman of Kupei, went with me. When we had climbed as high as 5000 feet, the fog and cold sleet set in upon us and never let up until late in the afternoon. There is a spot on the trail at 4300 feet where a landslide has cleared away the bush, leaving, on clear days, a superb view over the adjoining mountains, the Arawa Valley, and out to sea. Slightly up and to the left, the clouds and omnipresent fogs and mists pour through a gulch in the range and water the green valley beneath. Far out to sea the great barrier reef, its white spume assuming the shape of a diamond brooch, can be seen cutting the blue monotony of the horizon; and nearer, here and there, trails of blue smoke rise from the scattered native villages.

An accurate description of these lofty places, whose nature is at such variance with the common tropical appearance of the sea-level country, is difficult. Because Bougainville is a tropical island with a coast temperature always uncomfortable and sometimes almost unbearable, it seems strange to experience on the same island the climate of Cape Cod on a cool autumn day. From 4500 feet up, the tree and plant life, because it is continually enshrouded in fog, has all the clinging mossy coverings of marine flora. This point appears to be the dividing line between high altitudes and low altitudes on the island. Higher than this all the forest becomes dank and dripping, pools of water and mud appear upon the trail, and the whole aspect of nature changes as completely as if one were entering another world.

Although most of the terrain bordering the trail declines in a precipitous slope, there are ravines and gulches which, with their impenetrable plant growth, their fallen and decaying trees, their fog, and their great quiescence, resemble the nightmare haunts of some demon. In this region one's voice takes on a hushed and almost useless tone, and the voices of others seem as powerless as if they were trying to speak under the sea. Here it is nowhere possible to see over the forest, for in the one or two open places that can be found on the three miles of trail the white battlement of fog obscures everything.

Photograph by Hannibal Hamlin

ONA

Ona, pictured here with two poi poi, acted as the writer's personal servant. Compensation: a stick of tobacco a day

The birds, on account of the ubiquitous fog in these high places, are difficult to see and to shoot. They sing very little, and their figures, outlined against the fog in the vague and indefinable trees and bushes, are hard to orient for aiming, and, in case the aim and the shot are successful, still harder to retrieve. The natives, however, prove invaluable for recovering them.

The day's work brought in one thrush, one redbreast, some graybirds, and some flycatchers. The climb up and back makes a day's work by itself, and it was with great satisfaction and comfort that I returned to the less chilly altitudes of our camp and found good food, dry clothing, and a warm blanket under a rainless roof.

By this time the camp was becoming better organized and more efficient. In consideration of the vast evil influence that the two lazy cook-boys wielded over the two unadulterated cook-boys, the former had been discharged, and since their departure a great change took place. Bakki and Kokeri, the two who remained, now had the fire going in the cook-house before sunrise. Coffee was made at six and breakfast followed at half past. Our diet for breakfast was made up of rice and scones. The rice was excellent served with condensed milk and water; and the freshly-baked scones made with self-raising flour were unforgettable.

The cook-boys had learned to keep the camp clean. This was a considerable accomplishment inasmuch as it required a direct conquest of the most highly fortified trait in the native character.

The Bougainville Kanaka, or bushman, is a fairly imposing figure when he is at work in his own surroundings. Carrying heavy loads, cutting his way through the thick bush, ferreting out firewood, are occupations which he acquits so skillfully that their performance lends him a certain grandeur.

Photograph by Hannibal Hamlin

BALBI'S CRATER

Balbi, the highest mountain in Bougainville, was first (and never since) climbed by Hannibal Hamlin, leader of the Whitney South Sea Expedition, 1928–30. Its conquest is generally considered the finest achievement since Monceton's ascent of Mt. Albert Edward, British New Guinea, May, 1903. It is an active volcano about 9500 feet high

Squatting around a fire, however, with the fragment of a clay pipe stuck in his mouth, or singing through the rainy hours with his weird invariable chant, he takes on a different form. One becomes divided between awe and disgust in judging him, and the correct opinion of him, changing as it always must with circumstances and individuals, will probably never be submitted.

The women, or "marys," occupy a very low position. They are ugly, fat, and strike me as being almost incredibly unintelligent. They have short curly hair like that of their youngest children whom they carry on their backs straddle-legged fashion. They wear lava lavas, or loin cloths, and their figures are enlarged around the waist from the weight of the loads they are forced to carry up and down the steep trails. Save for a rare necklace or bracelet that their husbands have brought to them from elsewhere, they possess no ornamentation and wear none on the ordinary routine days of their lives.

As much as possible they keep together. They move in and out of the village to the taro gardens in one herd, like cattle of an identical and self-conscious strain.

Conversation and social intercourse between the two sexes is limited to monosyllables. A group of male natives, such as the group in our cook-house, will bring an animated conversation to a complete silence when a mary appears to sell her basket of taro, and will observe it until she departs. The mary, on such an occasion, inevitably performs some silly and embarrassed contretemps, and shifts and filigrees around like a child of two.

It would not be correct to say that all the work is left to the women. The men stir about considerably themselves. But they are free and independently spirited and their exits and their entrances, their tasks and their excursions, are timed to suit themselves. And when a mary sells anything, her husband takes the calico or tobacco and gives it, or part of it, to her if he chooses.

For all the wretchedness and squalor of the people of the village they are not wretched-spirited people. The struggle for existence is forever obvious, and the skulking lean-ribbed dogs that sniff hungrily around under the poles of the huts bear witness that there is little time for writing poetry or for a-strumming on the lyre. Under the circumstances it is surprising how many smiles the men have for one another, and how many giggles the women pour out over the trails as they start for the taro gardens in the morning.

Severe rains, which come up here simultaneously with the waning of the moon now began falling and lasted a whole week. The rain clouds poured through the gap in the ridge up above us and swooped down the valley under the force of a very high, gusty wind. Each rain squall was a storm in itself, and the trees on the ridges were shaken all over each other. Several of them, with a report like that of a giant cannon, fell over and careened into the bush on the side of the mountain.

The climate during the storms remained cold, like late October days in

Photograph by Hannibal Hamlin

A NATIVE HOUSE

Some of these abodes are beautifully built. The eagle-eyed native dogs keep the ground clean beneath them, and the family gear can be seen hanging above. This includes some taro, some baskets, and the jawbones of approximately fifteen pigs—trophies not of the hunt but of the stomach

New England. It seemed preposterous to look far down the valley to the coast and know that around the nose of the nearest northern peninsula was the hottest place in the world, with the exception of one famous little harbor on the Persian Gulf.

At night the clouds would clear away and there would follow the cold crystal atmosphere of New England in autumn. We were thankful for all our blankets, overcoats, shooting-coats, and everything we could pile on. The change was a blessing and I, for one, looked forward with melancholy circumspection to the time when we would have to return to the coast.

Each day disclosed an added natural endowment of the camp. One of the large tumbling mountain rivers which began its journey to the coast through the ravine below us, seemed to possess many of the stage properties of Alph, the sacred river of Kubla Khan. There were ancient logs, profound pools, and many veteran rocks from which frogs addressed their river-audiences. The river's roar was diminished to a whirr at the distance of the camp, but the river itself was within easy climbing-down distance, and a pilgrimage to it for some of its clean bubbles and much of its philosophy was a cherished item in the day's routine.

The clouds on the mountain were in themselves eternally engaging. Some would rise up slowly from the dank ravines to join the more lofty ones and become twisted into all manner of patterns and veils. When the weather was stormy, these smaller ones would be swallowed up in the fierce black manes of the long-distance fellows, and the entire package would fly on northward to the sea. There would be idle moments of the day when all the tussle of the winds and elements were in armistice. It was then that the caw of the native crow would expand its international illusion. With the rareness of the sky and air, one could believe, were he an American and were he to close his eyes, that he was near the Hudson and that he was dreaming through a day of early autumn.

All this, when it was possible to look down at sunset through the clouds on the thin delta of Arawa Plantation, and know that far over there Esson's native laborers were spread out under the palms hoping to catch one cool evening's breath of air.

On January 12, the storms were still continuing. Many trees had been blown over the trail and it was now necessary to make a series of detours into the bush and back on the trail again.

But the trail itself, is, I suppose, nothing more than the history of detours, and stood, when we first saw it, only as the most recent of an evolution of changes destined to continue as long as the black man of the forest trudges, scrambles, and cuts his journey to the coast. Indeed, a trail such as this has an analogy to the history of the people whose footsteps preserve it. At its best, the well-traveled conclusion of many many years, it is still a shadow line in the green confusion of the forest, altered when a little earth slides from the ridge, when a puff of wind conquers a too old tree, or when a bowlder slips and with it an ancient and dependable ridge becomes an intransversable ravine. As it stretches out, it compromises with the natural obstacles contending it, over a spring bottom upon whose weedy rocks it leaves a path of small bare surfaces, skirting here a rooty knoll, there the extended figure of a fallen tree, and, mounting ever upward on bowlder tops and favorable roots, it seems more a ghostly thing than a useful thing, more the casual motion of some woodland sprite who, being in a holiday mood, cares not the least where he is going.

The wind blew hard against the trees,

and there were few birds on the ridges. Above 4000 feet it rained continually.

Lutnineva went with me. We munched our ship's biscuits in a steady rain and gazed gloomily at each other across a bog. We returned to camp with a day's work of six common birds.

The passage of time among these mountains is a deepening study. I took my cue from the comparative identity which each day had with the next. In every week of all the months of the year each tree is just as green, the palms and taro leaves as tall and healthy, the song of the birds in the morning quite the same and quite as cheerful. One may go to sleep at night knowing that tomorrow may be indistinguishable from today, and if today was particularly beautiful it may be enjoyed all over again. For the weather is arbitrary. The rain clouds gather at certain times in the day and month, but it is perfectly possible for them to disregard their schedule. If they do not, it is still possible that they will not drop their rain. There is nothing new in the sky at any time as there is nothing changeable in the forest or in the hazy blue foreheads of the mountains. Every day is a repetition of some undated day, its exact counterpart in tincture of sky, pattern of cloud, and feature of the distant ocean,—a day which in itself is only the most recent of a numberless chain.

That is why, perhaps, with the natives there is no calendar. The year has no number and the month no name. Time, at least that slight obeisance that is payed to it, is exacted in moons,—so many moons. Some event that happened long ago happened by moons and moons. A very long time is moons and moons and moons. This is expressed with an accompanying gesture which means at the same time, "What on earth is the difference?"

Watching the sky, watching the days go by, watching the natives, and listening to the sounds in the valley, one does not find this a difficult thing to understand.

Photograph by Hannibal Hamlin

SIGNAL DRUMS

These hollowed out tree trunks are beaten with a stick and emit a low, guttural sound which is not loud at close range, but which may be heard for many miles

Photograph by Hannibal Hamlin

A MALE SECRET SOCIETY

Secret societies are not the exclusive property of American universities. Here is one in honor of the sacred estate of bachelorhood. The hats are fixed on the male infants of the tribe, and are not removed until the wedding day

January 24 was a very fine day and the yellow-bibbed dove-shooting had been good going up the mountain. We had also taken a thrush, and Ona and I, quite at peace with the world, had rambled pretty far down the trail to Kokere. We got another and last dove, and we turned around, all in the space of two minutes. This was at a quarter past three. About half past four as we were very near the summit on our way back, we heard the call of a crested pigeon. I looked at Ona and Ona looked at me. We sat down on the trail and began to call back. Each time we called we received an answer, but the pigeon, which seemed to be a long way off, came no closer. It was very discouraging. The bird's location was in a direction at right angles to the trail off and down a steep slope wooded with almost impenetrable bamboo. We kept on calling, growing more excited and more forlorn as the minutes passed. And the pigeon kept on calling, but its call sounded as if it were becoming a little fed up with the persiflage and very soon would cut it out altogether. It began to dawn upon me that my hunting, in fact the cut of my whole figure was a joke to all the crested pigeons in Bougainville. I grew slightly red in the face. I could bear it no longer.

Guided by the bird's call, Ona and I started back on the trail for a place where we could cut down into the bush. It proved to be farther away than we had expected, due, I suppose, to the distance sound carries in that altitude. The pigeon kept on answering our call at disinterested intervals. But these were enough to lead us. We pushed, fell, scratched, and crashed our way down the side of the ridge. As I slipped and fell on my face over a log, I remember thinking that the pigeon's call was sounding nearer. When I got up I saw a large bird flying over a distant tree, and I was about to start in that direction when I heard the "s-s-s-s-t!" signal from Ona behind me. I turned around and saw

him making all sorts of wild frantic gestures toward the top of a tree closer to him. I became very excited immediately. A crested pigeon within grasp! After all this martyrdom!

The slippery trunk of a fallen tree bridged a gully between Ona and myself. The tree he pointed to was hidden from me by several hundred others and it was necessary for me to go back over the fallen trunk to see it. While I struggled to execute a quiet reverse passage, Ona advanced toward me, keeping his eyes fixed on an object in the tree. It was a crested pigeon, and it was walking and turning about on six inches of a high limb!

One branch of a large fern in front of me covered the aim from my vantage point on the trunk, so I moved farther along the trunk, squatting and shoving myself down to get a clear shot at the pigeon. I was becoming more and more excited, my footing was becoming more slippery, and the pigeon was becoming more intensely desirable.

Finally I got an aim. Squatting with my left hand on Ona's shoulder, I raised the gun in a wobbly sort of way, sighted as best I could, and fired. As both Ona and I slipped off the trunk and crashed to the ground, we could also hear the pigeon crash in the distance.

I looked at Ona and Ona looked at me. Suddenly we both let out a whoop. I threw my gun in the air and yelled and yelled. Ona screamed out all sorts of marvelous native exclamations and dashed off into the jungle.

We never found that bird, but two and a half hours later when it was almost dark I discovered one gray feather resting on the leaf of a small ground plant. We were still on the top of the mountain.

Ah! Those crested pigeons!

Some six weeks later I was sitting again on the porch of "Arawa," the residence of Mr. Esson's plantation. In the heat of the noonday sun the rain clouds were gathering, and drooping listlessly over the peaks of the distant mountains. There was an epochal hush in the wide bosom of Arawa Valley through which I could hear a cockatoo conversing with a crow, and the thrumming and the droning of a thousand insects.

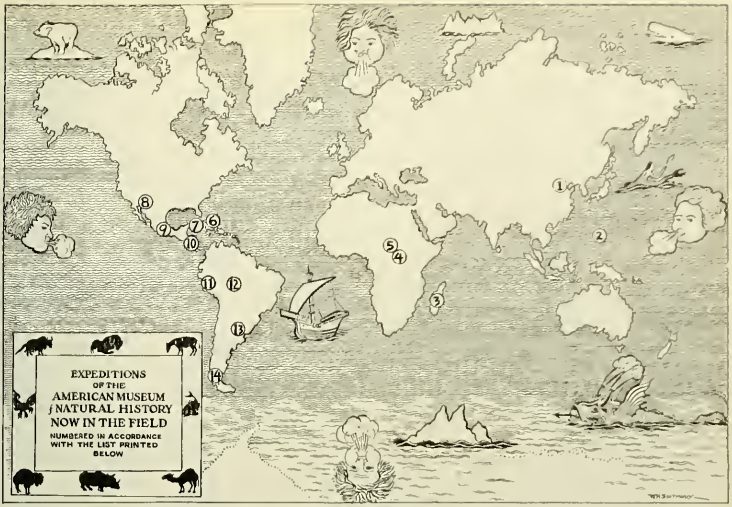
It seemed impossible that we had collected from that valley, birds of 65 species, 7200 land snails, 60 snakes, 600 frogs, and 18,000 insects. From all that droning not a voice seemed to be missing!

This old fore-and-after has worn out two engines, four crews, and three sets of canvas.

First put into commission by R. H. Beck as a collectors' vessel, it is still in the Solomons

Photograph by Frederick P. Drowne

THE "FRANCE"



1. Central Asiatic Expeditions; 2. Whitney, South Sea, Caroline Islands, for birds; 3. Madagascar, for birds, mammals, and fossils; 4. O'Donnell-Clark, Africa, for mammals; 5. Chapin, Congo, for birds; 6. Klingel, West Indies and Central America, for lizard studies; 7. Boekelman Shell Heap Project; 8. Frick-Rak, Southern California, for fossils; 9. Vaillant, Valley of Mexico, archeological research; 10. Chapman, Barro Colorado, for bird study; 11. Frick-Blick, Ecuador, for fossils; 12. Ollala Brothers, Brazil, for birds and mammals; 13. Naumburg-Kaempfer, Southern Brazil, for birds; 14. Scarritt, Patagonia, for fossil mammals

AMERICAN MUSEUM EXPEDITIONS AND NOTES

EDITED BY A. KATHERINE BERGER

It is the purpose of this department to keep readers of NATURAL HISTORY *informed as to the latest news of Museum expeditions in the field at the time the magazine goes to press. In many instances, however, the sources of information are so distant that it is not possible to include up-to-date data*

EXPEDITIONS

CENTRAL ASIATIC EXPEDITIONS.—Dr. Roy Chapman Andrews left New York on March 21 to return to Peking. He will spend the summer there in diplomatic negotiations preparatory to a 1932 expedition, and also on work on Volume I of the Monograph on the Geology of Mongolia.

Mr. Walter Granger returned early in March from China where he has spent the past eleven months. After leaving field work in the Gobi, Mr. Granger remained in Peking awaiting permits to ship the fossil collections, and finally started the 84 cases of material on their journey to the American Museum. These are due to arrive early in April, and will require a year's work in the laboratory.

MEXICAN ARCHÆOLOGY.—Dr. George C. Vaillant left early in March for Mexico for the fourth season of the Valley of Mexico stratigraphical research project, for a period of two or three months. He hopes to consolidate and if possible expand his data on the early cultures in the Valley, and also to connect them chronologically or culturally with the civilizations at the pyramids at Teotihuacan.

BOEKELMAN SHELL-HEAP PROJECT.—The faunal and cultural remains found in the innumerable shell-heaps so widely distributed wherever shellfish were utilized for food have always presented an alluring subject for study not only to the archæologist, but to the concholo-

gist. Under the auspices of the department of anthropology there has recently been organized an expedition which will study the shell-heaps on the mainland and island shores of the Caribbean Sea. On February 14, 1931, Mr. H. J. Boekelman, the leader of the expedition, accompanied by Mr. Junius Bird and Mr. Howard M. Mossman, who are charged with the responsibility for the archæological part of this program, left New York for Havana, from which port the expedition will sail in a chartered schooner. Its chief objective is to learn the distribution of shell-heaps along the coast of Central and South America bordering the Caribbean as well as the West Indian islands. Wherever possible the shell-heaps will be trenched to get some idea of their cultural and conchological content; it is expected that any pottery, implements, or skeletal remains resulting will be added to the Museum collections.

The expedition is financed in part by Mr. Boekelman, by an anonymous donor, and by the Voss Fund, and will initiate a series of explorations of shell-heaps in the New World which, it is hoped, will in the future be extended to the Asiatic Coast.

COLUMBIA UNIVERSITY-AMERICAN MUSEUM EXPEDITION.—After nearly two years of field work in the French Cameroun, Mr. H. C. Raven, leader of the Columbia University-American Museum Expedition returned to New York, bringing with him the last of the specimens collected. He was successful in obtaining the three adult male gorillas and three adult chimpanzees for which he remained in Africa after the other members of the expedition had returned to America a year ago. An account of the work of the expedition is being prepared by Mr. Raven, and will appear in a subsequent issue of NATURAL HISTORY.

CHAMOIS FROM SWITZERLAND.—The department of mammalogy of the American Museum of Natural History has received four specimens of chamois which were collected by Mr. William J. Morden, field associate in mammalogy, on January 12, in Canton Grisons, near St. Moritz, Switzerland. Despite reports to the contrary, chamois are not rare in the Swiss Alps, six hundred to one thousand being reported in the area covered by one game ranger in which Mr. Morden obtained the four specimens now in the American Museum.

According to local regulations, there is a short open season of two weeks in the fall, but methods of hunting are carefully restricted. Repeating rifles are not permitted and these particular chamois were obtained with a 10.2 millimeter, single shot rifle, without peep sights.

THE CHAPIN-CONGO EXPEDITION.—Word has been received from Dr. James P. Chapin that he expects to arrive in New York about the first of May. A fuller note concerning his work in the Congo will appear in the next issue of NATURAL HISTORY.

O'DONNELL-CLARK AFRICAN EXPEDITION.—The American Museum has had word through letter and cable from the O'Donnell-Clark Expedition that the party had reached Khartoum and was embarking from there on its sixty-day trip along the upper Nile.

THE KLINGEL WEST INDIAN EXPEDITION.—The yawl "Basilisk" owned by Mr. Gilbert C. Klingel, but placed in the service of the American Museum's department of herpetology and experimental biology, was wrecked December 7 on Inagua Island. A large part of the equipment was retrieved and Mr. Klingel began at once an intensive study of the reptile fauna of the region. He has already sent to the Museum more than 1500 specimens and writes a very enthusiastic account of his work in the southern Bahamas. Mr. Klingel has more recently started for Haiti and Santo Domingo, where he will continue the collecting for the Museum.

NOTES

ASTRONOMY

NEW USE FOR PLANETARIUM.—At a time when there is so much agitation for a Zeiss Planetarium for the city of New York the following occurrence is of particular interest. General Italo Balbo, the Italian Minister of Aeronautics, who recently made a trans-Atlantic flight to South America, took his crew to the Zeiss Planetarium in Rome that they might receive there a lesson in astronomy, to help them in their navigation on their perilous flight. The crew thus had an opportunity to study the particular stars that would be visible to them during the night of their flight across the Atlantic, and to familiarize themselves with the positions of these stars. This adds still another argument for the Planetarium. It is a first-class practical school of astronomy.

A NEW Board of Trustees Committee has been appointed for the department of astronomy and astronomical hall of the American Museum. It consists of H. Rivington Pyne, A. Cressy Morrison, and Charles J. Liebman. This Committee is in addition to the Advisory Committee appointed some years ago.

THE public is cordially invited to attend the meetings of the Amateur Astronomers Association, held the first and third Wednesdays of each month at 8:15 P.M. in the large auditorium of the American Museum. The lectures for the next two months will be as follows: April 1, Capt. J. F. Hellweg, superintendent of the United States Naval Observatory, who will talk on "How We Get Our Time"; April 15, Miss Henrietta Swope, Harvard College Observatory, whose topic will be "Variable Stars and the Milky Way"; May 6, Prof. J. Ernest Yalden, chairman of the Oculation Committee of the American Association of Variable Star Observers, who will talk on "Dialling." The Association is very glad to send to anyone interested all information concerning membership and activities, as well as sample copies of *The Amateur Astronomer*, the journal of the society.

THE hour for the Saturday radio talks given over Station WOR under the auspices of the A.A.A., has been changed from 5:30 to 5:25 P.M. These talks will continue throughout the spring.

BIRDS

EXCHANGE PROFESSORSHIPS are always reported with pride and satisfaction by American universities, and with good cause. With much the same feeling of satisfaction the American Museum records that Dr. Ernst Mayr, who has been an assistant in the Zoological Museum of the University of Berlin since July, 1926, has come to New York to spend a number of months as an honorary member of our department of birds. His duty and privilege will be to study part of the collections of the Whitney South Sea Expedition, the members of which have been working among various groups of the Pacific Islands since 1920. Doctor Mayr's first care will be the preparation of a report upon the ornithology of Rennell and Malaita, two previously unstudied islands of the Solomon group.

Doctor Mayr is peculiarly well-fitted to take advantage of the opportunity mentioned, for he has had exceptional experience in the field as well as in museums rich in ornithological specimens from Melansia. His first expedition was arranged by Dr. L. C. Sanford, a trustee of the American Museum, and was under the auspices of the Zoological Museum at Tring and the Dutch Colonial Museum at Buitenzorg, Java. This kept him in Dutch New Guinea from February to October, 1928, during which period he made the first zoölogical exploration of the Wandammen and Cyclops Mountains. Without returning to Europe, he began in November, 1928, a second project, for the Zoological Museum of Berlin, which led to the exploration of the Ninigo Islands in the Admiralty group, and then the Saruwaged and Herzog Mountains in the former territory of German New Guinea. His third undertaking began when he joined the schooner "France" of the Whitney South Sea Expedition in July, 1929, and spent eight months in the service of the American Museum among the British Solomon Islands. Doctor Mayr completed a study of his New Guinea collections at Berlin before making his visit to the United States.

MAUNSELL SCHIEFFELIN CROSBY

ON February 12, 1931, Maunsell Schieffe in Crosby, for many years closely associated with the department of birds, and a Patron of the American Museum of Natural History since 1927, died of pneumonia. February 14, the date of his burial in the cemetery at Rhinebeck, New York, was his forty-fourth birthday.

Mr. Crosby was an amateur ornithologist in the best sense of the term. Admitting that the sheer joy he drew from the study and observation of birds was his only objective, he nevertheless accomplished work of real significance, in addition to fostering and encouraging more specialized researches by others. He published a number of papers in *The Auk* and elsewhere, and his account of the bird life of Dutchess County (his own beloved province) stands as one of the more important local lists of restricted regions in the eastern United States.

As a volunteer field worker, Mr. Crosby took part in several expeditions of the American Museum. The latest of these he financed jointly with Mr. Ludlow Griscom, formerly assistant curator of birds. The party sailed to Panama in February, 1927, and there chartered a schooner which conveyed the members first to the Pearl Islands and then to virgin territory in the forests of the Sambú River, Cape Garachiné, and other important localities in the eastern part of the Isthmus. Nearly five hundred species of tropical birds were obtained during the course of this expedition.

Mr. Crosby's status as an ornithologist was signally recognized by the Museum during the winter of 1929–30, when he accepted the responsibility of delivering two lectures in a cultural course especially prepared for college and

high school teachers. Incidentally, he was the only speaker in this series who was not a member of the Museum's scientific staff.

Mr. Crosby was born in New York City, the son of Ernest H. and Fanny Schieffelin Crosby. His ancestors were mainly of English, Irish, and Dutch stock, and many of them hold a high place in the history of New York State and the nation. His great-great-grandfather, Ebenezer Crosby, was surgeon to General Washington during the Revolution, and subsequently a professor in Columbia College. His grandfather, Howard Crosby, was Chancellor of New York University, and his father a judge in the International Court in Egypt, where the son spent the early years of his boyhood.

MAUNSELL SCHIEFFELIN CROSBY
(1887–1931)

After graduating from Harvard in 1908, Mr. Crosby made agriculture his principal occupation. On his beautiful estate, 'Grasmere," in Rhinebeck, he cultivated fruit and other crops, and maintained a notable herd of brown Swiss cattle and a stable of Percheron horses. His love of trees was no less marked than that of birds, and the skill with which he created gardens and enhanced the natural charm of many acres of varied landscape, reflects in large measure his personality.

In the community where he made his home, moreover, he gave much time and enthusiasm to educational and philanthropic work, and was there, as elsewhere, a champion of causes bearing upon conservation of the country's natural resources. With the last aim in view he arranged frequent lectures and demonstrations for the citizens of his village and the surrounding farmlands. His official connections were far too numerous to mention, but, among many, he was first post commander of the local branch of the American Legion, and a lieutenant-colonel in the United States Army Reserve.

In his immediate family, Mr. Crosby is survived by a daughter, who is a student in Smith College, and a sister who resides in England. His friends were legion, for he was blessed with an unaffected and winning sense of kinship with all who shared any part of his wide interests. His *joie de vivre* and whimsical humor were highly infectious. Within the small and happy circle of his intimate friends he fostered relationships so rare that most of us can hardly hope to find their like again. For his naturalist comrades the years cannot dim the memories that cluster round Grasmere in the season of spring migration.—R. C. M.

CONSERVATION

A NEW NATIONAL FOREST. — The Forest Service of the U. S. Department of Agriculture announces the establishment of the new Hiawatha National Forest by proclamation of President Hoover. It is in the heart of the upper peninsula of Michigan, and its gross area is 270,071 acres. Bringing the total number of national forests up to 150, this forest becomes part of the vast area of more than 160,000,000 acres administered by the Forest Service. The Hiawatha National Forest will be protected and developed for its timber growing, recreational, and other public forest values. Its headquarters are at Munising, Michigan.

EDUCATION

A RADIO NATURE LEAGUE.—On March 1 Mr. William H. Carr, assistant curator in the department of education at the American Museum, inaugurated a series of nature talks to be given every Sunday at 3:45 P.M. over Station WOR. Each week Mr. Carr will speak for ten minutes on general nature subjects, referring the radio audience to exhibition groups in the American Museum, and will devote five minutes to answering letters concerning previous talks. To date, Mr. Carr has received more than 450 letters.

FOSSIL VERTEBRATES

A NEW RECONSTRUCTION OF *Dinichthys*.—The Arthrodira or joint-necked fishes to which

order the fossil fish *Dinichthys* belongs are of particular interest because they represent one of nature's experiments in producing a higher fish type out of a very low original stock remotely related to the cartilaginous fishes.

Several generations of ichthyologists have puzzled over the correct assembling of the armor-like skull and carapace plates of these forms and their successive results have represented so many approximations toward the truth. Dr. Anatol Heintz of the Palæontological Museum, Oslo, Norway, has now revised the sum total of these results and, together with some new features which he himself has found, has made a new reconstruction of the fish *Dinichthys*. Doctor Heintz found among the collections in the American Museum several small pieces fitting into this puzzle and with these and the results of his studies of these forms, he has now shown the way to the correct assembling of certain regions. He has confirmed and extended the work of L. A. Adams in the way these creatures used their jaws—throwing the head back and letting the lower jaw down. This is a unique arrangement of the musculature and betokens a high form of specialization in this side branch. This unusual mouth mechanism has never before been observed in any fossil or living animals. It operates by means of four pairs of muscles working respectively to lift the head roof, to move the head roof downward, to move the lower jaw upward, and to move the lower jaw downward; thus the first and fourth pair operate to open the mouth, and the second and third pair shut it. Doctor Heintz has just published a *Novitates* on this subject, and a more detailed discussion will appear in the Bashford Dean Memorial Volume.

RESEARCH ON FOSSIL CROCODILIA.—In 1920 Dr. Charles C. Mook planned and started work on an ambitious piece of research which will be published as a memoir entitled "Fossil Crocodilia of the World." Nineteen preliminary papers, with about 409 pages, 130 text figures, and 18 plates have already been published, and about twelve more will appear within the next year or so. The memoir has been planned to include the following sections, several of which have been completed:

1. OSTEOLOGY.—A detailed study of the bone structure, to get the range of structure within the species.
2. HISTORICAL SUMMARY of descriptions of about 75 genera and 280 species. This is completed for the North American, Australian and Asiatic forms; the European ones will soon be finished; the African and South American groups will be taken up next.
3. SPECIAL ADAPTATIONS.
4. DESCRIPTIONS of about 50 well-known species.
5. RELATIONSHIPS AND PHYLOGENY, with discussion of evolution within the group in the Triassic and Jurassic.
6. BIBLIOGRAPHY.

About 500 pages of the manuscript are ready now, but further preparation is needed, and Doctor Mook hopes to be able to spend next summer in the field and the following summer studying European collections. Most of the illustration work is completed and that remaining to be done is provided for.

In recognition of the admirable work which he has been doing on the Crocodilia, Doctor Mook was awarded the interest on the Osborn Research Fund, to be devoted to this work in 1931.

DISCOVERY OF FOSSIL CROCODILE BONES IN NEW JERSEY.[1]—Crocodilian remains have been reported occasionally from the greensand marl deposits, but in most cases the specimens have been fragmentary. In other cases they have been incompletely described and figured. Late in 1929 men employed in the marl pits of the Permutit Company, near Birmingham, New Jersey, found some fossil bones in the marl pits. Mr. William Vaugh, manager of the Birmingham plant of the Permutit Company, reported the discovery to Dr. H. B. Kümmel, director of the New Jersey State Conservation Commission and Geological Survey. Doctor Kümmel then called the attention of Mrs. Katherine Greywacz, curator of the New Jersey State Museum, to the find. Mrs. Greywacz arranged for a field investigation by Mr. Johnson, assistant state geologist, and Mr. Charles Lang, of the American Museum of Natural History. Dr. Glen Jepson, of Princeton University, also examined the bones. Mr. Lang, with the assistance of Mr. Paul Niemeyer and Mr. Thomas McDowell, of the State Museum, took up the bones. Facilities were provided by Mr. Vaugh and Mr. Mac Pherson, superintendent of the Permutit Company's plant. The bones were extremely fragile, and required careful treatment to insure their removal without destruction by crumbling. They were sent to the State Museum and were exhibited for several months in a partly prepared condition. Later they were sent to the American Museum of Natural History, where they were completely cleaned and prepared by Mr. Lang, and were studied and described by the writer. A technical description will be found in a number of the American Museum *Novitates* now in preparation.

The remains consist of portions of the skull, vertebræ, both humeri, ulna, both femora, both ilia, pubis, ischium, ribs, and many scutes. Exact identification is difficult, as the descriptions of previously described material do not permit exact comparison. It is evident, however,

[1]Contributions to the Osteology, Affinities, and Distribution of the Crocodilia. No. 21.

that the reptile was a procœlian crocodile, that is, a crocodile with the anterior ends of the vertebral centra concave, and the posterior ends convex. This character indicates a closer relationship with the modern crocodilians than with the commoner forms of Mesozoic crocodiles. The long snout, the curved dental alveoli, and the moderately large temporal fenestræ on the skull top indicate affinities with the gavials rather than with the alligators and true crocodiles. Among the forms previously described from the New Jersey greensand deposits is the genus *Holops*. This is a gavial-like form, and the type of the species *Holops pneumaticus*, Cope, resembles the recently found material closely. The latter is accordingly referred to this species. The bones have been described in detail in a recent number of the *Novitates*.

A point of interest is the fact that the specimen was found in typical marine sediments, associated with remains of marine turtles, fish, and invertebrates, in such a way as to leave no doubt that it belongs to a marine animal. The modern gavial is exclusively a fresh-water species.

The beds in which this specimen occurred are made up mostly of greensand marls, chiefly composed of the mineral glauconite. The formation is known as the Hornerstown Marl. It has two fossiliferous strata in it. The *Holops* specimen was found in the lower of the two strata.

The Hornerstown Marls have been considered late upper Cretaceous in age for many years. Recently, however, a member of the United States Geological Survey has determined their age as lower Tertiary. The Geological Survey of New Jersey has accepted this correlation. As the Hornerstown underlies typical Eocene deposits, we may consider them Paleocene in age.

—Charles C. Mook.

MAMMALS

Kalahari Mammals Received.—One hundred and sixty-four specimens of large mammals of the Kalahari desert and the Transvaal have recently been received from Mr. Arthur S. Vernay as a further token of his unflagging interest in this Museum. These specimens are a part of the collection made by the Vernay-Lang Kalahari Expedition, the story of which appears in this issue of Natural History. The expedition was conducted for the benefit of the Field Museum, the British Museum, the Transvaal Museum, and the American Museum of Natural History.

All of the specimens which constituted the American Museum's share of the collection are very desirable accessions. Of greatest interest is a remarkable series of eighteen gemsbok, some of which will be incorporated in a group in the new African Hall. Accessories for this group were also collected. A bull and a cow giraffe received are of a race new to our collection. The South African brown hyæna is represented by three good specimens. A Transvaal zebra is new to the collection and of great interest because this subspecies is close to extinction. Other animals in the allotment are: eland, kudu, roan antelope, sable antelope, black wildebeeste, tsessebe, blesbok, impalla, red hartebeeste, lechwe, reedbuck, waterbuck, springbok, steinbok, duiker, wart hog, spotted hyæna, baboon, and scaly anteater.

Besides the mammals, Mr. Vernay has presented us with two specimens of the wild Kalahari ostrich, and three beautifully prepared albums of photographs from the expedition.

MEETINGS OF SOCIETIES

The Explorers Club.—At its meeting of February 13, the Explorers Club elected Dr. Roy Chapman Andrews as its president to succeed George B. Heye, who has filled this office for seven years. Other officers elected were Bassett Jones, Richard B. Aldcroft, and Dr. Wm. S. Ladd, vice-presidents; George N. Pindar, secretary; and W. B. Clark, treasurer. Earl Hanson was re-elected assistant secretary.

HONORS

On January 16, Mr. Lincoln Ellsworth received from President Hoover a special gold medal and, in return, presented to the President the American flag carried over the North Pole by the airship "Norge" on her flight in 1926 from Spitzbergen to Alaska. The flag which was presented to the President has been on exhibition in the American Museum since the return of the expedition. It is a duplicate of that presented by President Coolidge to the expedition, and left at the Pole.

As the President presented the medal to Mr. Ellsworth he said:

On behalf of the Congress of the United States it gives me great pleasure to hand you this gold medal for your conspicuous courage, sagacity, and perserverance on your polar flight of 1925, and the transpolar flight of 1926. Please accept my congratulations, and the congratulations of the American people.

Mr. Ellsworth's response follows:

There are times when the silence of humility expresses more than any words for I realize the insignificance of the individual in every field of creative effort. That my two comrades, one of whom,—intrepid soul bent on a mission of mercy, remains swallowed up in the gray mists of the Polar Sea,—should share the honor with me I am, therefore, glad.

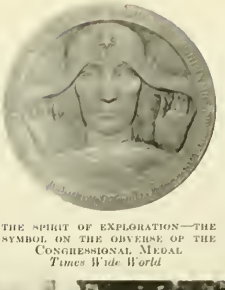
The world soon forgets, Mr. President, so only through material symbols may we hope to perpetuate deeds or events. Such is the purpose of this flag I am privileged to present to you today,—a remembrance of my gratitude. It was carried across the Polar Sea from Spitzbergen to

Alaska in the airship Norge and is a replica of the American Flag given by the President and left at the North Pole.

The memory of our flights by plane and airship remains but legend in the kaleidoscope of swiftly passing events. Even the lure of that far-flung, strangely beautiful world of glittering white upon which we gazed, with its mystery, its melancholy, and its charm, are but vague memories. But the trail blazed through one of the world's last and largest unexplored areas must ever be remembered as a romantic epic of advancing knowledge in man's conquest of the "Unknown."

But of what value? Only time can tell. With knowledge comes power, and with power untold possibilities. Modern progress moves swiftly. The blazed trail of today becomes the paved highway of tomorrow. So in a time not far remote the world may wake to find a new handmaid of progress in the linking of Occident and Orient by a short route through the air via the North Pole.

In the quest of the explorer it is fortunate that romance joins with reality and great adventure is found often to contribute to the welfare of mankind.



THE SPIRIT OF EXPLORATION—THE SYMBOL ON THE OBVERSE OF THE CONGRESSIONAL MEDAL
Times Wide World

Acme Photograph
THE PRESENTATION CEREMONY
LINCOLN ELLSWORTH RECEIVING THE GOLD MEDAL AWARDED HIM BY ACT OF THE SEVENTIETH CONGRESS OF THE UNITED STATES, IN RECOGNITION OF HIS COURAGE, SAGACITY, AND PERSEVERANCE IN THE POLAR FLIGHT OF 1925, AND THE TRANSPOLAR FLIGHT OF 1926, IN THE DIRIGIBLE "NORGE"

THE REVERSE OF THE MEDAL—THE DIRIGIBLE "NORGE" ON ITS TRANSPOLAR FLIGHT

In Recognition of Mrs. Mary L. Jobe Akeley's first book, *Carl Akeley's Africa*, she has recently received from Mt. Union College the honorary degree of Doctor of Literature.

MUSEUM ACCESSIONS

Californian Indian Baskets.—Thirty years ago, through the generosity of Mr. George Foster Peabody, the department of anthropology received as a gift the famous Briggs Basketry Collection, which at that time was unparalleled in the museums of the country, containing as it did outstanding examples of basketry weaving by the Indians of British Columbia, Alaska, Oregon, and California. When Mr. C. F. Briggs turned his collection over to the Museum, he declared his intention of adding to it as opportunity arose, but, unfortunately, all the baskets collected by Mr. Briggs were destroyed in the San Francisco fire, following the earthquake. Recently, Mr. Briggs fulfilled this promise made so long ago, by sending to the Museum a small series of baskets made by the Indians of California. Among these was a fine feather-decorated Pomo bowl basket and two of the unique miniature decorated bowls made by the Pomo, which invariably excite interest and admiration and which seemto be a modern development in their basketry art. The smaller of these tiny bowls has a base diameter of one eighth of an inch; the larger is three eighths of an inch at the base.

Cast of Old Mayan Temple on Exhibition.—The department of anthropology has just installed in Memorial Hall at the American Museum a cast of temple E-VII sub at Uaxactun, Guatemala. This is the oldest temple yet found in the Maya area, and was uncovered in perfect condition owing to its having been buried under another temple also erected in prehistoric times. This acquisition was the generous gift of the Carnegie Institution of Washington with whom the Museum has been coöperating for several years in Middle American archæological research. The model is by the distinguished preparator, S. J. Guernsey of Cambridge, Massachusetts.

The False Killer Whale (*Pseudorca crassidens*), a large porpoise considerably smaller than the true killer has been little known, as it is among the rarest of cetaceans. Though individuals were reported from New Zealand to the North Sea, no museum was able to obtain a

complete specimen of this animal in eighty years of effort.

On October 19, 1927, a large school of whales was stranded in Dornoch Firth, near Inverness, Scotland. Upon receipt of this news, Mr. M. A. C. Hinton of the British Museum, rushed to the Firth, as he was anxious to obtain statistical information on a large group of whales. To his great surprise, he found that here he had a school of the rare *Pseudorca*. Such a unique opportunity was fortunately utilized to the fullest extent. With the assistance of the local people, Mr. Hinton set about the task of making dissections, stomach examinations, and measurements of the animals, and of saving all possible specimens. Owing to good management and favorable weather 127 skeletons were recovered. Two specimens were sent in the flesh to London, where one of them was cast.

A few months later the American Museum of Natural History secured an eighteen-foot baby sperm whale that had become stranded in the Gowanus Canal, Brooklyn. This specimen was cast and dissected, and casts of the sperm whale and the false killer whale were exchanged by the two museums.

The cast of *Pseudorca* is fourteen and one-half feet long, and colored to represent a living individual. It is to be hung in the hall of ocean life, where it will form a valued addition to the American Museum's already remarkable series of whale casts and models.—R. T. Hatt.

New Fly Collection.—The collections of the department of insects of the American Museum have recently been enriched by the addition of the H. C. Curran collection of flies. These more than 10,000 specimens add approximately 1700 species to the Museum series. Speaking geographically, the collection is particularly strong in exotic forms. From the standpoint of classification, the family of Syrphidæ is especially well represented. This family contains important enemies of plant-lice. However, the most noteworthy feature of the collection is its large number (about 400) of types of new species described by Mr. Curran before his coming to the American Museum.

FISHES

The Beebe Exhibit of Fishes.—During February a series of paintings, photographs, and specimens was on exhibit in Education Hall, of the American Museum showing some of the results of the 1929–1930 Bermuda Oceanographic Expedition of the New York Zoological Society, under the directorship of William Beebe.

The Expedition's research station is on Nonsuch Island, one of the Bermudas, lent to it by the British government. Here Doctor Beebe and his staff have spent the last two seasons studying the life of the ocean and steadily improving their methods of investigations.

For the study of the material of the great depths, dredges and nets were used. Day after day, for months the Expedition drew nets through an imaginary but fixed submarine cylinder, five miles off shore, eight miles in diameter, and one half to one mile below the surface. The interest of this catch of thousands of deep-sea fish is that they came from a vertical zone between five hundred and one thousand fathoms deep and from a definitely limited circle.

With the aid of artists it was possible to record scenes from the lives of these deep-sea fishes and to study them while they were still fresh and icy cold from the depths of the ocean, making color notes and photographs, notes on length of viability, character of swimming, shape while still unshrunken, luminescence, etc., and to secure accurate data as to eggs and food.

By a special chemical process, Miss Hollister produced the transparent preparations shown in the exhibit. No dissecting knife has touched these; they have remained natural in size, shape, and structure, but the skin and flesh have become transparent, and the skeleton, stained a brilliant scarlet, has come into plain view.

When nearly a hundred nets have been drawn at a uniform depth of eight hundred fathoms across this cylinder of water, the study of their contents will reveal real relationships as to numbers, age, sex, as to which are prey, which are dominant, what proportion make their living by blind feeling, or by a combination of large eyes and abundant luminescence.

On June 11, 1930, for the first time in the history of scientific inquiry, the life of the ocean depths a quarter of a mile down was visible to man—depths to which, up to the present time, no human being has ever penetrated.

This was due to Otis Barton's invention—the bathysphere. The bathysphere is a steel sphere or tank, weighing five thousand pounds. It is four feet nine inches in diameter, with walls at least an inch and a half thick. Over the manhole is a four-hundred-pound door fastened with ten large bolts. The three windows, through which the occupants can watch the life of the depths, are cylinders of fused quartz, which is non-distorting. They are eight inches in diameter and three inches thick. The tank accommodates two persons. Air is provided by two oxygen tanks clamped to the wall, and a special valve set to allow the escape of two litres of oxygen per

minute. One tank lasts about three hours. Palm-leaf fans keep the air in circulation. Wire mesh trays above each oxygen tank contain respectively soda lime to take up the carbon dioxide, and calcium chloride to absorb the moisture. To the bathysphere are attached 3500 feet of non-twisting steel cable on which it is lowered. It is supplied with electric lights and telephone connection with the boat above through a half mile of solid rubber hose.

A test dive of the empty bathysphere was made on June 11; it was lowered to a distance of 2450 feet below the surface of the water. The greatest depth to which it descended when occupied was 1426 feet. At 1450 feet, the pressure of the water upon the sphere from all directions was calculated. It was 33,666.2 tons!

For next year, Mr. Beebe and his staff have set themselves four objectives in the use of this invention: (1) to descend to 500 or 600 fathoms, that is, 3000 to 3600 feet; (2) to remain for several hours continually at certain definite depths for prolonged observation; (3) to carry out definite tests of light, pressure, and temperature with adequate instruments; (4) to trace the gradual change from shallow water fauna to that of the deep sea.

NEW PUBLICATIONS

The Science of Life. By H. G. Wells, Julian S. Huxley and G. P. Wells.

IN these two stately volumes "Mr. Everyman," for whom the work has been so carefully planned and wrought out, may range with unflagging interest through section after section and chapter after chapter. For this work very successfully describes that life of which the reader is a part, it opens to him the resources of science in many directions, it has many practical bearings on the care of his physical and mental health and the conduct of his life.

The senior author began his scientific career as a biologist in the laboratory of the elder Huxley, and at heart he has always remained a biologist, although using the medium of the imaginative novel to arouse mankind to a sense of their own biological nature and sociological destiny. In the present work he has wisely associated with himself two partners: the brilliant grandson of the elder Huxley and his own son G. P. Wells of Trinity College, Cambridge and University College, London; together they bring to the work all the learning and resources of these great modern centers.

All three authors have collaborated very closely and effectively in the production of a plan that comprises the following main topics: The Living Body, The Chief Patterns of Life, The Incontrovertible Fact of Evolution, The History and Adventures of Life, The Spectacle of Life (Ecology), Health and Disease, Behavior, Thought and Feeling, Biology of the Human Race. From one end to the other the work is preëminent for its leisurely thoroughness, for the care with which statements of facts have been checked, for its restraint and fairness, and for its far-reaching applications of biological knowledge to every-day life and philosophy. —W. K. G.

Glimpses of Familiar Birds. By William H. Carr. 1931. Samuel Gabriel Sons & Co.

COLORED plates are the most valuable feature of any book which is designed to help us to know the birds. Here is a little book containing good colored plates of seventy-two of our commonest land birds, except birds of prey, of Eastern North America. In many cases the sexes are different, and in these both the male and the female are shown on the plate. Besides these, there are two full-page colored plates which show the eggs of all seventy-two species in correct color and markings and in their relative sizes. The colored plates of the birds and the eggs were made by Merle V. Keith.

There is a line-drawing of the robin with the external parts of the bird labeled, and there are three or four line-drawings to show how birds are measured. The relative sizes of birds for comparison is more adequately done then in any book I know. Instead of having two or three well known birds as units of comparison, in this book the following six birds are drawn to correct relative scale; hummingbird, chipping sparrow, bluebird, robin, blue jay, and crow.

Two pages are allotted to each bird in the book, one page being devoted to the colored plate and the opposite page to the text. In the latter we find the range, season, size, nesting habits, and other significant and interesting facts. Below each plate is space for field notes.

The book is small, about $4\frac{1}{2}'' \times 6''$, and about one-half inch thick, very convenient in size for the pocket. It is indeed a very useful field-book.

William H. Carr is assistant curator in the department of public education of the American Museum, and is also the author of *The Stir of Nature* (Oxford University Press) which appeared last fall.

The author is perhaps best known for his outstanding work during the last four years in developing the outdoor museum and nature trails at Bear Mountain in Palisades Interstate Park, which are under the direction of the American Museum of Natural History.

He has had abundant experience to qualify him to prepare a useful and attractive field-book, containing only the essentials, and he has done it well.—CLYDE FISHER.

THE COVER OF "NATURAL HISTORY"

THE cover painting by Arthur A. Jansson depicts a lama turning a prayer wheel which the Mongolian girl has just visited. These prayer wheels—some large, some small—are outside of every Mongolian temple and often on the street corners of Urga. Pilgrims frequently drop prayers written on paper into the top of the wheel, then give it a few turns. Every turn, by whomever made, sends up to the Buddha heaven all the prayers that the receptacle contains. Prayer flags are carried by every caravan and flutter from every yurt. Whenever the wind blows these flags, prayers are sent to heaven. Sometimes prayer wheels are cleverly arranged near a stream so that they are turned by the current. Thus night and day prayers are being said for the owner of the wheel without effort on his part.

The woman shown in the painting is of the Khalka tribe of Northern Mongols. These women wear their hair elaborately dressed over a framework which resembles the horns of a mountain sheep, and very probably originated from the horns of the great *Ovis ammon*, found wild in Northern Mongolia. Women wear on their heads a silver filigree cap, studded with jewels for the rich and with colored glass for the poor. Stones and precious stones are also used to adorn various parts of the hair, and when a woman is in full dress, the braids hanging below her waist are encased in jewel-studded cylinders of gold or silver.

The painting is based on photographs taken by the Central Asiatic Expeditions.

NEW MEMBERS

Since the last issue of NATURAL HISTORY, the followidg persons have been elected members of the American Museum, making the total membership 12,015.

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MR. D. E. POMEROY.

Associate Founder

Messrs. GEORGE T. BOWDOIN, J. S. MORGAN, JR., C. OLIVER O'DONNELL.

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Sister PRUDENTIA MORIN.

Mesdames DOROTHY ALLHUSEN, DAVID A. BELDEN, GRACE WEST COOKE, F. C. HARRIS, JOHN J. MCKEON, EDWIN F. METCALF, JAMES T. PORTER, WARREN T. VAUGHAN, C. D. WEIMER.

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Master BOBBY GODFREY.

THE AMERICAN MUSEUM OF NATURAL HISTORY

FOUNDED IN 1869

SIXTY years of public and scientific service have won for the American Museum of Natural History a position of recognized importance in the educational and scientific life of the nation, and in the progress of civilization throughout the world. Expeditions from the American Museum and members of the scientific staff are interested in facts of science wherever they may be found. As a result, representatives of this institution are forever studying, investigating, exploring not merely in their laboratories and their libraries, but actually in the field, in remote and uncivilized corners of the world, as well as in lands nearer home.

From these adventuring scientists and from observers and scientists connected with other institutions, NATURAL HISTORY MAGAZINE obtains the articles that it publishes. Thus it is able to present to the members of the American Museum the most fascinating, the most important, and the most dramatic of the facts that are being added to the Museum's store of knowledge or are being deposited in this and in other institutions.

MEMBERSHIP MORE THAN TWELVE THOUSAND

For the enlargement of its collections, for the support of its exploration and scientific research, and for the maintenance of its many publications, the American Museum is dependent wholly upon members' fees and the generosity of its friends. More than 12,000 members are now enrolled and are thus supporting the work of the Museum. There are ten different classes of members, which are as follows:

Associate Member (nonresident)*	annually	$3
Annual Member	annually	$10
Sustaining Member	annually	$25
Life Member		$200
Fellow		$500
Patron		$1,000
Associate Benefactor		$10,000
Associate Founder		$25,000
Benefactor		$50,000
Endowment Member		$100,000

*Persons residing fifty miles or more from New York City

Memberships are open to all those interested in natural history and in the American Museum. Subscriptions by check, and inquiries regarding membership should be addressed: James H. Perkins, Treasurer, American Museum of Natural History, New York City.

FREE TO MEMBERS

NATURAL HISTORY: JOURNAL OF THE AMERICAN MUSEUM

This magazine, published bi-monthly by the American Museum, is sent to all classes of members, as one of their privileges.

AUTUMN AND SPRING COURSES OF PUBLIC LECTURES

Series of illustrated lectures held on alternate Thursday evenings in the autumn and spring of the year are open only to members or to those holding tickets given them by members.

In addition to these lectures, illustrated stories for the children of members are presented on alternate Saturday mornings in the autumn and in the spring.

MEMBERS' CLUB ROOM AND GUIDE SERVICE

A handsome room on the third floor of the Museum, equipped with every convenience for rest, reading, and correspondence, is set apart during Museum hours for the exclusive use of members when visiting the Museum. Members are also privileged to avail themselves of the services of an instructor for guidance.

SCIENCE
EDUCATION

RESEARCH
EXPLORATION

SIXTIETH ANNIVERSARY ENDOWMENT FUND. Already, $2,500,000 has been contributed to this $10,000,000 fund, opened to commemorate the Sixtieth Anniversary of the Founding of the American Museum of Natural History and to further the growth of its world-wide activities in Exploration, Research, Preparation, Exhibition, Publication, and Education. Committees are now engaged in seeking the $7,500,000 which remains to be contributed. It is greatly to be desired that this fund, so vital to the scientific and educational progress of the Museum, shall reach completion at an early date.

EXPEDITIONS from the American Museum are constantly in the field, gathering information in many odd corners of the world. During 1930, thirty-four expeditions visited scores of different parts of North, South, and Central America, of Europe, Asia, Africa, and Polynesia. New expeditions are constantly going into the field as others are returning with their work completed, or in order to digest material gathered preparatory to beginning new studies.

SCIENTIFIC PUBLICATIONS of the Museum, based on its explorations and the study of its collections, include the *Memoirs*, devoted to monographs requiring large or fine illustrations and exhaustive treatment; the *Bulletin*, issued in octavo form since 1881, dealing with the scientific activities of the departments except for the department of anthropology; the *Anthropological Papers*, which record the work of the department of anthropology; and *Novitates*, which are devoted to the publication of preliminary scientific announcements, descriptions of new forms, and similar matter.

POPULAR PUBLICATIONS, as well as scientific ones, come from the American Museum Press, which is housed within the Museum itself. In addition to NATURAL HISTORY MAGAZINE, the journal of the American Museum, the popular publications include many handbooks, which deal with subjects illustrated by the collections, and guide leaflets which describe individual exhibits or series of exhibits that are of especial interest or importance. These are all available at purely nominal cost to anyone who cares for them.

THE LIBRARY of the American Museum is available for those interested in scientific research or study on natural history subjects. It contains 115,000 volumes, and for the accommodation of those who wish to use this storehouse of knowledge, a well-equipped and well-manned reading room is provided. The Library may be called upon for detailed lists of both popular and scientific publications with their prices.

COLLEGE AND UNIVERSITY SERVICE. The President of the Museum and the Curator of Public Education are constantly extending and intensifying the courses of college and university instruction. Among some of the institutions with which the Museum is cooperating are Columbia University, New York University, College of the City of New York, Hunter College, University of Vermont, Lafayette College, Yale University, and Rutgers College.

SCHOOL SERVICE. The increased facilities offered by this department of the Museum make it possible to augument greatly the Museum's work, not only in New York City public schools, but also throughout the United States. More than 22,500,000 contacts were made with boys and girls in the schools of Greater New York alone, and educational institutions in more than thirty states took advantage of the Museum's free film service during 1930. Inquiries from all over the United States, and even from many foreign countries are constantly coming to the school service department. Thousands of lantern slides are prepared at cost for distant educational institutions, and the American Museum, because of this and other phases of its work, can more and more be considered not a local but a national—even an international—institution.

THE AMERICAN MUSEUM OF NATURAL HISTORY

77th STREET and CENTRAL PARK WEST
NEW YORK, N. Y.

NATURAL HISTORY

Vol. XXXI, No. 3 1931 May-June

GORILLAS OF THE BELGIAN CONGO FOREST

JOURNAL OF THE AMERICAN MUSEUM OF NATURAL HISTORY

NEW YORK, N. Y.

Fifty Cents a Copy

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Entered as second-class matter April 3, 1919, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

BLAZING THE TRAIL

THOSE readers of NATURAL HISTORY who have enjoyed in former issues Dr. Frank M. Chapman's delightful tales about the wild life of Barro Colorado Island, entitled "Homes of a Hummer" and "The Conquest of Claudia," will hail with pleasure his most recent observations on the tropical life of this island in the Canal Zone. In the July-August issue, Doctor Chapman will tell what he saw and heard from his airy perch near a 150-foot almendro tree near the Biological Station where, as curator-in-chief of the American Museum's department of birds, he is working out certain scientific problems.

AN article on some of the more intimate phases of camp life in the Gobi and in China will be contributed by Mr. Walter Granger, who has been chief palæontologist and second in command of the Central Asiatic Expedition since its inception in 1921. He will speak of the climate, of the method of travel, of the camps and the water, fuel and food supply, of the Chinese and Mongol servants, and the native technical assistants who have been trained by the Expedition to great proficiency in the collecting and preparation of specimens, and of the diversions which help to break the monotony of the five months' isolation and routine work.

AS the first white woman to visit the village of Budru, high in the mountains of Bougainville, Miss Beatrice Blackwood was an object of no little interest to the natives. However, these people of the South Sea Islands, their manner of living, and their strange customs were of even greater interest to Miss Blackwood. In an article which will appear in the coming issue of NATURAL HISTORY she will give an account of a visit to Budru and two other villages which are tucked away deep in a mountain forest far from the civilized world.

IN the gorge of the Urubamba River only a short distance from where the ruins of Macchu Picchu overhang the valley, the Ottley-Anthony South American Expedition established its first collecting base. A railroad is being built down the Urubamba Valley, and steel has been laid from Cuzco as far as the foot of the slope that climbs to the site of the once flourishing city of Macchu Picchu. Mr. H. E. Anthony, curator of mammals at the American Museum, will tell the story of the expedition's trip by means of a "ferrocaril" or rail automobile, from Cuzco up over the mountain ramparts that hem in this ancient capital of the Incan Empire, down a broad valley, and into the wild gorge of the Urumbamba River, one of the tributaries of the Amazon.

ANOTHER article on Peru will be contributed by Dr. Ronald L. Olson, assistant curator of South American archæology, at the American Museum. The earlier article, "Old Empires of the Andes" was an attempt to outline the prehistory of the Andean region in terms understandable to the layman.

In the coming article the editors have succeeded in persuading Doctor Olson to throw aside for the once, his scientific caution and to attempt to make his mummies come to life and live again for a day their pagan life. "A Day in Nazca" will be a picture of a day's events in the valley of Nazca fifteen hundred years ago—centuries before the rise of the Inca power.

THERE is nearing completion at the present time in the new Hall of Ocean Life the gigantic Coral Reef Group which depicts a section of the coral reef barrier of Andros Island in the Bahamas. During the past six years scientists, artists, and preparators have devoted to this an amazing amount of work both in the field and in the Museum. Dr. Roy Waldo Miner, curator of living invertebrates at the American Museum, will present for NATURAL HISTORY readers the romance of this undertaking —and the many problems that had to be solved in bringing a section of this coral reef to the heart of New York.

THE work of the United States Naval Observatory will be described in the next issue of NATURAL HISTORY by Capt. J. F. Hellweg, U.S.N., superintendent of that institution.

IT has been the good fortune of NATURAL HISTORY MAGAZINE to be able to present to its readers many of Alfred M. Bailey's charming bird studies, and the July–August number will have another treat in the story of "Sac-a-Plomb," the elusive little pied-billed water sprite that nests in the inland ponds and lakes of our northern states during the latter part of April.

EVERY summer the Trailside Museum, at Bear Mountain becomes host to a number of unusual pets. William H. Carr, assistant curator in the education department of the American Museum, will tell in the coming issue about the personalities and activities of some of these animal visitors.

THE COVER OF THIS ISSUE

THE cover of this issue of NATURAL HISTORY, from a painting by Mr. Arthur Jansson, depicts a family of gorillas at home in the mountains of the eastern Belgian Congo. The mountain gorilla inhabits the highlands which form the western border of the Albertine Rift Valley and the Kivu volcanoes which have been thrust up in the valley itself. The gorillas are shown in a typical setting of the Kivu region. The forest in comprised of scattered trees, between which grows an incredible mass of succulent herbs and vines that form the bulk of the gorillas' food. Gorillas are sociable, sometimes living in groups of fifteen or more. The picture shows an adult male, standing, and a female with a baby about two years old.

VOLUME XXXI
NUMBER 3

NATURAL HISTORY

MAY-JUNE
1931

The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor

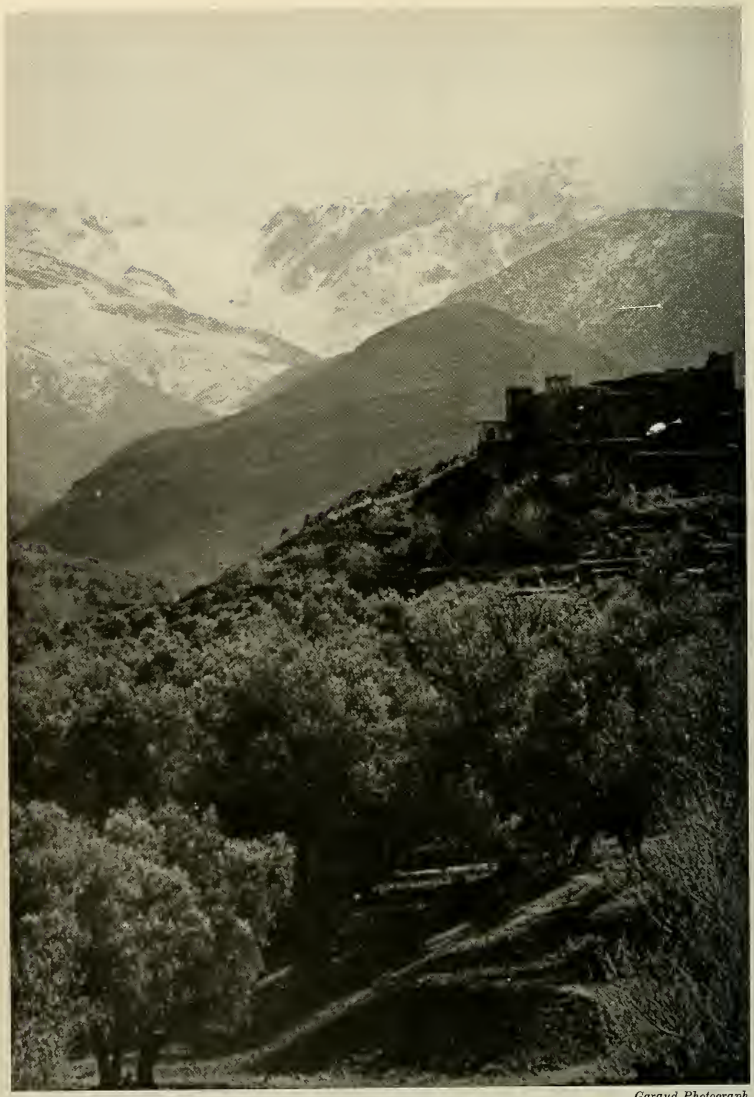
A. KATHERINE BERGER
Associate Editor

CONTENTS

Published bimonthly by The American Museum of Natural History, New York, N. Y. Subscription price, $3 a year.

Subscriptions should be addressed to James H. Perkins, Treasurer, American Museum of Natural History, 77th St. and Central Park West, New York, N. Y.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*



Garaud Photograph

THE ATLAS MOUNTAINS, MOROCCO

The fauna of Morocco attracts the naturalist for many reasons. There is a cool coast belt, a heated interior, and the great series of mountains known as the Atlas Mountains

(*See "The Wild Bees of Morocco" Page 310*)

VOLUME XXXI

NATURAL HISTORY

NUMBER THREE

MAY-JUNE, 1931

GORILLA: THE GREATEST OF ALL APES

The Adventures of the Columbia University–American Museum Expedition Collecting Gorillas in the Equatorial Forests of Africa

By H. C. RAVEN

Associate Curator, Comparative and Human Anatomy, American Museum

The Columbia University–American Museum Expedition to Africa was sent out in May of 1929, from the department of anatomy of the College of Physicians and Surgeons of Columbia University, and from the department of comparative anatomy of the American Museum of Natural History, to secure entire well-preserved adult gorillas and other African primates for anatomical study. The expedition was under the leadership of Mr. Raven, and included Dr. W. K. Gregory of Columbia University and the American Museum; Dr. J. H. McGregor of Columbia; and Dr. E. T. Engle of the College of Physicians and Surgeons. In August, 1929, two adult gorillas were obtained in the Kivu, and the party proceeded down the Congo to West Africa, where they hoped to collect additional gorillas and chimpanzees. Doctor Engle returned to America directly from the Belgian Congo, while Mr. Raven, Doctor Gregory, and Doctor McGregor went to the French Cameroon. At the end of one and one-half months, the two latter men returned to America, leaving Mr. Raven in the field until January of this year. In west Africa Mr. Raven collected three adult gorillas and three chimpanzees, all of which were embalmed entire and shipped to New York.—The Editors.

THE present range of the mountain gorilla is in the highlands of the eastern Belgian Congo and the Kivu volcanoes. Our camp in this country was west of the southern end of Lake Kivu, at an altitude of 7000 feet, on the slope and facing eastward over the cultivated country toward the lake. On a clear day we could see the hazy outline of the mountains on the far side, and on one occasion I could even see the volcanoes north of the lake. The forest began just behind our tents. This was mountain forest with rather low trees interspersed among a mass of succulent vegetation which was from six to fifteen feet high. Many of the trees on the highest slopes were covered with moss.

As soon as our camp was established I made daily excursions in the forest, accompanied by two or three natives whom I obtained in the neighborh . We found traces of gorillas, elephants, harnessed antelope, duikers, wild pigs, and buffalo, but we did not get close to any of the gorillas. The natives were not good hunters, and when we came upon signs indicating where gorillas had been feeding or walking, they were unable to say whether these signs were fresh or a few days old. Finally I managed to get some Batwa pygmies, professional hunters, to help me. It was delightful to go into the forest with these little people who understood the forest, whose home it was.

One morning when I had started out

AFRICAN EQUATORIAL FOREST
Over large areas the forest trees grow together so closely that they shut out most of the light from the ground beneath

with a couple of Bantu natives, two pygmies joined us and told us that gorillas had been feeding in a valley not far away. I accompanied them down the steep slope for nearly half a mile and up another ridge. The pygmies traveled much more quickly than the Bantu hunters I had had, and soon I was tired out. At the end of the steep climb of a half hour I had to sit down and catch my breath. Then we went on, up and down steep slopes, through the thickest kind of tangled vegetation, and finally came upon the trail of some gorillas, which we followed for perhaps a mile. Then we saw vegetation that had been trampled, stalks of wild celery that had been broken off and pulled through the teeth of the animals so that all the green bark and leaves were stripped off and eaten, while the perfectly white inner part, looking like a peeled willow switch, was dropped on the ground. After an examination of these switches, the pygmies turned to me and declared that gorillas were near, that this food had been eaten only a few moments before.

We proceeded very cautiously, one pygmy going before me with a peculiar combination sickle and hatchet, quietly cutting away the vegetation so that we could follow. We had gone along a densely covered ridge for perhaps one hundred yards when we heard a slight movement of the vegetation. On the advice of the natives I took the rifle from the boy behind me and went ahead more cautiously than ever. Suddenly and without the slightest warning there was the most terrific combination of screech and roar, stamping of feet and thrashing of underbrush, as a gorilla rushed at us. The vegetation here except for a few trees was dense as could be, and from ten to fifteen feet high. In order to get through we had been crouching down, often going

on our hands and knees. I was crouching when the gorilla began to rush, but in order to raise the rifle in his direction I had to back up against a thick mass of vines and weeds. The gorilla came like a cyclone until he was perhaps thirty or forty feet from us, when he suddenly stopped and was silent. The vegetation was so thick we could not see more than ten feet in that particular direction. We hesitated a moment, then I motioned the hunter before me to part the vines quietly and go forward. I followed, holding the rifle ready to fire. We came to the spot where the gorilla had stopped, but he was not there. He had turned about, retraced his steps a short distance, then taken a new course, and disappeared all without making a sound. By this time he was probably some distance away. We followed the trail as quickly as we could, first up along the ridge, then down the side of a steep ravine, until I was dripping with perspiration.

As suddenly as before, the gorilla rushed at us and stopped, and precisely as we had done the first time, we followed. On the brow of a ridge we came upon a very fine bed where this or another gorilla had slept the night before. It was about three feet in diameter, and was made of bamboo leaves. I would have stopped to photograph this had we not been in such hot pursuit.

That gorilla made seven similar rushes before he went down a very steep hill, across a small stream and over another hill nearly one thousand feet high. The pygmies then gave up and turned back, saying, "There is no use following him; he has gone too far."

Another day we had hunted up and down hill for hours without seeing any fresh signs of gorilla, though we saw many old ones. At this time I had only pygmies with me, no Bantus. Like the fine hunting people they are, the pygmies are ever on the alert to procure any food available in the forest. On this particular day, one of them who was ahead scouting called back to us, and when we came up to him, he was standing still, looking up at the

WHERE THE EXPEDITION'S SECOND GORILLA WAS SECURED
Here fourteen gorillas had slept. Some had made their beds or nests on the tangled lianas ten or twelve feet from the ground, while others had made theirs on the ground. Considerable clearing had to be done before the above photograph could be made

BUILDING A PHOTOGRAPHIC DARK ROOM

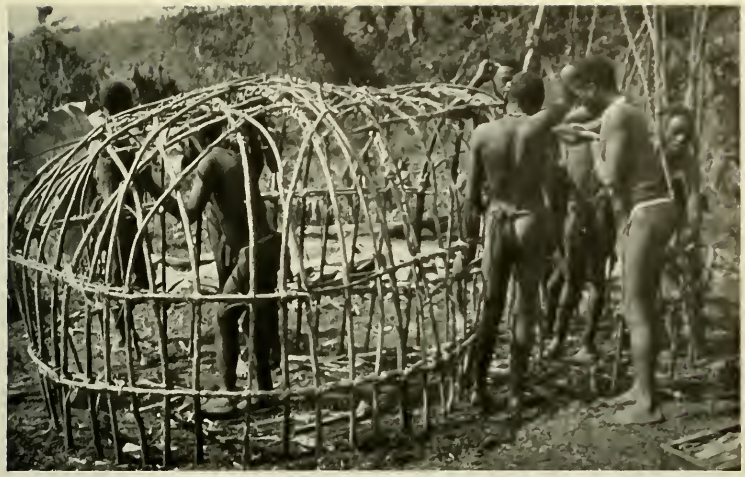
First, an outline of the floor plan of the structure needed by the expedition was marked off on the ground with a stick. The porters then gathered a number of green, flexible saplings that they thrust into the earth a few inches apart, following the outline

trunk of a tree about three feet in diameter. He told us he had seen bees go into a crack in the trunk and that there must be plenty of honey inside.

Well, the hunt was over for that day. The pygmies simply could not think of leaving all that honey there, and promptly went about collecting it. First they cut a sapling about four inches at the base; this they stood against the big tree, and then tied it with vines to the tree at intervals of several feet all the way up. While two or three were doing this, another had found and shredded some bark, which he lighted and waved about, making it smoke profusely. One man climbed to the very top of the sapling, waving the smoking bark, and reached his hand into the crack of the tree. He reported that there was honey there, but said he would have to make the hole larger in order to get his arm in. Another native carried up a little hatchet of his own making. With this he hewed at the crack until it was big enough to admit his arm.

By now, of course, bees were buzzing about his head and all around the tree, sometimes getting tangled in his kinky hair, so that he would have to stop working at the hive momentarily. We could see him bring out pieces of comb; the honey would drip down from his precarious perch while he chewed up the comb, spitting out the wax afterward. All the natives below were keeping up an incessant jabber, begging him to thrown down the honey, but he would only say "Wait," as he licked his fingers and arm.

It was not long, however, before he began to pass down pieces of comb to the native who had climbed up just below him. Then those on the ground would beg this man, "Pass down some honey," and like the one above, he would reply "Wait!" Finally there were five or six pygmies clinging to the sapling and eating honey. When they had removed all the honey from the tree and we had all had our



THE FRAMEWORK COMPLETED

To the saplings the porters bound, with bark and other vegetable fibers, two encircling bands of saplings. They then bent down the upper ends of the upright saplings and fastened them together to form the roof

APPLYING THE THATCH

The whole framework was finally covered with green plantain leaves, and the entrance covered with a blanket. As the plantain leaves dried out, additional ones were added. This made a serviceable dark room even on bright, sunny days

WILD HONEY!

The pygmies of the Kivu climb a big tree by lashing a sapling to it. They are here shown passing down honeycomb from a hive within the hollow trunk

small sapling, pulls it down, twists it under him, sits on it, and reaches for another. If it breaks off, he takes the piece, arranges it around him and continues to pull off, and twist around until he has made a nice nest or bed. Sometimes they undoubtedly walk a few yards to get the material for a bed, but as a rule, where the foliage is so dense, they simply sit down and pull the material about them.

After carefully examining the sleeping-quarters we followed on, dividing into three groups as the gorillas seemed to have done, but we had much difficulty in trailing them because elephants had been tramping all about.

One of the pygmies on my right suddenly spoke to the others, who darted forward as fast as they could go. I could hear the other pygmies, then the noise of an animal, then blows. When I reached them I found they had killed a wild pig that had been caught in a snare. After they had tied it up, two old men were left behind to carry it while we continued our hunt. Not more than a half mile farther on we could look across a little valley. On the opposite side a boy had seen the vegetation move and he was sure gorillas were there. We watched closely and, finally, with the binoculars I could see a black arm reaching up to pull down the bushes; We stole quietly down into the valley and then worked around so that we could come up-wind toward the feeding gorillas. We had first sighted these goril-

fill, the remainder was bundled up in leaves and we returned home; for after procuring the honey their enthusiasm for gorillas was gone.

Another day we had come upon the trail of a band of gorillas among some bamboos perhaps three miles from camp. We followed them for a long way until about 11:00 A.M. when we came upon the place where they had slept the night before. In an area twenty yards across there were nine beds, all on the ground on the steep hillside. It was easy to see how they had made their nests. The gorilla simply sits down among the dense foliage and with his long arms grabs a

las about noon, but it was 2:00 P.M. when we approached them. There were several, perhaps nine, as we had seen nine nests. They were quiet except for an occasional short grunt, indicating, I believe, that they were feeding quietly or perhaps telling their whereabouts to others of the group. They had moved slightly from where we first saw them and now were in low forest, the trees of which were fairly buried by lianas, many of whose stems were six inches in diameter. Underneath was a tangle of stems of thick undergrowth, so that in some places we could not be sure, on account of the irregularity of the terrain, whether we were looking at the ground or into the trees. There were many fresh signs of gorillas and we could see the place where one had sat down to eat. We felt the earth and found it warm; the animal had been there just a few seconds before. We were now right among them, and could hear them in three directions. Then I caught a glimpse of one in a tree, perhaps thirty feet from the ground.

I had with me a 30-30-calibre Savage rifle and also a 22-calibre rifle, the cartridges of which were less than an inch in length. In these tiny 22-calibre bullets I had drilled a hole and put in a small dose of highly poisonous potassium cyanide. If this actively poisonous substance could be introduced into the gorilla, whether his hand or head or body, he would drop dead within a few seconds. However, it was a question whether the heat generated in the bullet would not disintegrate the cyanide so that its poisonous action would be lost.

Using the 22-calibre rifle, I fired at the arm of the gorilla in the tree. Immediately there was a bark, screams, and wild commotion through the vegetation, as the gorillas rushed away. We rushed after them and found a few drops of blood from the one that had been hit. This one we carefully stalked. None charged or rushed at us; they were apparently

PYGMY HUNTERS

Pygmies of the mountainous region west of Lake Kivu, who assisted Mr. Raven in hunting the gorillas, usually carried a spear and a brush-hook

A GORILLA TRAIL

Gorillas and elephants live in the Kivu forest, and gorillas were seen walking on paths made by elephants. Gorillas do not follow the same paths day after day as hoofed animals do; they are more nomadic

thoroughly frightened. We followed cautiously until about 5:00 P.M., when we had to give it up in order to find our way to a trail before dark.

It was evident that the cyanide had not worked on the animal, but the question arose as to whether it probably would die before morning. Early next morning, therefore, we took up the trail again and followed all day. The gorillas had gone on feeding, including the one that had been hit. He was apparently none the worse for the wound, which of course was not bleeding on the second day. Probably that wound did not do as much harm as a bite from one of his friends, received in play, or a stab from a broken branch.

After several days of hunting near camp I decided to go farther up into the mountains to reach a place called Nakalongi. This was an all-day walk. I had with me several pygmies and a personal boy as well as a few porters. It rained most of the afternoon and was raining when we stopped at a little beehive-like hut high on the side of the mountain in a bean patch. To the west were hills covered with grass but in every other direction the hills and gullies were covered with dense forest. The natives immediately set to work to build for me a little dome-shaped hut of the coarse grass that grew round about. Its diameter was about the same as the length of my bed-roll but it shed the rain. Cold gray mist filled the valleys and often shut off everything more than twenty yards away. I ate my dinner at night crouched beside the fire with all the natives that could crowd in, then went into my own hut to sleep.

As soon as it was dawn we were up and shortly afterward set out to hunt. Most of the men remained in camp but four pygmies accompanied me. We first climbed up the mountain through a mass of cold, wet bracken, then descended into a ravine through virgin forest so dark that it seemed like twilight. After about a half-hour of walking, very difficult on ac-

count of the steep and slippery ground, we came upon gorilla tracks and saw the remains of chewed-up stems. The forest had been so cold and wet that it was impossible to tell whether the material had been chewed that morning or the day before. We followed on, however, and soon found tracks that had not been dripped on from the branches above. Farther on we saw signs that we knew were not more than a half-hour old. About an hour from the time we began to follow the trail we were passing diagonally down a steep slope toward a tiny stream. Across the ravine sixty or seventy yards away, we saw the vegetation move and we caught glimpses of an animal between the branches. Then we must have been seen or heard, for there was a sudden short bark. We followed across the stream and up the steep slope, climbing with difficulty where the gorillas could pass with ease. It was much more difficult for me, with shoes, than for the barefooted, strong-toed, unclad natives, and still easier for gorillas with powerful bodies, short legs, and long arms. Man's long legs are suited to the erect posture and not well adapted for going through underbrush, where he must be doubled up much of the time.

We were now getting close to the gorillas; we knew there was not a large troop, perhaps only three or four, but there was one big male among them, as we knew from the tremendous power in the bark he had given. The pygmies were nervous, saying that he would rush at us. We had gone less than three hundred yards from the stream and were still going through dense underbrush when suddenly the rush materialized with a terrific roar and shriek. The pygmy that was crouched down ahead of me, cutting

GORILLA BEDS

Gorillas usually feed until dusk, then, sitting down among the foliage, they use their long arms to pull down leaves and vines on which they rest in apparent comfort. In rainy weather they take advantage of shelter afforded by fallen trees and dense foliage

the vegetation, sprang back and raised his spear, while I stood ready to fire. But like the other gorilla, this one stopped short, and did come into sight, although there seemed to be more ferocity in this animal. We continued on the trail and in a short time he rushed at us again. This time he was directly at our left, not ahead of us. Here the forest was a little more open and we could see perhaps ten or fifteen yards, but still he did not come within sight though we could see the vegetation move.

Finally we started up the slope. One pygmy went ahead of me, holding in one hand his spear and in the other his little sickle. He passed beneath a fallen tree and I had just stooped under this tree when the gorilla, closer than any time before, gave a terrific roar. I was afraid I was going to be caught under the tree but I managed to step forward and raise myself. As I did so I could see the great bulk of the gorilla above me and coming straight at me. I fired at his head as I might have fired at a bird on the wing. The impact of the bullet knocked him down and I wheeled to the pygmies, yelling at them not to throw their spears. I feared they would spoil my specimen. But they in turn shouted to me, "Shoot! shoot!" The gorilla was not dead. When I looked around he was standing up like a man; it was plain to see that he was stunned. I fired again and he dropped lifeless exactly fifteen feet away.

A HUMAN HAND AND A GORILLA HAND

The hand of the gorilla compared with that of an adult Bantu negro man. Notwithstanding the shortness of the gorilla's thumb, it can be brought into contact with the other digits when the hand is flexed

This animal was the most magnificent I had ever seen, weighing 460 pounds. He was black and silver-gray, a powerful, courageous creature, determined to drive off intruders from his domain. Upon closer examination I found this giant primate as clean as could be. The long, shaggy hair on his head and arms was as if it had been combed only five minutes before. The silver-gray hair on his back was short and rather stiff.

Then came the time for quick action, for the specimen must be embalmed within a few hours. It must be got on to the trail, the trail must be widened from a

THE SECOND CAPTURE

The long hair on the arms and legs of gorillas is undoubtedly of considerable protection against thorns and nettles. This gorilla was one of the first two captured in the Kivu, and was photographed where he fell, but much time was necessarily first spent in clearing away sticks and vines. Mr. Raven, Doctor McGregor, and Doctor Gregory are shown with the specimen

foot to ten feet up and down steep mountains for about twelve miles. I sent a note to my companions in camp, telling them that I had secured the gorilla and asking them to send more porters. I sent another boy to call up the natives that had come into the mountains with me. While I examined the fallen gorilla, some of the pygmies were starting to make a bed or framework of saplings on which to carry him. These saplings were of strong, hard wood and very heavy. Three long saplings were placed about eighteen inches apart and numerous cross-pieces then lashed to them with vines. The gorilla was lashed on the top of this litter.

By about three in the afternoon we had the gorilla out on the trail where I could embalm him. We then wrapped him in a large canvas tarpaulin and made him more secure on the litter. I refused to leave him at night for fear a leopard or other animal might attempt to eat the flesh, so the natives made a little grass hut for me right there on the trail. More porters arrived the following morning and I detailed several to go ahead to widen the trail. The gorilla and litter together weighed more than six hundred pounds. However, the natives started off chanting and went along for some distance at fairly good speed. After getting my paraphernalia packed in the loads I followed and caught up with them as they were trying to get up a very steep incline, where there was scarcely any foothold among the rocks and mud. I had told them that we must reach camp by nightfall, but it was soon evident that this would be impossible. As a matter of fact, it took two and a half days, during which there were several severe electric storms that the natives claimed were caused by my having killed

the "king of the mountain forests." They said the same thing happened when someone killed a very large elephant. At night we simply had to sleep in the forest in whatever shelter we could make of leaves and branches, but it was always wet and cold.

Many of the natives ran away as soon as it got dark and I never saw them again, but as this was the main trail between Lake Kivu and Nakalongi, there were natives passing along at intervals, and some of these were persuaded to help carry the gorilla. When we arrived at camp we continued the work of preservation and all took part in the making of photographs.

The second gorilla was secured only three hundred yards from our main camp six days later. All members of the expedition took part in the various details of preservation of the specimen. There was material to be preserved for histological purposes, casts to be made of the hand, foot, and head, detailed measurements to be taken, etc. When we considered that the embalming fluid had penetrated the body thoroughly, the animal was bandaged, wrapped in blankets, and sewed up in burlap bags, these in turn coated with paraffin wax, and the whole again rolled in heavy canvas tarpaulin. A litter was again used to carry this specimen from our camp about four miles, and it was then placed in a motor truck and taken to Uvira, where it was shipped by steamer across Lake Tanganyika, then by rail from Kigoma to the coast, and put on an ocean steamer for America.

CARRYING THE FIRST GORILLA TO CAMP
This animal had to be transported about twelve miles to camp. Over much of the way the trail had to be widened from two to ten feet

A BEARDED FIGURE FROM THE RIO BALSAS, GUERRERO

A BEARDED MYSTERY

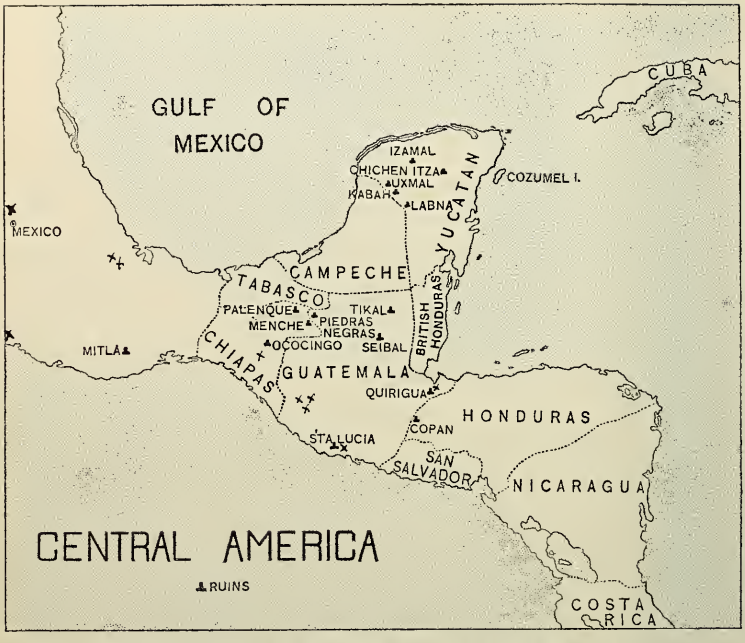
Considerations that Attempt To Establish the Source or the Authenticity of an Unusual Archæological Specimen from Mexico

By GEORGE C. VAILLANT
Associate Curator of Mexican Archæology, American Museum

THE detection of frauds and the identification of works of art not found in the main European and Asiatic culture streams are among the many duties of an archæologist. A development of the senses which enables one through long experience to detect the source or the authenticity of a specimen by its "feel" is the usual method employed. Intellectuality or actual reasoning is subconscious, and the trained observer reaches his opinion quickly. Yet to prove his opinion he must retrace his steps to search in the lumber of his memory before he can marshal the reasons for his decision. The attribution and validation of the bearded figure of clay which is the subject of this article offers a good example of this process, since highly technical considerations do not obtrude, and the curious reader may trace step by step—and vastly more quickly than in actuality—the impressions which led to the final conclusion.

Three years ago a gentleman brought into the American Museum of Natural History the figurine which is pictured in the headpiece of this article. It measured about three inches and a quarter in diameter, and was made of baked clay, pinkish in tone, which was covered with a slip of dark brown. The beard was painted black and a roughened space at the back indicated that though it had been modelled separately it must have been attached to something, perhaps a pottery vessel. The object had been found near Balsas on the Rio Balsas, a river which forms part of the boundary between the Mexican States of Michoacan and Guerrero, and was given by a peon to its owner who later most graciously presented it to the American Museum.

At first we thought it was a fraudulent specimen, but its oddness and individuality militated against this supposition. A fake is usually a copy of some existing specimen and embellished according to



MAP SHOWING THE DISTRIBUTION OF THE BEARDED FIGURES
The crosses indicate the locations in which the bearded figures have been found

the fancy and erudition of its perpetrator. But this head was out of the run of the Nahuan and Zapotecan sculptures that the unregenerate use as models for their frauds. By the same token it was not an example of the sculpture of either of those nations.

The features of the figurine were most unlike those of the various American Indian physical types. The long beard and mustache were very rare among New World aborigines and the flat blob of a nose was seldom depicted in the high arts of Middle America and Northern South America. Prominent cheek bones were a characteristic Indian trait, but the protruding eyes surmounted by heavy eyebrows were much less common. Although a tuft of hair adorning a shaven pate occurred among some of the northeastern tribes, their association with such a physiognomy as this was not known.

At this point in our examination we had ruled out the possibility of fraud, on account of the individuality of the specimen and the fresh quality of its execution. The piece was either indigenous to the New World or else it came from Asia, Africa, or Europe. If it were of Old World origin, it must have been imported to Middle America after the Conquest of Mexico, since no contact with a high Old World culture has been established anterior to that time. Such a piece as this would be easily transportable, and its oddness might have caused someone to

carry it with him as a pocket piece. The Spaniards, moreover, had a wide commerce with Europe, and also they traded out of ports in western Mexico into the Orient. Many Orientals furthermore entered Mexico during the last half-century, attracted by the need for cooks and laborers which the construction of railroads and the establishment of mines entailed. Yet the Rio Balsas is off the railroad and far south of the overland trade route to China. Thus the possibilities for intrusion of the figurine from the Old World are scant, but they must be none the less considered.

The figurine in its features suggests little that is Negroid. Moreover, Negro sculptures from Africa are confined, in general, to wood, to bronze, and to ivory. On the west coast in particular there does not occur any high development of sculpture in baked clay. Western Europe, on the other hand, yields a great variety of figures, and plastic portraiture is very common. From the Middle Ages on, grotesque figures were frequently made, and in Germany in particular an imaginative folk art reproduced the gnomes and trolls of the fairy tales. Yet the absence of color, the way the head must have been attached, the distinctly un-European methods of presenting the hair and the beard cause us to reserve judgment on a European origin for the figure until we have explored a little further into the more stable arts of communities less advanced. The grotesqueness of north European folk-art is gauged to the fancy of children and the simple-hearted, but this figure is so clearly mature that its interest must have been directed toward adults.

The Greeks evolved a conception of bawdy fellows frequently in their cups who pursued girls through the hills on summer nights. Yet these satyrs must have exerted a certain charm, for the protestations of the ladies against the uncouth gallants seem, from the vase paintings at least, to arise from coyness rather than from moral precept. The levity of satyrs is lacking in this serious face from the Rio Balsas. Although Greek and Roman minor sculpture fulfills the condition of earthenware figurines, and parallels such details of feature as a flat nose, shaggy brows, protruberant eyes, and a beard, there is more humor and less formality in their presentation than

GERMAN GNOMES
Many of the grotesque little beings of the German fairy tales are depicted with flowing beards

From a painting by Carl Gehrts in "Ehren Urkunden Moderner Meister"

A SATYR AND MÆNAD

Terra Cotta Figure. Photograph reproduced by courtesy of the Metropolitan Museum of Art

in the stiff seriousness of the Mexican figure. A lack of sophistication in modelling the expression of the face gives further cause to deny the specimen a Græco-Roman origin.

Monumental sculpture, governed by rigid conventions for the disposition of the figure, exists in the art of Mesopotamia, so that we might find there a source for our bearded figurine. The plastic of Mesopotamia, although skilled, is relatively unsophisticated, and human figures often wear long beards. But on comparison, our specimen is still homeless, for his nose is flat, while the Assyrio-Babylonian nose is high-bridged; his beard is simple, while those of the Mesopotamian sculptures are elaborately treated; he is sculptured in the round while the Assyrians are generally modelled in relief. Finally, he simply does not fit into their physical or artistic type.

The Buddhistic art of India and of Indo-China rarely depicts beards, and when such a representation does occur, it is perhaps attributable to Alexandrine or Persian influence. In China, however, bearded figures are found. Yet in comparing Chinese sculpture with the Rio Balsas specimen, we are immediately struck by the repose shown in the Chinese examples as opposed to the restlessness of the Mexican specimen. This contrast appears generally in the expression of the mouth and eyes, where age-long humanitarian philosophy reflects itself in the pensive beneficence of Oriental sculpture, while there is a staring brutality in the piece under consideration.

After having examined those Old World arts which are achieved and settled, we are unable to find a source for the bearded figure, unless we might find a parallel in the highly divergent arts of recent

CHINESE IVORY—FIFTEENTH CENTURY

Photograph reproduced through the courtesy of the Metropolitan Museum of Art

ASSYRIAN—NINTH CENTURY, B.C.

Alabaster relief from the palace of Ashur-nasir-pal, at Nimrûd. Photograph by courtesy of the Metropolitan Museum of Art

Europe. But since the specimen does not seem securely European, let us look farther in the New World, where we might find traces of its origin, as, indeed, the circumstance of its provenience led us to believe. Our search would naturally begin at the nearest point geographically to the Rio Balsas and would spread as necessity dictated.

No specimens of bearded figures are known from the states of Guerrero or Michoacan, as the archæology of the Rio Balsas is almost unknown. However, from Chama in Central Guatemala comes a very remarkable Maya vase, painted in colors to show a ceremony involving seven characters. Although the significance of the rite offers a number of conjectures, there is no doubt that two very important personages are involved, for, the fourth and the sixth figures from the left are painted black, a color sacred to the Mayas. The fourth figure is characterized by the high nose and retreating forehead of the Maya, and the three attendants standing behind him belong

VASE DECORATION FROM CHAMA, GUATEMALA

This specimen is in the University Museum, Philadelphia. (From Bulletin 28, Bureau of American Ethnology, "A Pottery Vase with Figure Painting from a Grave in Chama," by E. P. Dieseldorff)

to the same group. The next two figures (the fifth and sixth) possess flat noses and low foreheads, and the black figure approaching from the right has a full beard and shaggy eyebrows. The seventh and last figure in the group again is of Maya type like the first four. There is no doubt that the painter of that Maya vase was striving to reproduce two physical types, his own and another; and the foreigners are of the same group as the head from the Rio Balsas. The scene seems to resolve itself into the reception by a Maya chief and his court of a stranger whose attendant kneels before him while a Maya gentleman-in-waiting makes the sign of peace after the completion of the introduction of the two rulers. Thus the vase gives strong indication that a people existed of whom the little bearded figure from the Balsas is likewise a reproduction.

Another representative of this flat-nosed people was found by the School of American Archæology of the Archæological Institute of America during their excavations at Quirigua in Northern Guatemala. This vase has a human mask set against the side of the vessel. Bristling brows, protruding eyes, a flat nose, and a half opened, sneering mouth bear strong affinities to the Guerrero specimen, even though the moustache is absent and the beard reduced to a goatee. Since this vase came from a Maya city of the Old Empire and since the Maya sculptures represent their own facial characters of high noses, retreating chins and foreheads, and full lips, it is difficult to believe that they could have reproduced such a figure as this, had they not seen a living prototype. Both this Quirigua and the Chama vases were made probably near the close of the so-called Maya Old Empire, that is, not much earlier than 500 A.D. or much later than 1000 A.D. Hence, granting the vases are of Indian manufacture, there is no possibility that the artists could have seen

negroes in the train of Cortez. Moreover, the panoply of the priest on the Chama vase is certainly indigenous and not Fifteenth Century European.

To localize this racial type to a specific area requires more knowledge than we have at present. Yet some data are at hand. From Tepatlaxco, in the State of Vera Cruz, a stela was brought to the Museo Nacional in Mexico City, depicting a personage receiving homage from another. Both wear beards, but the erect figure shows once more the complex of blobby nose, moustache, and beard. Moreover, his mouth is opened enough to bare the teeth, offering a closer parallel to the Balsas specimen. A stone disc, without recorded locality but probably also of Vera Cruz workmanship, seems to represent this same group of features. However, the exigencies of creating a design in this instance blur

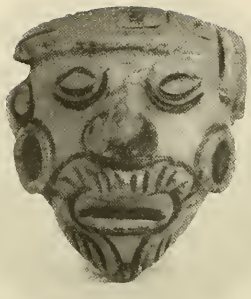
STELA, TEPATLAXCO, VERA CRUZ

Specimen in Museo Nacional. (From Batres, Leopoldo, *La Lapida Arqueologica de Tepatlaxco—Orizaba*, Mexico, 1905)

VASE, QUIRIGUA, GUATEMALA

Specimen in the St. Louis Art Museum (From *Art and Archæology*, Vol. IV, No. 6)

the characterization of salient points in the other specimens we have mentioned. Central Chiapas yielded a sympathetic figure of excellent workmanship, where yet another artistic technique reproduced a bearded face but in this case the striking points of the flat nose type are blunted, perhaps, by subordinating naturalism the better to achieve an artistic concept. Two little figures in jade now in the Trocadéro Museum offer the flat nose and full beard requisite for inclusion in the type. One is catalogued from Tula in Hidalgo, and the other simply Mexico. Their provenience lay more likely in Oaxaca or Guerrero since



SMALL JADE HEAD, MEXICO
Specimen in Musée de Trocadéro, Paris, through whose courtesy this photograph is reproduced

we have examined the greater part of specimens of native workmanship, conserved in museums, that show this complex of traits.

Yet these traits of a flat nose and a beard occur disassociated from each other with much the same general distribution as when together. In other words, sculptures exist of bare-faced people with flat noses, or conversely, individuals with beards whose nose is aquiline. Hence we cannot accept such portrayals as representing the type we just described. Figures with flat noses occur in Western Guatemala as the feet of pots, indicative perhaps of a subject tribe put under submission. In a religious sculpture from the center of jade distribution in Mexico lies there. Another seated figure in clay, from Quen Santo in Western Guatemala also depicts the racial type we have been considering, and its source falls well within the limits of the geographical area yielding such specimens.

From the data adduced in these pages it seems just to attribute the head from the Rio Balsas to an indigenous artist of pre-Columbian times. Yet we have reached our conclusion by examining both Mexican and Mayan material. We are left in the perplexing position of having the same physical traits portrayed by artists of several different tribal groups, who have evidently recognized a people different from themselves. Moreover,

SMALL FIGURE OF BAKED CLAY
From Libertad, Chiapas, Mexico. Specimen in the American Museum of Natural History

Santa Lucia Cosumalhuapa in Guatemala, minor figures offer to a deity the severed heads of four people, each perhaps a representative of a different tribe. One suppliant offers a flat-nosed head and another presents a bearded one whose nose, however, is aquiline. In his hand the god holds a head of the same kind. Possibly here we have a people offering their hostile neighbors as a sacrifice to their gods.

A great number of sculptures exist that show a chin beard and their distribution ranges from Nicaragua to the Valley of Mexico. An especially characteristic type of chin beard associated with a thin-lipped, high-nosed face is commonly

STONE DISC CARVED IN LOW RELIEF
Probably from southeastern Vera Cruz. Specimen in the American Museum of Natural History

POTTERY FIGURE FROM QUEN SANTO, GUATEMALA
In the Museum of the American Indian, Heye Foundation, New York, through whose courtesy this photograph is reproduced

depicted in such sites on the Pacific slopes of Guatemala as Pantaleon, E I Ba VI, and Santa Lucia Cosumalhuapa. In Plumbate pottery which had its origin in or near the Republic of Salvador this kind of face is frequently associated with the eye rings of the Nahuan rain god Tlaloc. The chin beard is found occasionally on Maya figures and on various sculptures made during the Mexican occupation of Chichen Itza in Yucatan.

The god Quetzalcoatl, who is associated with high culture in Mexico, is supposed to have had a beard and also to have been in the southeast of Mexico. Another south Mexican god Ehecatl wears as an attribute a beak which might have developed from the con-

ventionalization of a beard, a condition of some interest when one recalls the beaked figures of Nicaragua and the little jade statue with a beak from Tuxtla Vera Cruz which carries the earliest Maya date.

How far primitive sculpture as a guide to race can be trusted we do not know, but it is apparent that in some of the higher Middle American cultures there was a recognition of the physical characteristics of several peoples besides the Mayas and the Nahuas. It is indeed unfortunate that so striking a custom as the practice of wearing a beard is not to be detected in the skeletons of people who have passed away. The tribal affinity of the head from the Rio Balsas we do not know, but in our effort to establish its authenticity, the complex character of the peoples of Middle America may be more completely understood. It probably belongs to one of those groups whose names have escaped tradition and who may have broken the civilization of the Maya or founded the high development of Zapotec or Toltec arts. The great civilizations of the Aztecs and the Mayas are like flowers, but of the stalk which bore them and gave them nutriment we have scant knowledge. Who knows what discovery awaits us that may alter our entire conception of the unfolding of Middle American civilization?

CLAY RATTLE
From near El Baul, Guatemala. De Sosa collection

Gloucester's Memorial to the Men of the Fishing Fleet

THE FISHERMEN OF GLOUCESTER

Hardy Adventurers Who Wrest a Livelihood from the Treacherous Seas of the North Atlantic

By FRANCESCA R. LA MONTE
Assistant Curator, Department of Fishes, American Museum

MIDWAY along the esplanade at Gloucester, Massachusetts, stands a spirited statue of a Gloucester fisherman looking out to sea, in memory of the men who have never come back with their fleet.

Since Gloucester was first settled in 1623, fishing has been the principal source of her income, and here East India merchant captains used to land their small boats; here stretched the old rope walk; here were the old taverns and homes.

The wharves and the boats are larger now, but the main occupation of Gloucester is the same. In summer, sturdy men still unload their catches; the harbor is full of boats being outfitted for another trip, their crews cutting bait and overhauling the nets and gear. Miles of tarred nets hang up to dry along the sea front; ships are hauled out on tracks for repair.

You can walk along Hesperus Avenue and across the marsh to the Life-saving Station, from which life lines have so often been shot out over the sea in rescue, or you can climb to the upper part of the town to the Portuguese Church of Our Lady of Good Voyage, but no matter where you go, you are reminded of Gloucester's fleet and the men who are its sailors.

I was last in Gloucester in February. There were no summer visitors, and no artists; the water front was quite deserted; roads and wharves were inches deep in snow and slush, and a heavy snow was swirling down the main street. Inns and tea rooms were all closed, except the solid, warm hotel in which a very jolly Rotary Club meeting was in full swing. I was doomed to hear the chief joke of that meeting every time I came into human contact for the rest of my visit. The other joke which one never fails to hear there is about the innocent visitor who asked to be shown the "fishermen's huts," and was promptly driven past one after another of the large, neat, and far from inexpensive dwellings belonging to Gloucester's fishermen.

There are, however, one or two collections of residences which come a little

Courtesy of the Gloucester Chamber of Commerce

SOME GLOUCESTER FISHING BOATS TIED UP AT THE WHARVES

With the increased use of power, the smooth lines of the fast sailers of old days have gone. The fishing schooner of today carries only enough sail for stability and steerageway while jogging with her engine on the banks

nearer to that visitor's anticipation. These are the foreign settlements. In warm weather, the Sicilian quarter, for instance, down by the water front, is noisy, smelly, and colorful, and the Sicilian boats keep to their custom of vividly colored sails. But in winter the Sicilian, who hates to get his feet wet, seals himself up within his little house, and his door and window are tight shut.

In fact, in winter almost everything in Gloucester is tight shut, with one notable exception. This exception makes the night life of Gloucester somewhat more noisy than one might foresee, but after all, what fishing community has ever stimulated itself to activity on water?

The most active part of Gloucester in winter is the main street. Halfway down this thoroughfare and up a flight of stairs is the Master Mariners Association. Through a smoke screen on winter days the mariners can be seen here playing pool.

Emerging from the stairway into the smoke screen, I was obviously in the way in the most popular room, and was quickly escorted by the president into a most dignified and deserted inner room into which, a moment later, were ushered seven master mariners in varying stages of embarrassment. They seated themselves to be "interviewed," and it is uncertain who suffered most, I, trying to think of intelligent questions, or the mariners trying to get unobtrusively out of the room—in which effort three of them succeeded in an almost wraithlike manner. The remaining four finally discovering that I was merely paying an ordinary call, relaxed and gave me more information about their fleet than it was possible to absorb at one sitting.

Don't expect north-of-Boston fisher-

Courtesy of the Gloucester Chamber of Commerce

ABOARD THE "GERTRUDE L. THEBAUD"

The present holder of the Fishermen's Cup. The fishermen's races, originating in the rivalry between skippers as to who could be first into harbor with his catch, have become purely sporting events

IN THE GLOUCESTER HARBOR

Gloucester, although no longer a village, remains a fisherman's town. In summer the big harbor is active with the coming and going of fishing craft and the various activities of the large factories for the preparation of fish products

Edwin Levick Photograph

Edwin Levick Photograph

FOG ON THE BANKS

Summer fogs on the Banks take their annual toll of the fleet

men, or Nova Scotia men as a good many of them originally were, to be quaint characters. Fishing is a business requiring a very level head and an active and up to date mind. Most fishermen, captains and crew alike, start out too young to have had a finished school career, but this does not mean that they are uneducated. As a rule they are great readers, particularly of history and biography, and, usually, these particular fishermen speak better English than do many people in more intellectual occupations. The only characters really marking them as seamen are a ruggedness of complexion and build, and their keen, clear eyes.

Captains do not have to have any special qualifications; any one of the husky, independent-looking men in heavy reefers and seamen's boots waiting around for a chance to get in on the fishing, may eventually become skipper of a boat. Many of the captains own their own boats, but whether this is the case or not, while a man is captain he is absolute master and there is no interference with him either in equipping or managing his boat.

It cannot be desire for money that takes men into this occupation; the reward is too uncertain. Probably it is genuine love of the sea combined with a love of adventure. Maybe it is also the lure of the gamble involved, for the result of a fishing trip is a big gamble. The shares may be $600 apiece at the end of a few days out, or they may be only $6. I heard of one trip of several weeks which netted the men precisely $1.25 apiece.

The difficulty of wresting a living from the sea, and the danger of their work, have given the Gloucester fishermen a rather serious attitude toward life. They are calm, sturdy, and self-reliant, and many of them have a very deep-seated—and preferably well-concealed—religion, usually of their own eduction.

Almost opposite the Master Mariners Association is the Chamber of Commerce, one of the most active institutions in the community. At the time I was there, it was serving as a general adjustment

bureau. Issuing forth from an inner office, came a most cheery looking gentleman in naval uniform, addressed by a voice from within as "Commander." The Commander's son had apparently found a lonely firecracker wandering the snow-covered streets of Gloucester, and had set it off in a most inappropriate spot, with a resulting suspension from school. The Chamber of Commerce was tactfully arranging for his discipline and the further pursuit of his education. The next visitor was a fisherman, very ill at ease. There was a murmured conversation, then from the manager of the Chamber:

"How long have you been out of work?"

More murmuring, then:

"Now look here, we can't have that. Children can't walk around in this weather without proper shoes. Now just let me run across the street and get—"

A decided interruption from the sailor,

"I can't take that sort of thing. I've never taken charity and I can't. All I want is a couple of days' work."

Occasionally, during hard times like those of this winter, there are slack seasons for the fishermen, and their summer earnings do not carry them through. Various associations of seamen—the Master Mariners Protective Association, the Seaman's Institute, etc., and a local committee chiefly composed of the heads of the big fishery industries—try to take care of such emergencies, for fishing and the fishing industries are the most important things in Gloucester, and Gloucester must protect them and their workers in every possible way.

Gloucester has its fisherman "character." His portrait, very fine but in a rather "dressed-up" condition, hangs in

Brown Brothers Photograph

WINTER AT A GLOUCESTER WHARF

Back from the winter gales, the crew fork the catch into baskets which are hoisted by the deck engine out of the hold and on to the wharf

the main room of the Master Mariners Association. When I called on him last month in the apartment above his shop, I found him pretty well laid up with rheumatism. The story he tells is of a fisherman astray in a dory, his dory mate having succumbed to exposure and hunger, while this one rowed blindly on, his fingers frozen to the oars. He not only lives to tell the tale but in spite of the loss of all his fingers and toes, has made two solo trips across the Atlantic, one in a thirty-foot sloop, from Gloucester, Massachusetts, to Gloucester, England, and another in a twenty-five-foot sloop from Gloucester to Lisbon. His appetite for adventure still unappeased, he made a third but unsuccessful attempt from Gloucester to Havre—in a seventeen-foot dory!

I have an idea that Captain Blackburn has told his story many, many times, and it has been included in at least two books of Gloucester sketches, but either he is a very accomplished raconteur or he still really feels the horror of that fight for his life, and the thrill of those other trips. I don't know how old he is,—not young, and he has to use a crutch and a cane now, a very difficult thing for him, as only the stumps of his hands and the lower joints of his thumbs survived that first terrible exposure, but somehow I would not be a bit surprised to see him start out tomorrow alone in a rowboat for some distant port.

The backbone of the Gloucester fishing industry is the ground fishery, that is, the capture of those fish caught near the sea bottom,—cod, haddock, pollack, hake,

Publishes Photo Service Photograph

UNLOADING FISH

The catch is packed in crushed ice in the hold, which is divided into pens to allow sorting the different varieties

Brown Brothers Photograph

WEIGHING THE CATCH

After the fish have been pitched on to the dock, they are dumped into boxes on platform scales. A careful tally of the weight is kept by representatives of the captain and of the buyer

flounder, and halibut. This fishery is carried on chiefly on the banks, large areas of shoal water lying off the coasts. The principal banks fished by Gloucestermen are Georges, Browns, LeHavre, and the Grand Banks. The last are the most distant. In summer the Gloucestermen often meet the French fleet off the Grand Banks, and the summer fogs up there are the nightmare of sailors, for no matter how well the men and boats may be protected by the use of power and by wireless the sea still takes its toll of the fleet. Many Gloucester fishermen know what it is to go astray in a dory and to face death by collision or by storm.

Not all the fish caught by the Gloucester fleet are landed in Gloucester, for that community is chiefly concerned with prepared fish in various forms. The harbor is lined with the wharves and buildings of fish factories and their work forms another long chapter in the story of modern Gloucester.

The schooner is the most typical vessel of this fleet. There are also trawlers,—wooden or steel vessels run by steam or oil, and a third class of craft, the small trawlers or draggers which fish on the banks closer to the home port. In many cases these last are sailing vessels which have been modernized by the installation of an engine. The "Gertrude L. Thebaud" which won the Canadian-American Fishermen's Races last October has now descended to this somewhat inglorious station.

The schooner usually carries a crew of about twenty-five including captain, engineer, and cook. On its deck are nested the dories in which the men go out to put down the baited lines.

The men sleep in bunks in the forecastle, and in berths aft near the engine room. The fish hold is amidships. Women never go out on these boats except on a short trial run, or by mistake—as in the case of an aspiring authoress

who, her presence on board having been declined, embarked on the moving boat by means of a long jump (which in combination with her hurled suitcase overturned an able-bodied seaman), and by undaunted persistence, stayed on the schooner during a trip.

The meals on board a Gloucester vessel are excellent. I cannot describe the relish with which they were detailed to me by fishermen, beginning with "grapefruit for breakfast" and ending with "you couldn't get any finer in a big hotel."

The cook on one of these boats has a hard life, a fact which is obviously appreciated as he usually gets a bonus in addition to his share of the profits. Besides three hearty meals a day, he has to produce a "mug-up "whenever anyone feels hungry. A mug-up is a mug or two of tea or coffee, a large hunk of bread with cold meat, and perhaps a wedge or two of pie. Some one is hungry most of the time. In addition, the cook must keep the forecastle clean, and when the first dory or two comes alongside after a set he must hold the painter while the two dory men are pitching up the fish. If all the dories are out and the skipper needs help on deck, the cook has to come up and give it.

There is little sleep for the men, either. A trip may last a few days or a few weeks, but the routine is the same,—overside into the dory, lines set out, lines taken up, fish pitched over the side into the schooner, fish packed, gear gone over and prepared for the next day's or even that night's fishing.

Courtesy of the Gloucester Chamber of Commerce

HARPOONING SWORDFISH

Swordfish are lethargic fish and come to the surface to sun themselves. The fisherman stands in a "pulpit" erected at the end of the bowsprit of the schooner and throws his harpoon, trying to strike the fish in back of the large dorsal fin

Dory fishing is something beyond excitement and adventure. Imagine two men, in mid ocean in a fog or a storm, rowing around in a little fourteen-foot flat-bottomed boat, equipped solely with cumberous clothing and heavy fishing gear. If they go astray from each other or from their schooner, or if a large ocean liner suddenly rises above them out of the fog, what are their chances? Even the schooners are small enough to be in great danger of destruction by larger vessels. One of the most tragic accidents in the history of the Gloucester fleet happened in 1925, when a schooner was run down by a Cunard liner and thirteen men and the captain and a boy were lost.

Even getting overside from the schooner into the dory has its perils, especially in heavy weather—and the men go out in all kinds, even at night when they have to use torches to keep track of one another and their schooner. Try getting overside into a rolling little boat when you are weighed down with heavy woolen clothing, two suits of oilskins, seamen's boots, and the further disadvantage of not being able to swim if you miss connections, for many of these sailors cannot swim a stroke.

Yet in spite of all disadvantages and dangers, each year sees more boats added to the Gloucester fleet, and more men sailing out of her harbor to get their living from the sea.

Fishing equipment requires constant attention. This fisherman is reknotting the hemp ropes of his seine.

The seine is a large net with buoyed headline and weighted ground rope, used in catching haddock and mackerel

Courtesy of the Gloucester Chamber of Commerce

MENDING THE NETS

Damara Women From Near Lake Ngami

THE GREAT KALAHARI SAND VELDT

Picturesque Natives of the Desert Regions of South Africa

IN TWO PARTS—PART TWO

By ARTHUR S. VERNAY

ON "Lake" Ngami we found a Damara village—the home of an interesting people who had moved from southwest Africa into Ngamiland after the war. They are curiously picturesque and imposing in appearance—the women wear headdresses made of hide, of a form similar to that of a lotus leaf, with coats of antelope-skin scraped down to almost the thinness of a glove. This, coupled with the quantity of oil which the coats necessarily absorb from the wearer, causes the skins to fall in graceful folds.

Geological evidence and the distribution of the former molluscan fauna furnish proof that before the great changes in the earth crust of Ngamiland took place, the Okovanga emptied its waters into the Indian Ocean by means of what is now the Limpopo bed. At present the Okovanga flood waters are stored up annually against the eastern higher-lying portion of the Ngami fault. Toward the end of June the flood waters from the Angolan highlands arrive near the rift of Ngamiland. This year they were very late, and when we left the Kudumane River, which is one of the rivers feeding into the Thaumalakane, and eventually into Lake Ngami if there is sufficient water, the floods had not come within eighty miles of the Thaumalakane. This is a particularly bad year—there will be comparatively little water coming down, and it is presumed there will be no water whatsoever in Lake Ngami.

When the waters reach the rift, they form a huge delta composed of a series of streams whose channels are known as the shift. Most of this water is absorbed or evaporated, though sufficient quantities in certain parts of the swamps allow hippotami and crocodiles to remain there throughout the year. Of all the streams, only the Botletle may carry, at excep-

tionally high floods, some of the Okovanga waters into the Makarikari pan.

Of great interest are the stone axes, of probably late Palæolithic type, found near Gemsbok Pan in the Western Kalahari. Doctor Rogers discovered at Machumi Pan, south of the Mabeleapudi Hills, traces of primitive human settlement. Though the fragmentary bones and small pieces of chalcedony were imbedded in pan limestone four feet below the surface, no particular high age need be ascribed to them, as this kind of rock may form rapidly under favorable conditions. On top of one of the *kopjes*, the second highest of the Mabeleapudi Hills, Doctor Rogers also investigated a factory site of chippings of chalcedony and quartz. All these remains probably belonged to primitive types preceding the Bushman.

These discoveries prove for the first time that late primitive man invaded these parts of the Western Kalahari and Ngamiland, which most likely were provided with water that lasted throughout the year. He evidently did not reach the arid parts of the Kalahari. The observations made cannot furnish any support for the theory that the Kalahari may be the cradle of mankind.

During our journey extreme contrasts characterized the landscape; under the existing conditions the variety of living creatures is surprisingly great. Compare the almost monotonous aridity of the Kalahari and its nearly endless patches of grass, bush, and thorn veldt, with the almost equatorial luxuriance of the flooded Okovanga swamps, or with the charm of miles of Mopane forests, which remind one of the beech groves of temperate zones. On the other hand, there are in the central Kalahari the obscure traces of former river-beds, now hardly to be distinguished from the veldt except by the depression of the ancient stream-bed, but in Ngamiland one meets the strong currents of flood

DAMARA WOMAN

The women of this tribe wear a strangely interesting headdress which suggests the lotus leaf, and is made of leather

DAMARA NATIVES
Antelope skin which has been scraped until it is almost as thin as a glove fashions the coats worn by these women

water with its enormous stretches of reed beds, pools with water lilies, and groups of enchanting palms among the shoals.

In the Kalahari and Ngamiland the variety of animals depends directly on the changing features of vegetation. The open, more arid spaces form the habitat of springbok and gemsbok. More ubiquitous are the wildebeeste, tsessebe, and ostriches; in the Mababe Flats they are mixed with herds of zebras. In bush-covered regions eland, roan, sable, kudu, reedbuck, bushbuck, impala, wart-hog, and bush-pig are more or less numerous. On the veldt troops of elephant, giraffe, and buffaloes are attracted by fodder most suitable to their taste. The black rhinoceros trudges along, as a rule singly, but at times in pairs, in parts of the Okovanga delta, and becomes rarer every year. Sitatunga, lechwe, and pookoo naturally prefer swamps or roam about in their neighborhood. The lions, hyænas, wild dogs, and jackals are as much dependent upon the herds of game as are the marabous and vultures. The Okovanga and Chobe rivers still form the home of hippopotami and crocodiles.

In the whole of the area through which we passed we found lion not only prevalent, but very numerous. In fact, hardly a night went by that we did not hear them roaring around our camp, and we accounted for thirteen of them before we reached the Victoria Falls. It is interesting to note that the Kalahari lion appears to have a different coloration from the lion ordinarily found in Kenya or elsewhere.

The result of the expedition is that a collection which comprises 90 different species of mammals, 330 species of birds, 600 fishes, 2,000 lower invertebrates, 21,000 insects, and a large and important collection of botanical specimens, will be divided between the Field Museum, Chicago, the American Museum of Natural History, New York, and the British and Transvaal Museums. Some of the large mammals obtained were lion, leopard, gemsbok, wildebeeste, sable, brown hyæna, giraffe (*Capensis*), pookoo,

bushbuck, lechwe, springbok, wild dog, roan, Burchell's zebra (this is the true Burchell's, not the zebra generally found in Kenya). In the Orange Free State we also obtained groups of black wildebeeste, blesbok, and springbok.

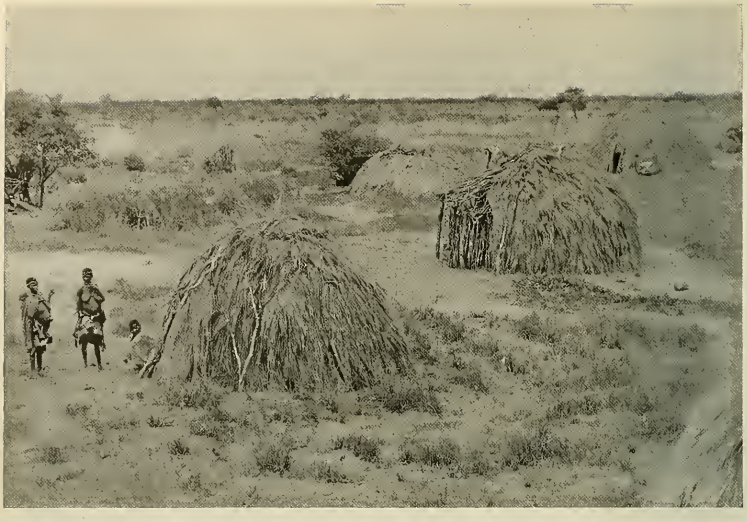
Apart from the collecting of these various specimens, the inhabitants were of great interest. Actually in the Kalahari, these consist of two tribes, Kalaharis and Bushmen.

The Kalaharis are the remains of the Bechuanas who emigrated many years ago. Some of them are of really magnificent physique, and distinctly different in type from the Bushmen. Many of them stand well over six feet. In the few villages which we came across, there were small cultivated patches of melon but no live stock of any kind. Apparently most of the hunting is done for them by the Bushmen, as they do not seem to be particularly energetic, or to have any other object in life than to be left alone to lead what appears to be a fairly pleasant existence. Some of the women we saw were wearing the ostrich-egg shell necklaces and head ornaments, which we ascertained had been bartered for from the Bushmen.

To us the more interesting of the two inhabitants were the Bushmen. Although neither pygmies nor dwarfs, they are very small, the average height of several of the women whom we measured being 4 feet 7 inches to 4 feet 8 inches, and that of the men, 5 feet. They are the true nomads of the Kalahari. Great hunters, their weapons are bows and poisoned arrows. No outsider has ever been able to ascertain how the poison is made. There have been many surmises, but as to their correctness there is no proof. It is said that it is made from the poison of the

A GROUP OF KALAHARIS

Both mentally and physically these natives are superior to the Bushmen who inhabit the same region



A VILLAGE NEAR GOMODINO PAN

The expedition saw small cultivated patches of melons, but no live stock of any kind in the few villages which they found occupied by Kalaharis

A KALAHARI WOMAN

From Koatwe Pan. The Kalaharis are the descendants of Bechuanas who came into the Kalahari region many years ago from the south

PREPARING SKIN FOR A GARMENT

Apparently most of their hunting is done for the Kalaharis by the Bushmen, as they do not seem to be particularly energetic themselves

A DESERT DWELLER

From Koatwe Pan. Many of the Kalaharis are of really magnificent physique, often standing more than six feet tall

FILLING OSTRICH EGGSHELLS WITH WATER
In so arid a region as the Kalahari Desert, water must be carefully conserved. Among the Kalaharis water is often stored in ostrich eggshells especially blown for the purpose

mamba and other snakes—and certainly there are enough in the Kalahari—mixed with the poison of tuberous roots. It is also said that certain beetles are crushed and used with the poison of the roots. The Bushmen are extraordinarily expert in the use of the bow and arrow, and can shoot very accurately up to fifty yards. Their method is interesting. They stalk the steinbok, duiker, or bigger game, and wound it with an arrow. After a hit, they do not immediately follow up the game, but leave it for several hours. The next day it is spoored up and, provided no lion or hyæna has already taken it, it lies there awaiting them.

I have seen natives in various parts of Africa and other parts of the world tracking or spooring animals, but the Bushman has a most amazing faculty, an extraordinary quickness of perception in seeing the spoor; he goes along at a jog-trot on the spoor, and in this way can actually run fifty miles a day. We ascertained quite definitely that they can run down such animals as steinbok and duiker by keeping on the spoor hour after hour, until eventually the animal is tired out and becomes their prey. This sounds incredible, but it is an actual fact. This method is more effectual with the steinbok, as, after continual running, its hoofs split, and the animal is unable to proceed. The meat of animals killed in this way, however, in hot blood, cannot be eaten by white men, for it is most unpalatable.

It is difficult to get in touch with the Bushmen, for they dislike and are afraid of strangers. In one particular instance, while scanning the country from the roof of one of our lorries, I espied two Bushmen about a mile away in the bush, apparently hunting for roots. I sent one of our own natives to spoor them up, while I watched from the top of the lorry.

It was not until our envoy was within a few hundred yards of them that the Bushmen realized they were being followed. They immediately dodged in and out between the bushes at incredible speed. Our native followed them for an hour or so without any result whatsoever. At another time we saw several Bushmen at a distance near a pan. Immediately they heard the noise of the motors, they ran like hares and disappeared. However, we eventually managed to get in touch with a few, and to attach them to our camp, for after they have once overcome their fear of the white man, they are excellent to have with one in the bush.

Tobacco was one of the most effective inducements we had to offer them and after that, a rug or an old shirt went a long way. Money was of no use. We had with us beads of various brilliant colors, but these did not appeal to them in the slightest.

Their greeting is a curious one, rather in the style of the Fascist greeting—the palm of the right hand held out in front of the face and passed several times across it.

They live in huts made of the branches of trees. These shelters can be made in a very short time, and in them they live while camp is pitched in one spot; when the camp moves on to another part of the country, they build another hut on the new site.

If you ask them to tell you where game is, they reply:

"There is no game."

GOING FOR WATER

Often when a Kalahari woman goes to a near-by "pan" for water, it is necessary for her to care for her baby at the same time. She solves this difficulty by carrying the baby on her back with the ostrich-eggshell containers

A BUSHWOMAN
Several men of the tribe to which this woman belongs claimed to be of great age. One man was credited with 120 years

If you ask them where water is, they say:

"There is no water."

You may be dying of thirst, but they will not surrender a single drop, although they probably have stored away a number of ostrich eggs filled with the precious liquid.

They are able to endure—and for that matter, so are the Kalaharis—great thirst, and if they have no water, they pulp up the inside of the Tsamo melon, which forms a very pleasant liquid refreshment, although somewhat thick. This is the melon which, with other tuberous roots, keeps the game alive during the dry period. And when the Tsamo melon fails, as it does at certain times, the suffering of both man and beast is intense.

When any member of the family dies, his body is buried a foot or so under the ground, his hut is burnt down, and the village, if it may be so called, moves on.

Their method of making fire is with sticks—one long one, jointed at one end, is put into a thicker piece of dry wood, the long stick is twirled round in the hand, boring into the soft wood, making an inflammable powder, which after a few minutes begins to smoulder, and then bursts into flame.

They apparently never wash, water is too scarce, and the result is that through the dirt one can see the lighter color, almost yellow, of the Bushman skin. Many of them have the appearance of a true Mongolian type.

The women have to attend to the supply of water, which is stored in ostrich eggs. They go down to a pan with a quantity of ostrich eggs in skins on their backs; very often a baby is in the same bag. With the shell of a tortoise they fill the

A NATIVE GIRL
Photographed near Gemsbok Pan. The Bushmen are physically much smaller than the Kalaharis

ostrich egg through a hole about half an inch in diameter, and then stop up the hole with a tuft of grass. The eggs are taken back to the village, and carefully concealed.

The sentiment of gratitude does not exist among them; neither have they, we are told, much affection for children—in fact, it is known that during certain very bad times, when the Tsamo melon had failed and conditions had become serious, children had been killed in order to economize in food and water. When an animal is killed, nothing is wasted, even the bones are crushed for the marrow; and the large sinew that runs down the back is saved for gut for their bows and arrows, axes, and similar equipment.

TWO HANDFULS OF STORK

A Kalahari Bushman photographed about eighteen miles east of Gomodino Pan. The birds he is holding are young black storks

They will eat almost anything and the bullfrog which has already been spoken of, is a delicacy. When this great frog estivates, he burrows down into the roots of bushes, and stays there during the long dry period. In due course a large spider weaves his web right over the mouth of the burrow, thus protecting the bullfrog, and at the same time allowing him a certain amount of ventilation. It is, however, no protection against the Bushman. He sees the web, and brings out the bullfrog.

Mice of various kinds are exceedingly plentiful, and are esteemed as another delicacy. The innumerable snakes, too, which are found in the Kalahari must enjoy the mice and rats, of which there are thousands.

Bushmen never cultivate the soil, nor do they rear domestic animals. Being hunters and nomads, they live on game, roots, beans, and wild fruits found in the bush.

They have a distinct sense of humor, and if anything appeals to them as amusing, they will jump, clap their hands, and burst into roars of laughter. The pipes they smoke are just ordinary tubes, made of iron, wood, or horn. The pipe is lit with the fire stick, a few deep puffs are vigorously inhaled, and the pipe is then passed on to the next man, who rubs it a little between his hands in order to

MR. VERNAY MEASURING A BUSHMAN

The average height of the Bushmen measured by the expedition members was five feet. The women were several inches shorter

cool it. He too, has his smoke, and it is again passed on.

In July and August, when the ostrich is breeding, the Bushmen collect as many ostrich eggs as possible. The cock bird sits during the night while the hen is feeding, the hen taking her turn at sitting during the daytime. Across a stretch of fairly open country it is not difficult to see the long neck of the bird apparently sticking out of the ground.

The Bushmen are not very expert with traps—by no means so expert as the natives of Burma and Siam, but they have certain snares which seem to produce fairly good results.

Space is insufficient to describe the many customs and curious habits of these people; but it is a marvel how they can exist in a country which contributes so little to the comforts and needs of the human being.

I have spoken of a lorry making only five miles in twelve hours. The work was most arduous, and the highest praise is due to Mr. Dowthwaite, who was in charge of the mechanical staff, for his perseverance and good nature during many periods of heart-breaking effort. Those acquainted with sand dunes know how firmly the force of the wind packs the sand, so that one may ride on fairly hard ground to their very summits. All the grains of sand not contributing to the compactness are apparently blown over the top of the dunes. Thus, on the leeward side, the sand is exceedingly loose. Probably it is composed of granules that will never pack.

Almost everywhere our naturalists found themselves on new paths of discovery, surprise, or admiration. Their eagerness to delve into the secrets of this part of the earth's history, the plant and animal life, and their friendly exchange of opinions created an enchanting atmosphere during our travels. Their hearty coöperation and the steady increase of authentic data and valuable collections made our camp, which in itself was a

A GROUP OF BUSHMEN

These people are nomadic hunters, and do not cultivate the soil nor rear domestic animals. The women, however, gather some roots, beans, and fruit

A BABY'S TRANSPORT ON THE KALAHARI DESERT

These desert dwellers are generally thin and wiry, and are capable of great exertion

A NATIVE BLIND

This blind, erected by Bushmen, was photographed by the expedition near Kanke Pan

small village, a most interesting place; and at the evening meal, when fourteen sat down to supper, the discussions on the results of the day, and the prospects for the morrow, made the hours pass rapidly and pleasantly.

Our expedition was an interesting effort, but there is still much to be done in this great area. Altogether, with the time at our disposal, we feel that owing to the intensive campaign which was carried out and the activity shown by all the members of the expedition, the ground has been fairly well covered, and it is with a feeling of great satisfaction that we recall our crossing of the Kalahari and going through to Livingstone within a period of three and a half months without one day's sickness occurring to any of the expedition, or any untoward incident.

Our expectations have been more than realized, the expedition has been successfully completed, and the scientific results and the value of the collections are gratifying from every standpoint.

The use of traveling is to regulate imagination by reality, and instead of thinking how things may be, to see them as they are.

—Samuel Johnson.

BUSHMEN ARCHERS

Photograph by Brown Brothers

A Bit of New England Shore

AT THE SEA SHORE[1]

Homes and Habits of Some of the Animals of the Sea Shore—A Hunting Ground Teeming with Treasure for the Naturalist

By PAUL B. MANN
Associate in Education, American Museum

THE conjunction of the sea shore with the salt water, encroaching or retreating under the influence of waves, storm, or tide, produces a region of unending and kaleidoscopic interest to the naturalist.

Many of the plants and animals are steadfast residents of their various haunts throughout the year. Others hibernate or migrate to avoid the rigors of a winter which makes adamant and impenetrable the once oozing mud and the shifting sands. The sea wrack, flung on the beach as the aftermath of a storm, will be sure to contain exotic treasures like the Portuguese Man-of-War, jellyfishes and shells, or even a huge blackfish,—foreign perhaps to that immediate shore, but related because part and parcel of the abounding ocean.

Animals like sponges, oysters, and mussels, which cannot migrate because they are anchored with self-imposed links, together with slow-crawling forms like sea urchins, are sometimes called "benthos." To the active and free-swimming organisms the term "nekton" may be applied. A third term, "plankton," describes animals, often minute, which float close to the surface. The animal organisms of the sea can all be classified under one or the other of these terms. Just as the wide distribution of bird life is dependent, somewhat, on environmental factors, so the organisms of the sea shore are sensitive both to the temperature and depth of the water, as well as to food supply. The animals of the shallow water near the shore are often called "littoral," in contrast to the "pelagic" forms living in the ocean far from land. Deep sea forms are called "abyssal." Sometimes abyssal

[1]A chapter from *Out of Doors—A Guidebook to Nature*, by Paul B. Mann and George T. Hastings, to be published by Henry Holt in the fall of 1931

Photograph by Miss Gladys Parker

FASCINATING NEW STRETCHES OF TERRITORY ARE EXPOSED BY THE EBB TIDE
These are rich hunting grounds for the naturalist interested in studying the animal life that must adapt itself to the constant advance and retreat of the waters

forms which normally seem to prefer the cold depths of the tropical oceans, may be found in the shallower waters of northern seas, if they find there a temperature to their liking. Such an animal is the English whelk found in the cool waters of the New England coast north of its accustomed latitudes. Probably to an extent far greater than we are yet aware, temperature and food supply are determining factors for much of the life of the sea shore.

The character of the shore itself is of great significance. Sandy shores with lagoons, rocky ledges with tide pools, mud flats, and coral strands are four types of shores, each characterized more or less by distinctive organisms. Mud flats may not be so enjoyable to explore, but they are overflowing with animal life well worth investigating. Eelgrass is usually abundant and the mud beneath it harbors a multitude of creatures such as marine worms and other small organisms. Such shores are treacherous because of deep pockets of soft mud here and there on the bottom, and because of the danger of cutting one's feet on shells.

Sandy shores are perhaps the commonest from Cape Cod southward. The exposed beaches of pure sand are relatively barren, though characteristic species may be found near and below the low tide limit. The most productive regions are the sandy mud flats where the sand is somewhat darkened by combination with fine particles of mud. Here, great numbers of forms find homes or temporary concealment beneath the soft contours of the sandy mud, the fine texture of which is pleasing to the touch and easily retains impressions of all sorts for the sleuthing naturalist to consider.

Sandy shores having a rather precipitous slope to the bottom are not the best for our purposes. A shore of gradual descent is preferable; still better, a region where the ebb tide makes a profound difference in the amount of new territory exposed.

The strange inflood and retreat of waters constituting the tide may amount

to a difference of as much as ten feet in vertical measurement between levels thus produced in a constricted area such as Cape Cod Bay. Twice a day this phenomenon takes place. There is no escape; animals must adapt themselves or perish. Some mollusks simply close their shells, or if univalve, withdraw into the shell and close the entrance with a protecting operculum. Many more organisms, however, will burrow into the moist sea bottom and thus avoid the dangerous exigency of being exposed to the air. Some animals wait in the tide pools around rocks, others hazard the wet strands of eelgrass, now lying flattened,—inert compasses pointing in the direction of the ebbing tide.

In studying the life of sandy sea shores, it is important to observe every mark or disturbed condition, because each trace is a telltale to keen eyes. Footprints of birds, furrows of clams, grooves of undulating worms, indentations of crawling crabs, blowholes of buried mollusks and round holes drilled in abandoned snail shells, all have stories to tell to those who will take the trouble to investigate. Let us take our notebooks and go down to the shore. If we expect to collect and study any of these forms, we should also have a pail, shovel or old iron spoon, long-handled net, sieve, strong knife, hand lens, and several small bottles. A pair of good field glasses is necessary for studying shore birds.

Wild grape, wild rose, beach plum, beach pea, milkweed, false cranberry, and reindeer moss grow down as close to the high tide level as they can. Where they hesitate, the beach grass, here solitary and there in clumps, wrests a precarious living closer to the water. Some of these plants have marked the sand with a tiny,

Photograph by M. C. Dickerson

A MUDDY BEACH

In the sandy mud flats hide great numbers of marine worms and other small organisms such as are shown on page 278

indented circle where the tip of the leaf has bowed to the winds and swung back and forth in its fixed arc. Near by are masses of Russian thistle; over there is a kind of spurge, and close by is a rampant pigweed,—all strange visitors. It seems a miracle that any plant could live in these hot sands. Yet several allied forms may be found if one searches. And where it is not so sandy and is distinctly wetter, one may find sea lavender and even cranberries mingling with reeds, rushes, cattails, sedges, and grasses. As we walk along, mottled grasshoppers become apparent as they launch themselves into the air, but seemingly disappear when they alight, for when they are quiet, the eye cannot distinguish them from their sandy environment.

The sticks and timbers projecting from the sands are smoothed by nature's sand blast as though some Old Man of the Sea had used them for his own through the ages. The frosted window panes of life-saving stations bear similar testimony to the effectiveness of the wind-blown sand. The contour and physical character of the beach itself may be changed from season to season by the fickle winds, especially when aided by a nor'-easter. Dunes may come, and dunes may go, unless held intact by beach grass or other vegetation; but the life of the shore is adaptable to such minor fluctuations in environment, and will be found fairly constant.

The shore is likely to be covered by windrows of "sea weed," so-called; really the brown or bleached leaves of dead eel-grass cast on shore by waves and tide. Turn over a clump with your foot or stick. Out of the moist layers leap innumerable sand hoppers or beach fleas.

MARINE WORMS AT HOME

A detail of the Annulate Group in the American Museum. This illustrates the kinds of life that exist within the mud and sand of a sheltered harbor bottom like that pictured on the preceding page

Photograph by Paul B. Mann

A PIPING PLOVER'S NEST

Just a slight depression in the sand satisfies the piping plover's demands for a nesting site. The sand-colored, mottled eggs blend so effectively with their surroundings that they need no further concealment

Perhaps a green crab will scuttle back under a protecting mass.

A further examination of the shore may reveal some mermaid's-purses,—those strange egg-cases of the skate: curious, swollen, black, rectangular objects, with a tendril-like extension at each corner. The split across one end shows how the young occupant got out. In certain localities, and especially after a storm, the string of seedlike capsules of the channeled whelk, or the compact egg-cases called "sea corn" may be found. Sand dollars may be picked up, brown with tiny spines if only recently exposed, or white and smooth if old, revealing the symmetrical rows of perforations through which projected the tiny ambulacral feet. Here and there will probably be found clear or brown or purplish masses, the remains of jellyfishes stranded on the shore by the waves. If we look for them when we return, we may find nothing more than a moist spot on the sands, since they are about 99 per cent water and dry down to an impalpable film.

If tomorrow you chance on tide-pools of a rocky shore, you will see many of the same forms, with some additions. Sea urchins may be seen moving about like living pin-cushions in the midst of hydroids, resembling animated plants. Starfishes, caught out of water by the hot sun and killed by exposure, are slowly drying. Whether the shore is rocky or sandy, periwinkle shells of many species will be in evidence as we approach the water, which harbors many millions more of these small univalves. Fiddler crabs, the burrowing crab Hippa, sand crabs, and other crabs will be encountered. In some localities many beautiful shells may be picked up, as well as bleached sponges and occasional corals. If we use our spade or iron spoon, we begin to realize that the shores, which appear so empty, are teeming with hidden life. In the mud flats the *Nereis* or clam worm, the richly colored opal worm, the slender "red thread," the fierce "four-jawed worm," the ribbon worm, the tiny "blood spot" and other tubeless worms may be easily

ANIMALS OF A TIDE POOL

Here purple snails and their eggs are surrounded by rockweed, while mussels crowd below them in a dark mass. From the Tidepool Group in the American Museum

caught by washing the mud through a sieve. The "four-jawed worm" and clam worm are carnivorous and their bite should be avoided. There are other worms which construct a tube within which they live. One of the commonest is the tufted worm, which builds a leathery, U-shaped tube. Another, the shell worm, secretes the little, white tubes which are so frequently found zigzagging over the outer surface of marine shells. Spirorbes are tiny worms which make little coiled tubes slightly larger than a pin head. They are usually found attached to *Fucus* or to eelgrass.

On rock-bound shores an abundance of life clings to the surface of rocks normally submerged but exposed when the tide ebbs. Oysters may be found in profusion attached toward the base of the rock or on shelly bottoms. Wherever the black-ribbed mussels can get a foothold, they, too, hang on as for dear life by skeins of threads called byssus. Above them, and also growing on both mussels and oyster shells, are hosts of white-shelled barnacles. The upper flanks of such rocks will undoubtedly be covered with mats of *Fucus* or rockweed, one of the brown sea weeds. Great streamers of kelp are found along some coasts. Formerly most of the world's supply of iodine came from these plants. Various-hued sea anemones should also be common here below the low-water mark. Leave them undisturbed until each expands its tentacles like an unfolding bud of innumerable stamens. The strong knife will play its part in loosening such specimens as may be desired.

Photograph by M. C. Dickerson

A COMMON STARFISH

Starfish wander continually among the waving seaweeds of rocks and warves in search of delectable sea mussels and other mollusks

The old wharf yonder looks as though it might repay a visit. Some of the boards may be gone from the top, but the piling seems solid enough. What masses of colored creatures cling to its flanks when we peer through the water surface below the lowest limit of the receding tide! Barnacles with their white cockades, mussels in black and purple profusion, sea squirts or tunicates with two protruding openings, tiny red and yellow sponges, mats and floral designs constructed of living anemones and delicate hydroids, encrust the entire outer surface. And within the old piles, we suspect, are plenty of shipworms, prisoners in their strange tunnels, whose devastating tubes, pushed deeper and deeper though never intersecting, can disintegrate and ruin wood exposed to sea

A CORNER OF A TIDE POOL

In the center are shown a number of sea anemones which have contracted, withdrawing mouth and tentacles within their bodies. From the Tide-pool Group, American Museum.

Photograph by M. C. Dickerson

SEA ANEMONES

As beautiful as flowers, these are really voracious animals with the tentacles that encircle their mouths armed with sting cells

water, faster than the millions of bacteria of decay, bent on the same purpose. If we watch long enough we may be rewarded by seeing a jellyfish or two, idling slowly through the water with frequent pulses of its tenuous cup of jelly. If it has long tentacles, do not touch them, for those streaming filaments are armed with hundreds of sting cells.

The bird life of the sea shore is characteristic. Sand pipers are probably as sociable as any of these birds, and they are most interesting as they feed, incessantly agitated, taking to wing on alarm in a group that banks and turns as one bird. Herring gulls, the most abundant of the larger gulls, are conspicuous in the winter everywhere along the Atlantic coast, straggling south during the summer and autumn. In the spring they go north

Photograph by Frank M. Chapman

YOUNG NIGHT HERONS

Their parents have gone to the sea shore for food. Crows, blackbirds, and certain sparrows will visit the shore for the same reason

to their nesting grounds. Their continuous, cackling squawks, especially over food exposed on flats by the low tide, are a characteristic sound on many sea shores. The dark-headed laughing gull is much more common during the summer. There are other gulls and there are terns, frequently mistaken for gulls, but distinguished from them by the possession of a more slender body and a definitely forked tail. Skimmers, shearwaters, plovers, and curlews, sooner or later will be observed, though probably not all on the same day. In many regions, herons—especially the little night heron,—and crows make regular trips to the shore for food. Blackbirds and certain sparrows sometimes visit the shore for the same reason. Birds of inland, freshwater localities, such as the loon and various ducks and geese, may be seen frequently during their migrations in spring and fall.

On some of your wanderings along the shore, you may have the good fortune to discover the nesting place of one of the shore birds like the piping plover. The bird utilizes a slight depression in the sand and there the spotted eggs are laid without any attempt at concealment more than their excellent protective resemblance to the surroundings.

Sometimes sand bars are exposed offshore at low tide, and are worth investigating, especially if to reach them one has to wade through intervening shallow waters. Don a bathing suit and put sneakers on your feet to avoid possible cuts from shells. How strange and how difficult it is to walk through water! Wherever you traverse deeper pools, frightened killy fishes, the minnows of the sea, dart for the protection of the surrounding eelgrass. With good luck you may surprise a flounder, and capture it, too, if you are alert with your net. Here on the sea bottom may be picked up some of the frail sand collars or Tom Cod houses, the strange egg-cases of the Lunatia (Polynices) snails, resembling lamp shades. They are somewhat tenacious while wet, but after they have dried in the sun and air, they crumble at a touch.

Crawling everywhere and fighting continuously with one another, are hermit crabs of varied sizes. A purple lady crab or a spider crab edges away. In some pool timid squids may be seen, suffused with changing colors. Catch one in the net, and holding it by the body now out of the water and now in, get it to shoot ink forward through its siphon. Under good conditions, a squid may be induced to throw a stream of inky water ten or fifteen feet. Avoid a bite from the parrot-like horny jaws. The female squid hangs her eggs from eelgrass or other sea weed in long fingers of jelly, from which the little embryos escape after hatching.

The omnipresent eel grass is one of the few flowering plants growing in salt water, and its long, floating leaves afford a relatively safe home to myriads of creatures. Tiny shrimps and prawns cling to the swaying leaves, and scallops make their brief spurts as we approach. A bubbling hole may betray a soft-shelled clam, a quahog, or a razor-shell clam. Possibly you can get the razor-shell to show you how it goes underground, pushing its muscular foot down below, then anchoring it by swelling it full of blood, and suddenly yanking the rest of the body down an inch or two. With a series of such jerks it rapidly disappears.

Gently pick up one of the larger sea snails abundant everywhere, and tap its broad foot. You will be amazed at the sudden reaction. Quantities of water will be shot out, an extraordinary amount of living tissue pulled quickly within the shell, and the opening sealed with the horny operculum. You continue to wonder how such a large animal could completely withdraw into such a small shell.

Pick up any old stick that has lain in the water a long time, and perhaps you may find it harboring forms like planarian worms, ascidians (sea squirts), delicate

Photograph by Frank M. Chapman

YOUNG LAUGHING GULL

The laughing gull is common among the bird life of the sea shore during the summer. The plumage of this young gull has not yet acquired the coloring of an adult bird

THE LARGEST OF OUR CRUSTACEANS
The lobster is a great burrower, digging with its claws holes into which it backs tail first
Photograph by M. C. Dickerson

plantlike hydroids, polyzoa, sponges, and possibly sea urchins, besides showing evidence of the internal borings of the shipworm.

Perhaps you may find a horseshoe crab moving slowly away from the zone of danger, or burying itself in the oozing sand. It is a venerable descendant of ancient types, a kinship obvious when the related fossils are seen. Before you let it go, loosen with the knife one of the flat shells with which it is fairly covered. You have in your hand a decker or shelf-shell (*Crepidula*), and its living inhabitant. Find the "shelf" at one end.

Such specimens as you want to exhibit alive may be temporarily kept in your pail. A marine aquarium is rather difficult to maintain unless you have running sea water, or an aquarium directly connected with the sea, or plenty of oxygen-producing plants like sea lettuce. Otherwise, small animals are likely to die, and the water then quickly becomes polluted, especially in hot summer days. By frequent observation and prompt removal of any dead animals and by changing the water twice a day, a temporary salt-water aquarium without any oxygen-producing plants can be conducted long enough to display many of the living marine forms described in this article. It would be a sad mistake, however, to attempt to crowd many animals at one time into such an exhibit. After it is set up and the water has cleared, it will be of particular interest to watch the rhythmic, muscular movements of the foot of the snail, as it crawls up the inside of the glass; to note how the starfish or sea urchins use their tubular feet in locomotion; to see the row of steel-cut, beaded eyes just inside the mantle of the scallop,

A BLUE CRAB
This edible crab, when caught just after molting its heavy armor, is the familiar "soft-shelled" crab
Photograph by M. C. Dickerson

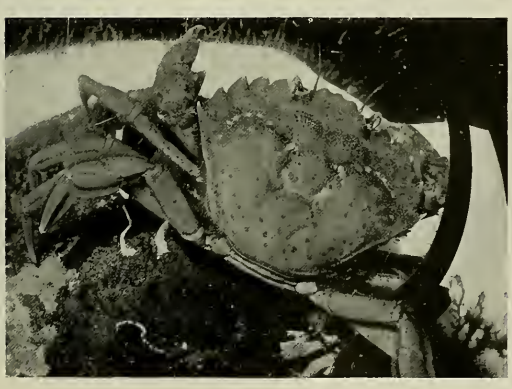
THE FIDDLER CRAB
Shown at the entrance to its burrow, which is often a foot or two deep. The crab uses its walking legs to scrape out the mud
Photograph by M. C. Dickerson

and to observe the activities of shrimps, prawns, and other marine forms.

If any specimens are desired for permanent collections, they should be immersed in a solution of alcohol, or 5 per cent formaldehyde, changed after a few days to a fresh solution made by adding 5 parts of strong formaldehyde to 100 parts of water. Keep bottles or jars tightly corked to prevent evaporation. Delicate specimens may be narcotized in a solution of magnesium sulphate (Rochelle salts) and sea water.

Wrap individual specimens in cheesecloth or muslin, and for extra precaution place them in a large cloth bag. Ants will quickly clean up shells, though a quicker way is to tie the shell where it will lie in sea water and let the small crustaceans known as amphipods clean it up. This will be accomplished in a few hours. Dry specimens may be wrapped in portions of newspapers. If a collection of shells is being made, a good plan is to number each shell temporarily with a lead pencil and to make notes as to date, locality, and other details. Never write with ink on specimens or on paper to be placed in the preservative liquid. Later the shell may be permanently numbered or labeled with India ink, then brushed over with a layer of shellac.

In certain sea-shore localities many kinds of true sea weeds will be found floating in the water. If you want to add them to your collection, gently lift such specimens into a pail or basin of sea water, making sure that no sand adheres. When you reach the work shop, take out each specimen in turn and float it in a smaller dish of water, so that you may trim it as desired. Now pass beneath it a sheet of paper, preferably of the consistency of Bristol board or



Photograph by M. C. Dickerson
THE GREEN CRAB
A pugnacious fighter and rapid runner that likes to hide in moist pockets in eel-grass windrows

regular herbarium paper, and lift the specimen from the water, rearranging parts if necessary. Lay the specimens thus mounted on blotting paper or newspaper, cover with a cloth and more blotting paper. If there are many specimens repeat this procedure. Finally place the layers between flat boards with moderate weights. One authority suggests changing blotters and cloth frequently for the first few days, then discarding the cloth entirely. At any rate the important thing is to get the specimens dried as quickly as possible, and blotters should be changed often enough to accomplish this result. A little glue may be advisable to secure parts of specimens that have not adhered of themselves. Finally, label each specimen as you would in making an herbarium.

Whatever marine lore we have gained from sojourning at the sea, whatever fascination we have felt for wisps of living colors and for twisted shells, whatever respect has been engendered by stinging filaments and piercing spines, we can hardly leave such a marine laboratory without a special appreciation of the amazing variety of adaptations peculiar to sea life. We should realize that most marine animals have gills which are thin structures kept moist by the water and provided with blood by means of which breathing (the exchange of oxygen and carbon dioxid) can take place. They swim either with fins, or tails, or other flattened parts, with collapsible umbrella-like structures, or with cilia or flagella. Sometimes they spurt through the water by rapidly opening and closing their shells. They may walk or crawl with a muscular foot, or with hundreds of tube feet, or with slender jointed legs. They procure their food by creating currents which suck it in, or by using stinging cells or suckers on long arms, or by swimming and seizing their prey. Since their eyes,—if they possess any, are continually moistened by the sea water, they are lidless, and since ears would be an incumbrance, they have none, but are sensitive to vibrations through specialized areas. The creatures not protected by sting or claw or shearing teeth or by impervious shells into which soft tissues can be withdrawn, have special structures for digging their way into sand or boring into wood.

Photograph by M. C. Dickerson

A HERMIT CRAB

THIS BELLIGERENT LITTLE CREATURE IS ALWAYS READY TO FIGHT ANOTHER HERMIT CRAB AND DEVOUR IT IF VICTORIOUS

Egyptian Cattle of Early Historic Times

THE ORIGIN OF DOMESTIC CATTLE

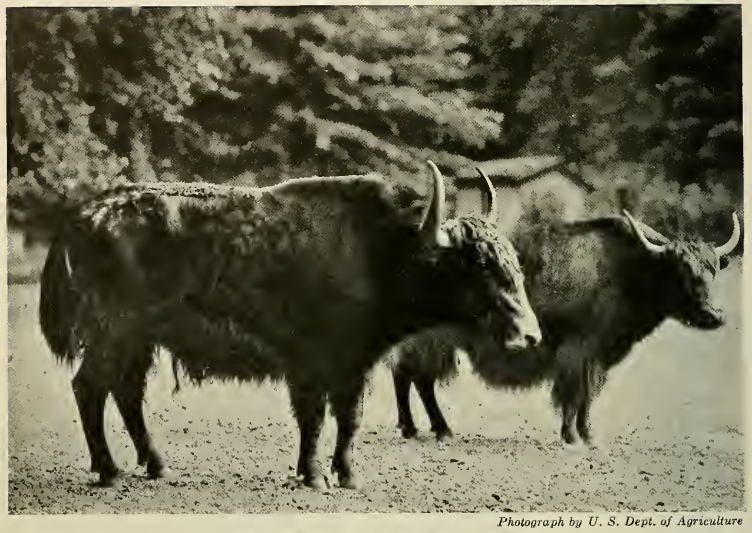
The Progenitors of One of the Most Important of Our Domestic Animals—Their Wild Forebears and the Steps by which These Wild Creatures Have Been Domesticated and the Influences That Have Changed Them

By ARTHUR T. SEMPLE
United States Department of Agriculture

THE origin of our domesticated cattle has been the special object of study by many investigators. Here an attempt is made to review briefly the progress made by the many who have worked on this difficult problem. The term "cattle" usually means domesticated bovine animals, principally of two species —*Bos taurus*, European cattle, and *Bos indicus*, the humped cattle of India and Africa, commonly called zebus.

Domesticated cattle have been derived from wild species of the genus *Bos*, which is one of the largest genera of the family Bovidæ. The members of this family, like all ruminating mammals, possess hoofs with an even number of toes. Among the noticeable features which usually distinguish them from other ruminants are hollow horns which consist of a bony horn core, surrounded by a hard sheath that grows continuously from the base. However, some breeds of cattle and many breeds of sheep do not have horns. The Bovidæ include sheep, goats, musk oxen, and antelopes, as well as cattle. It is the youngest and most specialized family of hoofed animals. Members of the family have been found in all parts of the globe except South America and Australia. In North America it is represented by the bison, musk ox, mountain sheep, mountain goat, and a few allied fossil forms. Africa appears to be the center of distribution, although their original home may have been in Asia. The Cervidæ, or deer family, are closely allied to the Bovidæ, but they have solid horns which branch and are shed annually.

The genus *Bos* is the most specialized division of the family Bovidæ, as is shown



Photograph by U. S. Dept. of Agriculture

THE DOMESTIC YAK OF CENTRAL ASIA

These are believed to be descended from crosses between the wild yak and domestic Asiatic cattle. The wild yak does not thrive at low altitudes. Its usual habitat is at an elevation of 12,000 to 15,000 feet

by the structure of the teeth and by its late geological appearance. According to Lydekker, the genus includes five subgenera or groups designated as

(1) Bibovine, composed of the gaur, gayal, and banting;

(2) Leptobovine (extinct species only);

(3) Bisontine, which includes the yak and bisons;

(4) Bubaline, or buffalo group;

(5) Taurine, which includes our common beef and dairy cattle and the humped cattle of Africa and Asia.

The size of the wild species of the genus *Bos* range from that of the anoa, which is only 3 feet 3 inches in height at the shoulder, to the gaur, which measures fully 6 feet in height. Among domesticated cattle we find that some individuals of the Kerry, Brittany, and Permian breeds, are only a little more than 3 feet in height. The domesticated water buffalo is sometimes 6½ feet high, and some specimens of the sacred oxen of Ceylon are said to be only 2 feet 2 inches in height.

All of the Bibovine group are humped forms and are natives of southeastern Asia. The banting and the gayal have been considered by some zoölogists as distinct species, while others regard them only as forms of the gaur. The wild banting of the islands of Bali and Borneo and the Malay peninsula, is a beautiful animal with dark, grayish brown or reddish brown hair and horns. In view of its variability it might well have been the starting point of widely differing modern breeds.

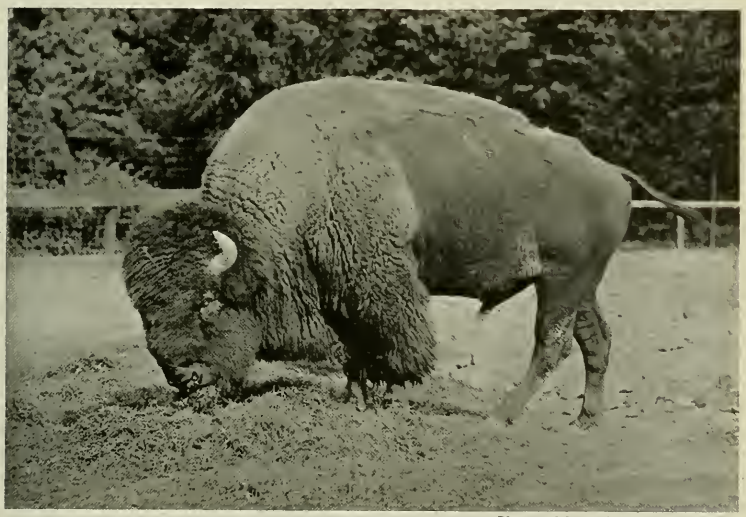
The Leptobovine group is represented by two extinct species, one of which, the Etruscan ox, lived in France and Italy. Remains of the other species are found in the Siwalik Hills of India. These two species are believed to be most closely allied to the banting. They were peculiar in that the cows were hornless. The

Siwalik ox was a large animal, with enormous horns, measuring about 10 feet from tip to tip.

The important members of the Bisontine group are the European bison, the American bison, and the yak. The European and American bison probably had a common ancestor which also inhabited Asia and crossed from Siberia to Alaska when there was connecting land there. There were bison in Mesopotamia up to Assyrian times. The wild yak ranges over nearly the entire central part of Asia. The domesticated yak, though somewhat smaller in size, is probably derived directly from the wild form, as the result of a cross between the wild yak bull and a domesticated cow of the Taurine group. There may be yak blood in the long-haired cattle of the upper Oxus.

The buffalo is a domesticated animal of considerable importance in southeastern Europe and southern and eastern Asia. It is used as a draft animal and for beef production, and in some sections is the principal dairy animal. It was known in Europe previous to Roman times. It was first introduced as a domesticated animal into Italy at the end of the Sixth Century.

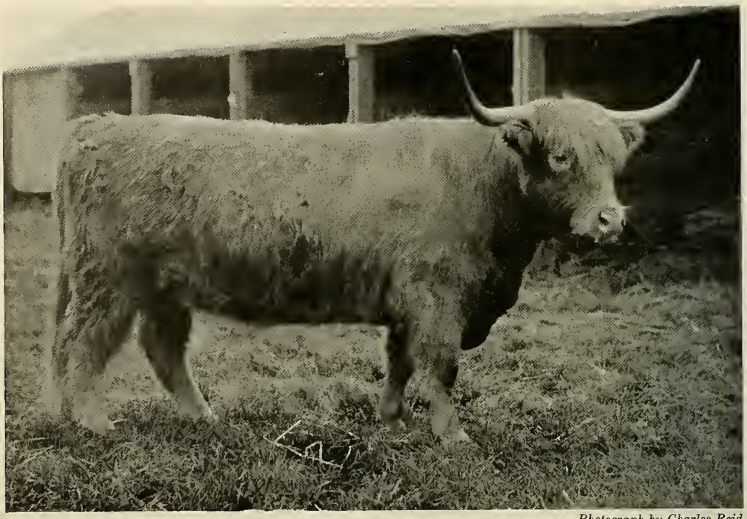
There was a prehistoric Algerian buffalo which roamed from Algeria to South Africa. The ancient inhabitants of Persia, Babylonia, and Assyria hunted a wild bovid, the Indian buffalo, which is depicted on the cylinder seals of Assyrian kings. Large numbers of these animals were killed by the Assyrian King Ashurnasirpal on the hunting grounds near the Euphrates. Aristotle also mentions the occurrence of the buffalo with horns curved back to the neck, in the Persian Province of Kohkand. Wild buffalo are found in Africa and the Philippine Islands, the latter a small type known as tamarao.



Photograph by U. S. Dept. of Agriculture

AN AMERICAN BISON

Bison are now increasing in number in the United States and Canada. Many herds are maintained and protected on private estates and national parks



Photograph by Charles Reid

A PRIZE HIGHLAND COW

The West Highland cattle of Scotland are most picturesque, and are noted for their hardiness and the fine quality of their meat. As the Roman legions and the Anglo-Saxon warriors failed to conquer the ancient inhabitants of Scotland, so their cattle escaped quite free from continental blood

A still smaller domesticated buffalo, the anoa, is found in the Celebes Islands.

In considering the extinct species which may possibly be ancestors of domesticated European varieties of cattle one cannot at present go back far in geological history. The Narbada ox, *Bos namadicus*, is one of the best known species of extinct Indian oxen. In some specimens the horn cores are somewhat flattened at the base, which shows a close relationship to the bison type. It was a contemporary of early man in India during the Old Stone period. Recent explorations at Anau, Turkestan, have thrown considerable light on the oldest civilization of which we have any record. In deposits of the oldest layers of Anau remains have been found of a wild species of ox which is undoubtedly *Bos namadicus*. In the later deposits, about 8000 B.C., a domesticated long-horned ox appeared, which Dürst regards as a domesticated form of *namadicus*.

The ur, *Bos primigenius*, a contemporary and probably closely related to the Narbada ox, was a large and stately animal, being 6 or 7 feet high at the withers. It roamed over western Asia, northern Africa, and the entire continent of Europe. Like its near relative the European bison, it was a forest-loving animal and, judging from old pictures and inscriptions, it had a hairy coat, which varied in color from black or dark brown in summer to gray in winter. A light-colored ring encircled the muzzle, and along the back was a white stripe. Unlike the bison, it had no long hair about the head and neck. To the old Teutons it was known as the aurochs, or ur.

That there were large numbers of them is shown by the numerous fossil remains found throughout a wide region. One of the best skeletons ever found is now in the

zoölogical collection of the Agricultural High School of Berlin. This skeleton is very similar to that of the cattle of the lowland and steppe breeds found in Europe today. The remains of the ur are found in all the earlier pileworks of the Lake dwellers. It was first domesticated in Neolithic times, and later the wild form was driven out by man. Some teeth of the ur have been found in the bone breccia of Lebanon. Doctor Schliemann found the remains of bones of *primigenius* at Troy. It has been suggested that the unicorn referred to in the Bible down to the time of David may have been the ur, but another alternative is that the unicorn was a straight-horn antelope, which when seen in profile has the appearance of possessing only one horn.

There is much evidence to show that the ur has lived within historic times. It is mentioned by Cæsar, who saw it, or knew of it, as an inhabitant of the forests beyond the Rhine. Seneca speaks of both tame and wild cattle. Tacitus and Pliny say that the horns of these cattle, used as drinking horns, sometimes held as much as twelve quarts. In the Niebelungenlied, Siegfried kills a wisent (bison) and four ur. In an old chart, made in 1284, the ur is said to exist between the upper Duna, the Dnieper, and the Carpathians, the same region in which it is thought to have become exterminated early in the Seventeenth Century.

Two Roman statuettes of oxen were dug from a depth of nine feet in widening a railway in Swabia, in 1895. One represented a bison, the other a ur. So it is presumed that both lived in the Black Forest in Roman times; one roamed in the woods of the highlands, the other in the lower meadows.

A CATTALO

Numerous and persistent attempts have been made with American bison and cattle to establish a hybrid of economic value. Thus far the results have not been encouraging. The Canadian Department of Agriculture has been working on this problem recently

A painting, presumably made about 1500 and found in 1827 in Augsburg, represents a rough-haired maneless bull, with large head, thick neck, and small dewlap. Its powerful horns turn forward, then outward, and are light colored with black points. The color is sooty black, with a white ring about the mouth.

Two golden cups, on which were engraved pictures of cattle, were found in a grave near Sparta. These cups, now in the museum of the Archeological Society at Athens, are evidently the work of a master artist of the Mycenæan period, about 1500 B.C. On one is represented a hunting scene with three wild oxen; on the other is a wild ox held by a man, who has fastened a rope about the hind leg of the beast. The other ox appears peaceful and domesticated.

Perhaps the best affirmative evidence that both the ur and the European bison lived within historical times is furnished by Baron Herberstein, who lived during the first half of the Sixteenth Century. According to his own statements he saw both of these animals when he tarried at the court of King Sigismund August of Poland during a journey to Moscow. Of the present wild species the gaur of India is probably the nearest relative to the ur.

The Celtic shorthorn, *Bos longifrons*, inhabited western Europe from Italy to the British Isles. It is probably identical with the marsh cow, of the prehistoric Swiss lake dwellers. Nowhere has it been found wild with certainty. Breeds of cattle in Africa and Switzerland, as well as the zebu of Asia and Africa, possess strong characteristics of this species. Hence it is argued that *longifrons* must have come originally from some Asiatic species, probably *Bos sondaicus*. The recent studies of Ewart indicate that *longifrons* is more intimately related to the zebu than the wild ur.

MALE AND FEMALE GAUR

The gaur is one of the most impressive of wild oxen; in fact, it is the tallest ox in the world. It is, however, shy and inoffensive. The above picture illustrates a group in the Vernay-Faunthorpe Hall of South Asiatic Mammals, at the American Museum

THE WILD BANTING

This is the characteristic wild ox of the Malay region. The species has little trace of the shoulder hump seen in other Asiatic oxen and carries no dewlap. The above picture is of a group in the Vernay-Faunthorpe Hall of South Asiatic Mammals, at the American Museum

Compared with the ur, the Celtic shorthorn is much smaller and has a shorter face but a longer and broader forehead. The horns are shorter, and there is a ridge in the center of the poll. It is found with early remains of man's culture in the marshes of Mecklenburg and Harz. It has also been dug from trenches near Bologna, Italy. In England it was probably the predominating type of cattle during the Roman occupation. In France it was the only bovine species about Lyons during the Gallo-Roman epoch.

The zebu, *Bos indicus*, which includes the humped cattle of Asia and Africa, are probably descended from the banting. The name is not known in India and has probably been derived from the Polish zubr or suber. They are known as Brahmans in the United States. Perhaps the most notable characteristic of this species is the hump at the withers, although the large dropping ears, the shape of the skull and horns, the white shanks and the grunting cry readily distinguish it from other species. Its habits, such as seldom seeking the shade, and never standing knee-deep in water, are also characteristic, though varying as those of any species must with so wide a geographical distribution. Some races have two humps; the ribs may be 13 or 14 in number, and the horns vary greatly in size and curvature. No wild form has yet been found, although some instances are known where they have become semi-wild and were able to maintain themselves even in a region infested with tigers. There are no records in ancient Egypt of wild cattle. The zebu was domesticated probably as early as 4000 B.C. and spread from Asia to Africa. Aristotle, Pliny, and Oppian knew of the zebu in Syria, and it may have gradually changed into the steppe breed.

Throughout Africa humped cattle

have been widely distributed since very ancient time. Prehistoric pictures in the rocks in South Africa show cattle similar to the trek oxen of the Boers. The Bornu, a distinctly humped breed near Lake Tchad in Africa are said to have a horn which merges imperceptibly with the skin at its base. This is also characteristic of the banting.

Throughout most of the period when man first used cut-stone implements he was a hunter and fisherman, and had no domesticated animals. Undoubtedly this period ended at a much later time in northern than in southern Europe. Shell heaps along the coast of the Cattegat contain bones of the ur and the European bison, which lived there wild at that time, at least 3000 B.C. There are some traces of a smaller ox, but no authentic remains of the domesticated ox.

At the beginning of the Neolithic or polished-stone period the change from savagery to barbarism was made. About this time it is the common belief that there was an invasion of Europe by people from Asia, who brought with them a few domesticated animals. During the polished-stone period, which probably extended from about 4000 B.C. to 2000 B.C. in Switzerland, cattle, sheep, goats, swine, and perhaps the horse, were kept as domesticated animals throughout northern and central Europe. The Swiss lake dwellers had considerable knowledge of agriculture and cattle breeding. Bones of the marsh cattle, smaller than typical Celtic shorthorns, are frequently found there.

At about the beginning of the Bronze age man was slowly advancing from barbarism to semi-civilization. The number of domesticated plants and animals increased. In central Europe the lake dwellers were at the height of their

Photograph by Charles Reid

PRIZE-WINNING HOLSTEIN BULL

It is believed that the Holstein-Friesian cattle originated in Friesland, Holland, and are closely related to the aurochs. They are distinctly a dairy type and have been widely distributed over the world and especially in neighboring countries of Europe, the United States, and South Africa

A PURE-BRED NORMANDY COW

From near Nogent-le-Rotrou. Evidently a descendent of the aurochs. French cattle are generally triple purpose in that they have been developed for milk and work as well as for meat

development. Cattle breeding at this time held an important place in their industrial life. The skulls of the marsh cow and those of cattle of some breeds in the Balkan peninsula today can hardly be distinguished from one another.

A study of figures and inscriptions on stones indicates that *Bos longifrons* of the lake dwellers came from Asia in very early times and was domesticated long before Babylonian culture, also that Egyptian breeds came from Asia in prehistoric times. Recent excavations have uncovered works of art in the palace at Knossos, on the island of Crete, in which the urus is depicted as domesticated and used in bull-fighting previous to 1500 B.C.

It seems practically impossible to trace our modern breeds directly to the wild species from which they were derived. In the first place, practically all of our cattle are descended from stock which were domesticated in prehistoric times, or in such ancient times that no satisfactory records are available. The earliest records indicate that the tame cattle were smaller than their wild ancestors. In connection with the great westward migrations of Asiatic people, the Roman conquests, and the minor migrations of Germanic, Nordic, and Slavic tribes following the fall of the Roman empire, foreign cattle must have been introduced and mixed with the native stock. Among nomadic and migrating tribes cattle were the chief form of wealth and could be moved even more readily than the people themselves. As cattle followed the legions of Rome to furnish food, some must have escaped and mixed with the local cattle. Supplying the military posts throughout the Roman empire must have involved extensive movements of cattle.

Skulls of oxen from the Roman military station at Newstead, Melrose, England, include several distinct types among which

are the Celtic shorthorn, the ur, and hornless oxen of two distinct varieties. A comparison of these types with others in the British Museum indicates that the Celtic shorthorn is probably more closely related to the zebu than to the ur; that polled black Galloway cattle and polled white "wild" Cadzow cattle are closely related to the ur; that the round-polled Aberdeen-Angus cattle may be the descendants of a race allied to a modern Syrian breed apparently in the act of losing its horns; and that some of the cattle in the south of Scotland during the Roman occupation were descended from an Indian species now extinct. At Uriconium, which for a long time was the headquarters of the Roman Twentieth Legion, remains of the large-headed type, native of southern Sweden, have been found.

From Columella's description of the points of bulls, cows, and draft oxen, we may conclude that the Romans paid considerable attention to selection of breeding animals. EachRoman province had its own breed of cattle. In general, they were large and of the brachycephalus type. In Campania and Siguria the cattle were smaller and of the *longifrons* type. The smaller breeds in the valleys of northern Italy yielded a good flow of milk, which in the spring was considered of medicinal value. Many Romans went to the herds of Switzerland for the cure of tuberculosis. That cattle were bred in large numbers we know from the Punic Wars, when Hannibal captured 2000 oxen and at one time offered up 300 white bulls as a sacrifice. At another time he escaped from a snare laid by Fabius Maximus by tying torches to oxen at night and driving them up the slope of the mountains. The Romans, thinking that the Carthaginians were escaping, started to head them off, but were met by an array of wild oxen. Hannibal easily escaped through a defile which was then left unguarded.

In ancient Greece there were white cattle in Thessaly, hornless cattle in Borysthenes, and a large breed of cattle,

ZEBUS GRAZING NEAR HOUSTON, TEXAS

Zebus were introduced into South Carolina in 1849. A few years later they reached South Texas, where they have proven their value for crossing with cattle of western Europe breeding. Now, thousands of South Texas cattle contain zebu blood. They are commonly called Brahmans in the United States

Photograph by U. S. Dept. of Agriculture

A LONGHORN STEER, KING RANCH, SOUTH TEXAS

A remarkable steer on the King Ranch in South Texas, with horns resembling those of Hungarian cattle, yet not closely related to them in any way. While mostly of Brahman and Shorthorn blood, whatever Texas longhorn blood there was present must have been very prepotent in respect to horns

improved by Pyrrhus about 300 B.C. in Epirus. Pyrrhus selected breeding stock according to strict rules, and no heifers were allowed to breed until they were four years of age. Arrian says that Alexander the Great imported 2000 or more head of cattle from India (probably they were zebus).

The oldest inhabitants of Holland of which we have any records are the Frisians, who dwelt on the shore of the North Sea as early as 300 B.C. They were a peaceable, pastoral people, and may have originally migrated from central or western Asia. Little is known concerning the characteristics of their cattle, but it is certain that a portion of them were white and that they were of some religious significance. Two hundred years later the Batavians came down the Rhine from Hesse and settled near the Friesians, where they drained marshy lands and islands, built dikes, and had numerous herds of large, long-horned black cattle of the *primigenius* type, which in all probability they had brought from their former home. That a cross of the ur of the old Teutons with the Celtic shorthorns took place is evident in the lowland breeds of Germany today.

From the ancient sagas we learn that there were two breeds of cattle in Scandinavia. One was a small white or white-spotted, hornless breed living among the mountains in north Sweden; the other was a large black breed similar to the cattle of Jutland and Denmark. At the entrance of the Goths there was another highly prized, large-horned breed, either red or yellow in color, which appears to have been introduced by them. The vikings were in the habit of taking their cattle with them on shipboard, and the Norwegian settlers in Iceland in 874 brought their cattle along with them. Thorsin, the Icelander who founded a colony in Vineland (New England), carried cattle with him.

Abundant remains of the bison and the ur appear in Great Britain. Both con-

Photograph by U. S. Forest Service

HEREFORD CATTLE

A fine herd of Hereford cattle grazing in the Colorado National Forest, Colorado, at an elevation of about 9000 feet. Since 1880 the Herefords have so rapidly and completely displaced the Texas longhorns and the bison on our western ranges, that they might form a solid front of "whitefaces" from the Rio Grande to the Milk River of Montana

tinued to live there for a long time. The bison disappeared first, while the ur continued possibly in the mountain fastnesses until within historic times.

Cæsar found large herds of domesticated cattle, which were evidently of the Celtic shorthorn type. The remains reveal a small breed about the size of the Irish Kerry. The small horns were sharply curved forward. Sculptures, coins, and mural paintings of Roman cattle are represented with upturned horns much like some Italian breeds of today. Other Italian breeds have horns growing outward. Reasoning from these premises, it seems that cattle were carried from Italy to England during the Roman occupation and crossed with the native stock. The semi-wild cattle now roaming in the parks of Great Britain resemble the Sicilian and ancient Roman breeds.

The Saxons probably brought their cattle with them to England, while the Britons retreated with their cattle to the mountains of Scotland and Wales. The descendants of these cattle have furnished the foundation stock of modern breeds in those districts. Later introductions from Normandy and northern Germany have modified the breeds in the eastern and southern counties. The Kerry is the modern breed most typical of the old Celtic shorthorn, the Highland and Welsh breeds of the cross between the Celtic shorthorn and Roman cattle and the Longhorn breed of the cross between the native cattle and those of Germanic and Norman importations. While the oldest annals of Ireland refer to horned cattle, for a long period hornless cattle also have been quite numerous. They are being perpetuated in the present Irish Moiled cattle.

The Channel Islands cattle, the Brittanies, and the Kerries, are regarded as descendants of the Celtic shorthorn. The deerlike form and color of the Jerseys indicate such descent unmistakably.

The first cattle in America were brought in 1493 by Columbus on his second

voyage. About 1525 some of Spanish origin were taken to Vera Cruz, Mexico, where they rapidly multiplied and gave rise to the stock which later became known to the breeders in the United States as the Texas longhorn.

The cattle introduced at Jamestown, Virginia, were from England, with some mixture of Spanish cattle from the West Indies. In New York the cattle were largely of Dutch origin. In Pennsylvania the cattle were brought over by the Dutch and Swedish settlers. At Plymouth, Massachusetts, the cattle were brought from Holland and England. The ships which arrived at Boston contained mostly English breeds, the Devon predominating. In New Hampshire Captain Mason introduced a large yellow breed from Denmark. In Canada the importations were largely from France.

In the West Indies, Mexico, and Central and South America the cattle were nearly all from Spanish stock until within recent years. Many good breeding animals from improved breeds have been imported from Europe and the United States to Argentina and other countries of South and Central America during the past fifty years. Humped cattle of India (zebus) have also been imported to Texas, the West Indies, and tropical South America. On account of their greater ability to resist disease, parasites, heat and drought, the crosses with cattle of European origin have been very successful. With the exception of the Holstein-Friesians, the Brown Swiss, and the zebus, but few cattle from other countries have been imported except from the British Isles.

Cattle not being native to America, there are no strictly American breeds, but, owing to differences in climate, care, and ideals of American breeders, the European breeds which have been brought to America have nevertheless changed to some extent. Occasionally a strain of improved stock has arisen as a sport. The Gore breed, well known in New England seventy-five years ago, and still later the American Holderness, were recognized in New York. At the present time the Polled Shorthorn, Polled Hereford, and French-Canadian are the only important breeds which may be called American.

This typical old-time Texas longhorn visited the stock yards of St. Joseph, Missouri, in 1917

Needless to say, he was one of the leading attractions of the stocker and feeder cattle show

Photograph by U. S. Dept. of Agriculture

A TEXAS LONGHORN

A Glimpse of the Mountains through the Ferns

BOA CONSTRICTORS AND OTHER PETS

The Curious Dispositions of Some Island Reptiles

By PAUL GRISWOLD HOWES

Curator of Natural History, The Bruce Museum, Greenwich, Connecticut

Photographs by the Author

SINCE my previous article in this magazine[1] on the wild life of the little island of Dominica, which is the highest member of the Leeward group of the West Indies, I have continued my studies in that wonderful outdoor laboratory, and have explored the far interior of the island at every altitude, from sea level to the tops of her two highest mountains. One of the chief purposes of this last expedition was to study and capture specimens of reptile life. True to my expectations, these reptiles lived up to the island's reputation for producing unique characters. Never have I seen snakes with more unexpected dispositions or ones that baffled us more in trying to care for them.

Near the base of the mountains we found nothing of interest, but at an altitude of some 1800 feet, where our main camp was located, we ran into snakes aplenty. At first we began to encounter that beautiful species known only by the scientific name *Leimadophis juliæ*. It is rather small, reaching about twenty-four inches, or perhaps a little more, in a full-grown specimen. In color it is usually black and white, black being the ground color, with a white spot or mark on every scale. In this snake are the materials for new species, for the specimens vary greatly and these variations are doubtless heritable. Besides this, the reptile lives at many altitudes and these environmental differences cause physiological differences which have much to do with the survival of variants.

Color varieties were encountered that ranged from very dark specimens, almost devoid of the white markings, through brilliantly black and white individuals, to

[1] "Wild Life in Dominica." Natural History, Vol. XXX, No. 1, p. 90.

others with a gray ground color and less contrast in the white markings. The largest and oldest specimen found, which was at a comparatively low altitude, measured twenty-nine inches and was almost solid black on the upper surface with slight iridescence in places, and, about an inch apart, irregular whitish bands running about the body with four rows of scales between each band. The throat was tinged with light yellowish-orange. The under surfaces of these snakes also varied greatly, some being mottled black and white, while others were plain grayish-white.

It is a strange fact that the smaller and younger individuals were unusually docile. It was quite impossible to induce them to bite or even to open their mouths in the usual threatening manner of small reptiles. They loved the warmth of the human skin and would crawl up one's sleeve or trouser leg, at every opportunity. They were at once tame and delightful pets. Only the small and comparatively young individuals were tame when first captured. The old, dark snake just described was the wildest, most untamable creature one could imagine. It thrashed about madly when caught, wound its coils about my arm, tied knots in itself, and ejected the most foul-smelling fluid upon my skin. It never became tame and died a cringing, angry, self-imposed death from starvation.

On February 21 and 25 two captive specimens deposited clutches of elongate white eggs with parchment-like shells. They were uneven and very different in size and moved from the reptile's womb very slowly, with slight pauses between each movement, which caused tiny ridges to form in the soft shells. The eggs hatched in March and April, giving birth to little snakes that very closely resembled the parents in color

THE RUGGED DOMINICAN COAST

Photographed from the top of Scott's Head. This bay is doubtless a crater. As shown here, even in the dry season, the coastal mountains gather in some moisture from the clouds

CORONA HOUSE, HEADQUARTERS OF THE 1926 EXPEDITION
When the expedition returned here in 1930, it found that the buildings had completely fallen into decay

The position of this snake in the "food ring" of the island's wild life is between the insects and earthworms and the tree frogs and the Antillean broad-winged hawk. The snake feeds upon the smaller insects and worms, and the eggs of *Eleutherodactylus* frogs, and is fed upon to a great extent by this common island hawk.

We were particularly anxious to capture several boa-constrictors during the last expedition. We found them quite easily near our headquarters, but they were never found in high mountains, "hanging from every tree," as one over-imaginative resident of the island informed us. None were found above 2000 feet and all of those we did find were in grassy clearings or overgrown, abandoned fields near tumbled-down plantations. They lay coiled in the undergrowth by day, and crawled out through the dank vegetation by night in search of their natural food of black rats and 'possums. In the moonlight we would sometimes see them gliding through the clearing in front of our tent, and to the uninitiated, an eleven-foot boa looks unusually large and sinister in the moonlight.

To capture them we prepared forked sticks by cutting saplings with suitable branches, so that we were armed with a sort of wooden, two-tined pitchfork, about five feet long and bearing three-inch tines. These and a burlap bag were our only equipment.

On our first hunt we had entered a heavily grown field. We had proceeded but fifty feet when I stepped down off a fallen tree directly in front of a seven-foot boa. The reptile shrunk back, but did not move its coils. I called to Cummings, my companion, who approached cautiously. Then at a given signal we ploughed our forked sticks down over the snake's neck and body, pinning it after a short struggle so that it could do nothing but writhe. We then grabbed the boa by the neck just back of its head and pounced upon its body and in a minute or two we had it subdued and in the burlap bag.

Thus we caught all our large boas, but

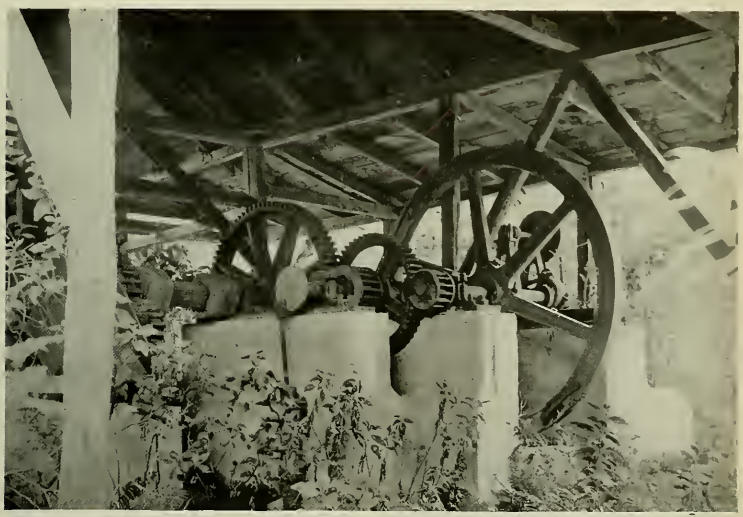
we were to have our troubles with them in other ways. Our two finest ones, measuring about seven feet six inches each, were confined in a large flat box with heavy meshed wire over the outdoor portion of this temporary home. We admired them greatly each day and marvelled at the two distinct color varieties that we had been fortunate enough to obtain—one dark bluish-black with beautiful iridescence in its scales and the other lighter and quite brown in tone with large blotches of still darker coloring becoming much more distinct toward the tail.

We considered the safety of their cage, but imagine our surprise and disappointment one morning to find that both snakes were gone. The wire mesh must have been accidently ruptured, and the captives had taken advantage of the opportunity to escape.

In early February boas begin to have their young. They do not lay eggs, but give birth to their offspring just as mammals do. We began to find them in the clearings, brilliantly patterned and beautiful to look upon.

The boas possessed peculiar dispositions, to say the least. They remained extremely vicious to the end. Not one ever showed signs of becoming tame or even partly used to cage life. They would fly at the wire of their cage the instant anyone came near, catching their teeth in the meshes and then tearing them out by the roots in rage and panic as the wire held them. It became necessary to put them in slatted boxes, and even then they would fly at the slats, banging and injuring themselves in a most wicked manner.

In strange contrast to this senseless



ABANDONED TO RUST AND DECAY

Rusting machinery and tumbled-down factories are found occasionally, mute evidence of the failure of some ill-advised attempt in the past toward industrial development. All the timbers in this building were hand hewn, and it was roofed with hand-split shingles. Near these old ruins was a favorite haunt of the boas

© *Photograph*

THE SNAKES LAY QUITE MOTIONLESS
From a respectful distance tame ducks inspected the two Antillean boa constrictors

A COMMON DOMINICAN TREE FROG
The *Leimadophis* snakes feed upon the eggs of this frog, *Eleutherodactylus martinicensis*, together with insects and worms

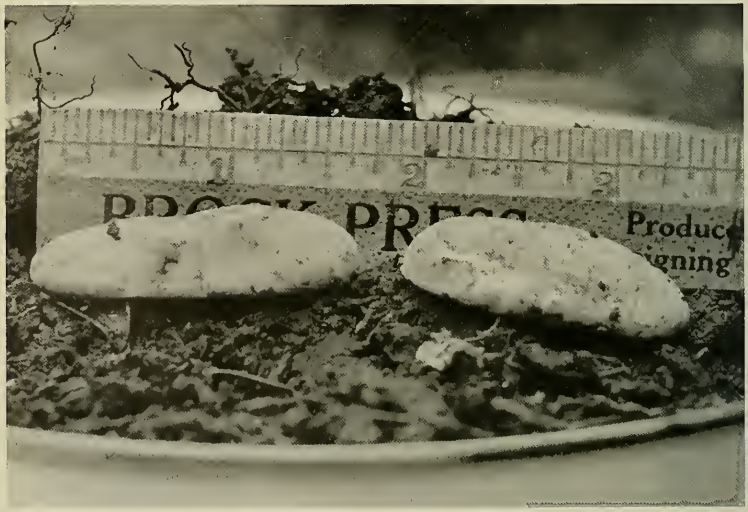
ONE OF THE EXPEDITION'S CAPTURES
A fine iridescent specimen of the Dominican boa constrictor, *Constrictor orphias*

HEAD OF THE ANTILLEAN BOA CONSTRICTOR
These reptiles are not uncommon in Dominica. They reach a length of eleven feet and perhaps more, and are very bad-tempered

behavior, was their attitude when removed from their cages. As shown by the photographs of the two medium-sized boas upon the ground, with the ducks keeping a respectful but interested vigil, they made no attempt whatever to escape. They would lie thus in the sun quite motionless. If one of us went near they would lunge at the intruder and show their wicked teeth, but otherwise they were content to remain in one spot with the whole open country and the great forests near by. Perhaps they felt that there was no hope for them, but that is extremely unlikely, judging from my past experiences with tropical snakes. The fact remains, however, that none of them ever tried to escape when we deliberately allowed them an opportunity.

They all went on hunger strikes as soon as confined, and this was our next problem. At first we tried putting live things into their cages at night, which appears to be their regular time for feeding. In turn, a lizard, a smaller snake, a black rat, and a perfectly good chicken were chosen as the victims for sacrifice, but to our amazement they all came through unharmed. The chicken was most nonchalant, and in the morning we found it roosting comfortably upon the coiled up reptile, in a most unconcerned manner. We never could make the snakes eat of their own free will, although from reliable island authority we learned that they are usually very fond of chickens, visiting plantation hen coops and destroying the inmates during the night.

At length we had to resort to forcible feeding. By means of a large grease gun with a long spout and a screw plunger, we kept our charges alive by forcing a half pound of ground raw beef into the belly of each reluctant boa. It took three to do the job—two to hold the angry reptile and one to manipulate the gun, but



EGGS OF THE *LEIMADOPHIS JULIÆ*
The shells were parchment-like and the eggs distorted and dented. Only two or three were laid by each individual

the trick worked and we brought the snakes safely back to America. At home at the museum they lived for some months, but at length they died from some strange malady similar to diphtheria, and to the end not one of them swallowed a mouthful of food voluntarily.

The gecko of Dominica, *Thecadactylus rapicaudus*, is a reptile at once wild and repulsive looking to those who do not naturally take to such creatures, but for all its ugly, staring eyes, and its blunt suction-disc feet, which enable it to climb upside down over your bed at night, it is quite harmless, although it will sometimes try to bite in a sluggish sort of way.

It lives on insects, which it hunts tirelessly at night, pouncing upon its victims and grinding them up with a nightmare sort of noise and a strange smiling expression. In watching these creatures at their work of destruction, I could not help but be glad that I did not live in the time of the huge, carnivorous dinosaurs, for one would meet the same horrid grinding fate in their jaws as these helpless Dominican insects do today under the reign of the geckos.

MR. HOWES WITH TWO ANTILLEAN BOAS
He is standing at the door of the station headquarters in the mountains of Dominica

Geckos deposited white eggs in the eaves of old buildings and in plantation houses, where their much paler, ghostlike young were often seen and where their even more ghostlike tappings within the walls may be heard in the stillness of the night.

The strangest fact concerning them is that they possess easily disjointed tails. When they are caught or pounced upon by an enemy, they wrench their bodies violently and the wildly squirming tail comes away in the jaws or talons of the destroyer, while the actual living body of the lizard escapes unharmed. This violent reaction to danger is automatic, as I have witnessed the complete disjointing of the tail when one of these geckos was passing into unconsciousness under the fumes of chloroform.

Still more remarkable is the fact that the gecko possesses the power of regeneration to a remarkable degree, and it is only a matter of a few months after an accident that this reptile appears with a nice new tail, which may again serve its purpose as a life-saver to its owner.

HARMLESS

A life-sized view of the Dominican gecko, a strange, nocturnal creature that dwells in old houses

Lizards are numerous in Dominica. There are the very common and varicolored Anoles, those quick little dwellers in the houses and fields and forests; the still more energetic and rapid glassy skinks (*Scincidae*), the *Ameiva* lizards of the coastal zone; and the large green, noisy, and hard-running iguanas.

This latter animal is one of the hardest of all to capture. It lives in the hot, drier zone well below 1000 feet and is one of the fastest moving creatures upon four legs. I never caught one in Dominica, but my friend Doctor Thaly of Roseau, the capital of the Island, caught one for me by his strange method of charming the reptile by his whistling. As incredulous as this may sound it is the truth, for this lizard actually stops in its tracks and succumbs to the strange whistling notes which the Doctor produces. The only specimen which we brought home alive was captured in this manner. It lived for a time, but like its distant cousins, the boa constrictors, it would not eat, and finally died after laying several large white eggs in its cage.

As we were leaving Dominica, in the confusion which always accompanies the departure of a ship which is cluttered with natives and their nondescript luggage, one of our cages of boa constrictors was left upon the deck by mistake. Before long a dusky and portly lady sat down upon the case. With characteristic abruptness and violence one of the snakes lunged up under her, striking her a good blow as its head came up between the slats of the box. She looked down and caught sight of the word "SNAKES" written in large letters upon her box seat, and then with a yell that could be heard all over the ship, she literally exploded into the air and ran shrieking down the companionway and out of sight.

Later when we were well out to sea,

with the aid of a friendly purser and a dark night, we spirited all of our snakes into our cabin and under our bunks. Next to our cabin, across the companionway were two ladies from Brooklyn. We struck up an acquaintance naturally enough, but they both had a horror of what we had gone down to Dominica to do. "The idea of having those horrible snakes near one," they had exclaimed. How near they were, these dear ladies will never know!

IN THIS DEEP HOLE HIGH IN THE MOUNTAINS WERE NUMBERS OF CAVE BATS. NOTE THE NET AND LANTERN AT THE TOP.

SO LITTLE DAYLIGHT PENETRATED INTO THE FOREST THAT THREE FLASH SHEETS WERE NEEDED TO OBTAIN THIS PHOTOGRAPH

H. P. Montanye, Member of the 1926 Expedition, Descending Into a Steaming Fissure

Photograph by A. Mackie

A Stream at Ifrane, in the Middle Atlas Mountains

THE WILD BEES OF MOROCCO

An Entomologist Studies Isolated Species in the Mountains of North Africa

By T. D. A. COCKERELL
University of Colorado, Boulder, Colorado

IN these days the most fashionable type of biological research is that carried on in the laboratory, and, considering the wonderful discoveries made by laboratory workers, it is not surprising that this should be so. Yet we must not forget Nature's laboratory, out-of-doors, where experiments have been going on through the ages, with the result of producing the varied assemblage of living things now inhabiting the world. Why are there so many genera, species, and races? How did they come to be, and what is their place in the economy of nature? No one can answer these questions for the plants and animals of his own neighborhood. No one can completely answer them for a single species. Yet if one has studied some group of creatures intensively, approximations to answers may be found, and travel may be combined with fruitful observation.

A very important factor in relation to all forms of life, is that of isolation. That is why islands are so interesting to the naturalist. I have just received a paper on the lizards of the islands east of Spain, which illustrates local modification in the most striking way. The author, Mr. Eisentraut of Berlin, recognizes three species of the common European genus *Lacerta* inhabiting these islands. One, *Lacerta lilfordi*, lives on the Balearic Islands, and has fifteen different races on the different islands. The second, *Lacerta pityusensis*, lives on the Pityusæ group, and has no less than twenty-seven races inhabiting the various small islands. The third, *Lacerta atrata*, inhabits the much smaller Columbrete Islands, nearer the coast of Spain, and has three races. Now it is admitted that these races of lizards are not very different, but according to the author they

are quite recognizable, and it is evident that we have the beginnings of changes which, in the fullness of time and under favorable circumstances, lead to the formation of distinct species. We have also a measure of the age of the several islands, and of the rate of evolution in the various types of animals and plants inhabiting them.

I do not know any group of small islands where the bees are similarly differentiated, but no one has yet studied them in this intensive way. There is no adequate account up to the present time, of the bees of any group of small islands, nor has it been customary to examine bees for small and incipient characters. At the same time, there are isolation-factors affecting bees which have no influence on lizards. Especially we note isolation through food habits, or restriction to particular genera or species of flowers. There are some kinds of bees that are so completely dependent on particular kinds of flowers that they cannot exist where these do not grow. When one is looking for new bees, the best way is to look for new flowers, which are usually productive of something interesting. Thus the student should be a botanist as well as an entomologist. In the vicinity of Milwaukee, Wisconsin, Doctor Grænicher observed a bee which visited plants of the large group Compositæ, the group of the asters, golden-rods, etc. But on the Parnassia, or grass of Parnassus, he found a very closely related species, which was entirely confined to that plant. It can hardly be doubted that the second originated as an offshoot from the first, perhaps a good many thousands of years ago, but possibly more recently.

Another kind of isolation is on mountain masses or peaks. Many species exist only in the mountains and do not cross

Photograph by A. Mackie

COLLECTING BEES AT ASNI

Professor Cockerell is shown here collecting a new and excessively minute species of *Ceratina*

Photograph by A. Mackie

A VILLAGE IN THE HIGH ATLAS MOUNTAINS

Located near Asni is this picturesque village. Its architecture is very reminiscent of that found in the state of Arizona

the low country between. That is why among mammals such as chipmunks there are so many more species and races in the west than in the relatively uniform eastern states. Many bees have been collected on mountains, but no one so far has done the work thoroughly in any region where the ranges are broken up as in New Mexico and Arizona. It would be a great and arduous undertaking, but the results would be very interesting.

Recent studies have brought out the fact that in Africa certain bees exist high in the mountains close to the equator, and the same species appear again at low levels far to the south, in Natal or the Cape Province. In studying the distribution of bees, we have this advantage, that as they visit flowers they are easily seen and it is possible to collect all or nearly all the species flying in a district at the time it is visited. There is, however, a succession of species during the warmer months, just as there is a succession of flowers. Hence, in order to get all of them, it is necessary to collect throughout the season. Even then some will be missed, as there are off-seasons when particular kinds are rare or almost absent, whereas in other years they may be common. Many people are surprised to hear how many species of wild bees there are. In a good locality or district it is possible to find more than 300 sorts, and in a continental area there are thousands. I have not computed the total number known in the world, but it would only represent a minority of those actually existing, I believe.

Many years ago, Wallace and Sclater, two famous English naturalists, undertook to define the zoögeographical regions of the world. These were the areas of continental size which had the fauna and flora fairly uniform. The Palearctic

(or northern region of the world) extends from the Atlantic shores of Europe and North Africa to the Pacific coasts of northern Asia, including Japan. It is an enormous extent of country, with, of course, very diverse conditions. In any large group of animals the species will vary in different parts of this great area, but most of the genera will be the same. On the coast of eastern Siberia I heard the cuckoo call just as in England, and I collected a beautiful butterfly, almost identical with one which I had found on the Madeira Islands out in the Atlantic off Africa.

Having collected and studied wild bees at the eastern end of the Palearctic Region, or eastern Siberia and Japan, we were especially interested to see those of the western extremity, in Morocco. The fauna of Morocco attracts the naturalist for many reasons. There is a cool coast belt, a heated interior, and a great series of mountains, very much as in California. The Atlas Mountains, though near to Europe, and long famous in history, have remained comparatively little known. Owing to the condition of the country, it has often been unsafe to venture into them, and difficult to obtain permission to do so. In 1887 was published a very interesting book *Journal of a Tour in Morocco and the Great Atlas*, by Sir Joseph Hooker and John Ball. These distinguished botanists, after surmounting many obstacles, made their way into the midst of the high Atlas, by way of Marakesh (Morocco City), Asni (which they call Hasni), Arround and Amizmiz (their Amsmiz). This was in the year 1871, but at this comparatively late date the social conditions were mediæval in character. Thus it happened that they received favors from the aged governor of Shedma, who created a most favorable impression. His venerable aspect, re-

Photograph by A. Mackie

CAMELS AT ASNI

These ubiquitous burden bearers still prove their usefulness to man in these mountainous regions high above sea-level, as well as in the sandy plains of desert areas

markably fine features, and combination of dignity and frankness in conversation, convinced the travelers that here at least they had met a man of superior type. On speaking of him to a long resident of the country they were told: "Yes, he is a fine-looking fellow, but he is not much better than other men of his class. Last year he poisoned two friends of mine under very discreditable circumstances." Then follows an account of these circumstances, ending with the comment made by the governor's son: "Well, the fact is that my papa did not know what to do with them, so he had them poisoned."

Today the Sultan is little more than a nominal ruler, the greater part of the country is under the French, a broad zone to the north is administered by Spain, and a small coastal district including Tangier is under international control. Railroads and good roads are to be seen crossing the country, and travelers are generally safe. At the ancient university in Fez, we met a man from up the country. Our missionary friend, Miss Dension, spoke to him in his own tongue, remarking that he came from a turbulent district.

"Yes," he said, "Formerly one went out on the road and got killed, but since the French have come, we eat our tomatoes and sleep in peace."

Nevertheless, there are still places where it is not considered safe to go out without an armed escort, though these are rapidly diminishing. The country is being opened up for modern civilization, to the great advantage of the people in most respects, but not without some disadvantages arising from competition and the introduction of methods foreign to the genius of the natives. History shows that the Moors have inherent qualities of a high type, and are capable under favorable conditions, of making noteworthy contributions to human culture.

The French have not only developed the country in a material way but have established at Rabat an excellent scientific institu-

Photograph by A. Mackie

CHILDREN AT TANGIER

These delightful subjects for the camera lived in Tangier, the most important seaport of Morocco, which consists partly of houses of one story, built along narrow lanes too steep for the use of vehicles

Photograph by W. P. Cockerell

HOTEL AT ASNI

Professor Cockerell and his party made this their headquarters while they collected a large number of bees in the vicinity

tion, with collections representing the natural history of the country. M. André Théry, the principal entomologist, is a great authority on beetles of the family Buprestidæ, and has an immense collection from all parts of the world. He has recently (1928) published an admirable revision of the Buprestidæ of North Africa. He lists about 300 species, and numerous varieties. Thirty-six of the species were first made known by him. M. Jean Mimeur, of the same institution at Rabat, specializes in Aphididæ (plant lice) and Coccidæ (scale insects). Conditions are thus more favorable for the scientific exploration of Morocco than they have ever been. It is the one country to be reached in a few days from London, which still affords striking novelties, which according to our experiences can be obtained without difficulty. Thus Mr. B. P. Uvarov of the British Museum reports that of sixteen species of Orthoptera we obtained, no less than three were new. One, a blue-winged grasshopper came from Arround in the High Atlas; the other two were from Ifrane in the Middle Atlas.

Our expedition of 1930, consisting of Miss Alice Mackie, Mrs. Cockerell and myself, reached Tangier at the end of July, and sailed thence for Southampton on August 7. Thanks to the generous assistance of Judge Barne of Tangier and various other friends, we were able to choose the best localities and make the most of our limited time.

It was, of course, not the best time to collect bees, which in north Africa are especially abundant in the spring, as in California. During the heat of the summer much of the vegetation dries up, the crop of flowers is greatly diminished, and of course the bees are correspondingly fewer. However, it was our only opportunity and we had to make the best of it.

Photograph by A. Mackie

CROSSING THE RIVER NEAR TAHANAOUT

At this spot of the river, locally called Asif Reraia, which was north of Asni, lower carboniferous fossils were found

At Tangier the species were few and not particularly interesting. At Rabat, in a vacant lot in front of the hotel, I found a new species of *Nomioides*, a minute, prettily colored insect similar to our *Perdita* of the dry parts of North America. At Mogador I found another new species of the same genus. These places are all on the coast, but it was in the interior, in the Atlas Mountains that we found our real success.

In the high Atlas we found accomodation at a small inn, situated in a grove of olive trees, at Asni. This was the very place where Hooker and Ball had camped in 1871. There is a broad arroyo through which only a small stream was running at the time of our visit. Flowers were not very numerous, and became scarcer before we left. Yet there were enough, in enough variety, to attract a large number of bees, and our collection grew until the available boxes were nearly filled.

Later we spent some time at Ifrane in the middle Atlas, not very far from Fez. This is a place which is being established as a summer resort for Europeans, and the large hotel was still in process of construction while we lived in it. The surrounding hills are covered with oaks (on which, to my surprise, I failed to find any galls), and on the summits are tall cedar trees of the species *Cedrus atlantica*. Hooker and Ball in their time were not sure that this tree was to be found in Morocco. Through the valley runs a winding stream of cool water, inhabited by a vast number of snails called *Melanopsis maroccana*. The flowers were more abundant than at Asni, and we got many bees. This locality, which can be reached by way of Meknes, is indeed an ideal spot for the collector as well as for holiday purposes in general.

Not all our Morocco bees have yet been worked up, but 23 new species and

several varieties have been described. Undoubtedly the Atlas has a considerable fauna peculiar to that general region, and as regards several groups of insects, not yet made known. From the Great Atlas Hooker and Ball reported 465 species of flowering plants, of which 75 were said to be endemic, or peculiar to the region. In addition 61 were confined to this and adjoining regions. Presumably the list could now be considerably augumented, and while it is probable that several of the supposed endemic species have been found elsewhere, many others must have been added. Indeed, it must be remembered that Hooker and Ball did not divide species so minutely as is customary today, and doubtless many of their "varieties" take rank as species. In the case of the bees, it is not yet profitable to offer statistics, but it may be said that the peculiarities are at least as great as those of the plants. Also, as with the plants, there is a conspicuous lack of peculiar genera, and also of forms which could be supposed to have come from south of the Sahara. The fauna and flora with few exceptions are of a Mediterranean type.

The highest altitude reached by the expedition was Arround, 1900 m., in the High Atlas. This place was visited by Mrs. Cockerell and Miss Mackie, going on mules from Asni, under the guidance of Mrs. Joseph Nurra, a resident in the vicinity of Asni, who helped us in many ways. They put up at a small rest house provided for travelers. One of the discoveries at Arround was a new bee, which I named after Mr. Nurra. It belongs to the wide-spead, quick-flying genus *Anthophora*.

Photograph by A. Mackie

A view near Asni

Wide World Photograph

Man o' War Leading Sir Barton by Eight Lengths, at Windsor, Ontario

"MAN O' WAR" AND "GALLANT FOX"

Two Great Race Horses of the Last Decade.—With Weights and Measurements, and Notes on Speed Adaptation

By S. HARMSTED CHUBB

Associate Curator of Comparative Anatomy, American Museum

Photographs by the Author, except where Otherwise Credited

THE comparative merits of Man o' War and Gallant Fox have, for some time, been a never failing subject of discussion, but it is safe to say that this controversy will never be closed. The fact that these great runners worked out their illustrious careers at widely separated dates renders such a comparison extremely difficult or impossible.

Man o' War held the excited attention of the turf in 1919 and 1920, while Gallant Fox drew thousands to the grand stand ten years later. The would-be rivals of Man o' War, have, with him, long since retired from the track. The horses that ventured to compete with Gallant Fox were of quite a different class, and worked under conditions that had greatly changed during the intervening years. Each horse is so worthy, such a perfect example of equine conformation, intelligence, and achievement, whose value as a premier entertainer at the race course is known, not only to the frequenters of the track, but to many other "grown-ups" and children as well, throughout the United States and the world, that comparison of their accomplishments would necessitate dwelling on minute technicalities and be unfair to one or the other of these remarkable horses.

These facts, particularly that they never met in direct competition, would seem almost to pre-

RACES IN WHICH BOTH HORSES WON
Man o' War, 1920, and Gallant Fox, 1930

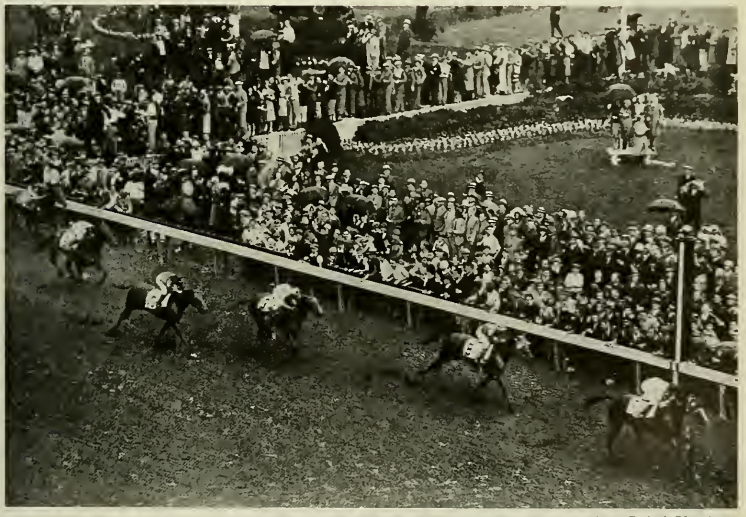
Track	Race
Belmont Park	Belmont Stakes
Belmont Park	Lawrence Realization
Belmont Park	Jockey Club Gold Cup
Aqueduct	Dwyer Stakes
Pimlico	Preakness

clude comparison of their accomplishments on the track. We may, however, call attention to the races that were won by each on the same tracks, though it must be remembered that even here there were many changed conditions, such as: length of course run, different competitors and weather conditions, as well as other minor changes. A list of these races will be found on page 318. The Kentucky Derby, mentioned below, was not run by Man o' War.

We may also discuss some of their interesting characteristics, and comparative weights and measurements. Both horses are of a gentle and attractive disposition, not unduly nervous, even submitting, in a most trustful manner, to the flourishing of measuring tape and calipers about their flanks and heels. They never wasted energy in useless fretting at the stable, but conserved their nerve fuel for the serious work at the track, and they show many interesting traits of psychology, and a high degree of intelligence.

Through the kindness and generosity of the owners, Messrs. Samuel D. Riddle and William Woodward, the present writer has had unusual opportunity to study these great horses. Observations were made, not only on the track and at the stables, but at Berlin, Maryland, and Paris, Kentucky, respectively, after their retirement from the track.

In December, 1920, Prof. H. F. Osborn and I accepted Mr. and Mrs. Riddle's kind hospitality at their estate on the eastern shore of Maryland, one of the three Glen Riddle farms, where Man o' War sojourned for a time before departing for his present home in Kentucky. It was here in Maryland that careful measurements were made of every important section of limb and body, weights



Acme-P & A Photograph

GALLANT FOX WINS THE KENTUCKY DERBY

The Preakness and Belmont Stakes were also among his victories. Owned by Mr. William Woodward of New York

GALLANT FOX

As he appeared at the Aqueduct Stables in October, 1930, shortly after his owner, Mr. Woodward, had retired him from the race track

were taken, and numerous photographs made from various points of view, thus adding valuable portraits to our series of pictures in action, previously taken on the track.

About the box stall of Man o' War, we noticed at once that there was a perceptible shade of sadness due to his approaching departure for Kentucky, necessitating a separation of horse and trainer. It is not surprising that the trainer, Mr. L. Feustel, should feel a true affection for his charge and keen regret at parting with so noble an animal, whom he had watched and cared for with utmost solicitude, and who had responded so wonderfully to his training.

Three months after his retirement from the track, the scales showed a gain of one-hundred pounds, as it was no longer necessary to keep him in training. As Man o' War's weights and measurements were taken ten years ago, those who have had the pleasure of seeing him more recently will undoubtedly tell us that he has put on considerable weight since then, which is always to be expected, and is quite in accord with the life insurance formula, that allows us a certain amount of expansion with the accumulation of a few more years of experience. Furthermore, a horse at three years of age is not fully mature, as is clearly shown by dental and bone development.

It is sometimes said that one who calls forth no criticism, has little to recommend him. So we are not purturbed that Man o' War has been criticised for "running too high." Certainly he is very high above the track in the remarkable photograph on page 318, where he is leading Sir Barton at Kenilworth Track, Windsor,

MAN O' WAR, CHAMPION OF 1920

Photograph taken at Berlin, Maryland, three months after his owner, Mr. Samuel D. Riddle of Philadelphia, had retired him from the track

Ontario. When carefully considered, this elevation would seem to be a merit rather than a blemish, and was necessary to carry him the surprising distance of twenty-five feet in a single stride, the stride being the completed movement of all four feet. Eadweard Muybridge, a pioneer in the study of animal locomotion, gives 22 feet 10 inches as the longest stride of a thoroughbred that came under his observation.

It may not be generally known that a horse, while running at high speed, is entirely free from contact with the ground approximately one-fourth of the time,—this being the moment when the feet are drawn together under the body, as shown in the photograph just mentioned—so that the above discussion is not whether the animal is on or off the ground, but rather what may be his average height from the ground during the running action.

Quite aside from the interesting individualisms of Man o' War, that we all like to point out, no one will dispute the fact that he is a wonderful horse, and that he set new world records for himself, and during his two racing seasons lost but once in twenty-one starts.

Now that his spectacular days on the track are long since past, and his retirement to the stud, near Lexington, Kentucky, has somewhat removed him from the public eye, we again look to the race course for marvelous feats performed by succeeding horses. In the ten years past since Man o' War held the foremost position "on the stage," several great thoroughbreds have made excellent records, and attracted widespread interest and commendation, but none so marked

as that of Gallant Fox, the great champion and favorite of the season of 1930. Truly he is a remarkable horse, the first since Sir Barton in 1919 to win the great stakes that make up the "Triple Crown" of American racing, the Preakness at Pimlico, the Kentucky Derby at Churchill Downs, and the Belmont at Belmont Park, as well as other great races, and is worthy to be classed with Man o' War, among the immortals of the horse world.

Professor Osborn, being interested in the achievements of Gallant Fox, and desirous of obtaining photographs and measurements of the great horse, asked me to join him in a visit to the Aqueduct Stables. Mr. Woodward welcomed us most cordially, shortly after his colt's retirement from the track. Here, I took a series of photographs and made measurements of the most important sections of limb and body. Later, upon the suggestion of Mr. Woodward and with his generous coöperation, the horse was followed to the breeding stud at Paris, Kentucky, where I was entertained with true southern hospitality by Mr. and Mrs. A. B. Hancock. Here, Gallant Fox was further studied, photographed, and weighed. Mr. Hancock kindly gave me an opportunity of also photographing the sire and dam of Gallant Fox, Sir Galahad III and Marguerite, who have recently become even more famous through the glories of their offspring.

In observing the personality of Gallant Fox, we find a most noticeable characteristic which manifests itself in an extreme interest and curiosity in everything that goes on within his sight or hearing. In fact, it has been said that the failure in his first race was due to his "varied outside interests," his concentration upon the important matter in hand being somewhat diverted by interesting observations not pertaining directly to the contest before him.

It is with great appreciation for his responsive pupil that his devoted trainer, Mr. James Fitzsimmons, tells us, in the New York *Herald-Tribune*, of the horse's intelligent curiosity.

> I had taken an umbrella with me. When the rain stopped I put it down on the ground without bothering to close it. A lot of yearlings would have shied away from it, but when Gallant Fox got a flash of it out of the corner of his eye, he just naturally had to find out all about it. So he walked over, just as calm as you please, and nosed around it. Then, when he had found out everything there was to know about it, he gave it his O.K. and went his way. It didn't interest him any more.
>
> He was like that about everything—and he never quite got over it. Right through his career, whenever he was going to race at a track that was strange to him, I'd have to show him everything there was to see. I'd have him led into the paddock a couple of times and let him stand in one of the stalls to see what that was like. He wanted to see everything for himself.

My acquaintance with Gallant Fox has been very brief as compared with that of his trainer, but I found that it did

MARGUERITE
The dam of Gallant Fox, owned by Mr. William Woodward. Photograph taken at Claiborne Farm, Paris, Kentucky, October, 1930

SIR GALAHAD III
Sire of Gallant Fox and of other noted colts. Mr. William Woodward is part owner of this handsome stallion

not take the colt long to find out all he wished to know about me. After that, when I was photographing him and wished him to look toward the camera, there was generally something of greater interest in the remaining three points of the compass.

We also find, as Salvator has interestingly pointed out in his article in the *Thoroughbred Record* of January 24, 1931, that even at the finish of a hard race, when drooping ears usually indicate more or less lagging of general interest, Gallant Fox crossed the finishing line still looking ahead with ears "pricked" forward, interested as usual and ready for more.

Gallant Fox is a horse above the average in size, and is often referred to as the "big bay," although in most dimensions, but not all, Man o' War is just a little the larger of the two, as shown in the table of comparative weights and measurements on page 326

In taking the weight of fore and hind quarters, separately, the horse was placed with the fore feet on the scales, while the hind feet rested on the ground. In weighing the hind quarters, the reverse operation was adopted. This method gives us only an approximate result and it will be seen that there is a greater discrepancy, when compared with the total, in the case of Man o' War than of Gallant Fox. This is due only to the variable position of the head. At first sight it may seem surprising that the weight supported on the fore feet is so much greater than that on the hind, but this is quite obvious when it is recalled that the fore feet support the weight, not only of the fore quarters but also of the heavy head and neck. Furthermore, when the neck is extended forward horizontally, it causes an increased leverage, with the fore feet acting as the fulcrum, which actually transfers many pounds of weight from the hind feet to the fore. Every one has observed that a horse's fore feet are larger than the hind, which is also the case with nearly all quadrupeds, owing to the fact that the greater weight of the body falls on the fore feet.

While these qualities of mind and body are of interest and, no doubt, contribute to the excellence of these horses, we are still at a loss to know just what peculiar anatomical structure and mental make-up it is that accounts for the great speed of these two thoroughbreds. After the most careful study possible, we find no extraordinary points which would seem sufficient to account for their remarkable records.

It is safe to say, however, that speed requisites are many and varied: that it is a preponderance and favorable combination of various qualities happily associated and harmonized in one individual which give the phenomenal result, although we have much to learn regarding these qualities and combinations.

In the meantime, possibly we might not

go far astray in giving some credence to the African philosophy expressed by a venerable old colored stable "boy," of whom the following story has been told. The late Mr. James R. Keene, with a group of horse experts at his stable, was carrying on an animated discussion of the contour and appearance that go to make up a good horse. Tom was a quiet, but interested listener, who shook his gray head doubtfully on all points.

"Well, Tom," said Mr. Keene, "what do you say makes a good horse?"

"Speed, Mista Keene, speed's w'at makes da good hoss."

"Oh! yes, of course, but what else, Tom?"

"Mo' speed, Mista Keene, mo' speed's w'at makes da good hoss."

It is true that there are mechanical factors, such as limb proportions, length of humerus, radius, femur, tibia, cannon bone, leverage and fulcrum, etc., that might give us a basis upon which to conduct research work along these lines, if measurements could be made with sufficient accuracy. But it must be remembered that the measurements referred to above, having been taken from living subjects, at best only approximate the truth.

At this point, let me hasten to say that we all hope that Man o' War and Gallant Fox, and other great horses, may remain "living subjects" for many years to come, and that this hope is sincerely shared even by the ardent student of equine osteology and of post mortem examinations. Yet, due to the fact that the human span of life is much longer than that of the horse, every friend of a great steed confidently expects to outlive his cherished equine companion.

Therefore, let us study the living subject at the track and stable; then let us examine his progeny at the breeding stud, as we are at the present time watching the movements of Man o' War's colts, and are looking forward with intense interest while we await the development of the descendants of Gallant Fox; and, finally, in due course of time, let us continue, extend, and verify these studies; so that a great horse may still live to science and posterity when no longer in the flesh, under the sunshine of the pasture or paddock. For, in order to obtain measurements upon which to build the most reliable foundation for further study of speed adaptation, it is necessary to obtain the accurate length of each bone, unobscured by surrounding tissues, all the way from the withers down to the hoof, and from the hip to the hoof. Beginning with the scapula, or shoulder blade, we must caliper accurately the distance from its upper border to the articular surface at the shoulder; the length of the humerus between proximal and distal articulations; likewise that of the radius, or forearm; and so on throughout the whole skeleton, so that we may ascertain the true proportions of different parts, particularly of the limbs, these organs being of paramount importance in speed adaptations.

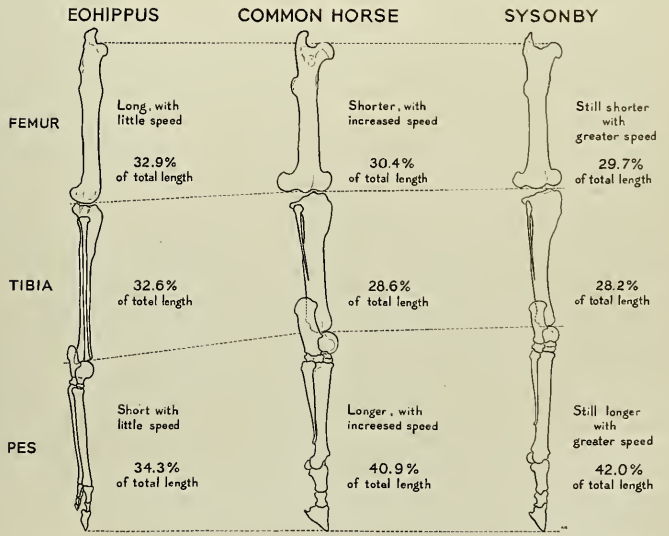
There is one mechanical principle which, during the evolution of the Equidæ, has been carried out in a most interesting manner. Little Eohippus, the earliest ancestral horse with which we are well acquainted, was a small animal hardly larger than a fox. In order to escape from his carnivorous enemies, which in his early day were beginning to develop to a menacing degree, and also in order to cover the ever widening distances between his gradually drying pasture lands and his drinking resorts, he and his descendants were obliged to increase their speed, if the species was to be perpetuated. To this end, size must be developed within practical limits. Most essential of all, length of limb must be increased, but this lengthening must be carried out in a very special manner. If, for example, we sup-

pose that all the bones of the limbs had been lengthened equally, a great mass of heavy muscle would thus have been moved farther down from the shoulder and hip joints, farther from the source of power, and also farther from the point from which the whole mass swings. This would have retarded the natural and economic swing of the limb mass as a whole. By way of illustration, compare this with the pendulum of a clock. If we wish the clock to run more slowly, we move the weight farther from the swinging point, thus retarding the swing of the pendulum. If, in the course of the evolution of the Equidæ, this plan had been followed, the line of descent would most certainly have been doomed to failure.

Who can say to what extent it might have affected the human race if, when man arrived on the scene of action, he had not found his faithful helper and companion, the horse. Fortunately, this was not the plan. On the contrary, the upper bones of the limbs, the humerus and femur, which are surrounded by a great mass of heavy muscles, have remained comparatively short, while the metapodials, or cannon bones, and phalanges, or pasterns, where the weight is reduced to little more than bone and tendon, have been greatly elongated.

The very comprehensive diagram, devised by Prof. H. F. Osborn for his Titanothere monograph, has here been adapted to the Equidæ, and illustrates this point clearly. (See below.)

The three examples figured in this diagram are: the fossil horse, Eohippus; a common type of domestic horse, of no great speed as compared with a thoroughbred; and the great race-horse, Sysonby,



HIND LIMB BONES OF THREE SKELETONS

These show proportionate lengths of proximal and distal segments, the femur being shortened and the pes elongated with increased speed

COMPARATIVE WEIGHTS AND MEASUREMENTS

Made by S. Harmsted Chubb

	MAN O' WAR	GALLANT FOX
Weight, total	1150 lbs.	1125 lbs.
" of fore quarters	675 "	645 "
" of hind quarters	525 "	475 "
Height, at withers	16 hands 1⅝ in.	16 hands 1 in.
" at crest of ilium (pelvis)	16 " 2 "	16 " ¾ "
Length, withers to crest of ilium	34½ inches	33¾ inches
" withers to proximal end of humerus (shoulder joint)	26 "	24½ "
" proximal end of humerus to olecranon process (elbow)	17 "	13½ "
" olecranon process of pisiform ("knee" joint)	16¼ "	17⅞ "
" of carpo-metacarpus (fore cannon, including "knee" joint)		13 "
" of tibia (shin bone)	14½ "	16¾ "
" of tarso-metatarsus (hind cannon, including astragalus)	18¾ "	15 "
Girth of chest, behind shoulder	71¾ "	73 "

Man o' War Measured and weighed, as three-year-old ..... Dec. 12, 1920.
Gallant Fox Measured, as three-year-old ..... Oct. 11, 1930.
" " Weighed, " " " " ..... Nov. 23, 1930.

famous twenty years ago. These skeletons are in our Museum collection, where the individual bones have been carefully measured and show an interesting result. Disregarding the great difference in size of the specimens, it has been arbitrarily assumed, for the purpose of comparison, that the limbs are of uniform length (100). It will be seen that in Eohippus, an animal which we believe to have been of little speed, the pes, or foot, is very little longer than the femur. After long ages of evolution we find that the common horse of today, where there has been little or no selective breeding, has a greatly increased length of pes as compared with the femur, while, in the Sysonby skeleton, a further reduction of the femur with an increase in the length of the pes, would seem to be correlated with the great speed of this race horse; and it is to be expected that bone measurements of other speedy horses will show a similar result.

In considering speed adaptation, we should not overlook the Arabian horse. In our collection we have the skeletons of several very fine examples of the Arab, Astraled and Abu Zeyd, the remains of which were presented by Mr. W. R. Brown, owner of the Maynesborough Stud; Halim, presented by Major-General J. G. Harbord; and Nimr, the gift of Mr. Randolph Huntington. The Nimr skeleton was mounted and placed on exhibition in 1906. These skeletons show limb proportions very close to those of Sysonby. But the Arabian horse, not having been selected and trained for the short race, although capable of great speed coupled with endurance and weight-carrying ability, should not be compared with the thoroughbred on our race track.

In the course of equine evolution, the gradual change in proportionate length of upper and lower limb bones has been a most important factor, and it is in the elongation of these bones of the feet that the greatest speed adaptation has taken place. If, today, a horse should appear with a femur measurement almost equal to that of the entire foot from the hock joint to the ground, as was the case with his remote ancestor, Eohippus, we may be sure that his winnings would be much greater at the freak show than at the track. According to these principles, to

increase speed on the track, we should therefore breed for the shortest possible humerus and femur, and the long cannon and pastern bones, although, at the tracks, we so often hear a view expressed that is quite the reverse.

Another very important speed adaptation has been the elimination of toes. While Eohippus possessed four distinct toes on each front foot, and three on the hind, all bearing small hoofs, fossil horses of later geologic time show a gradual reduction of toes through succeeding stages of evolution, until, in the modern horse but a single toe, the third digit, remains on each foot. This has further reduced weight at the extremity of the swinging "pendulum" where every additional ounce would greatly retard its action. These are obvious mechanical principles, but there are many other factors not so tangible, such as: heart and lung action; muscular strength and endurance; psychology, will power, determination; just the proper balance of nervous energy; etc. These points are difficult to measure or determine but, nevertheless, of very great significance; and it is possible or even probable that these obscure characters might be so variable in the thoroughbred of today, that they would counteract slight variations in limb-bone proportions, thus affecting to some extent our calculations based upon accurate bone measurements alone. However, in order to ascertain the true importance of these proportions, the most accurate measurements must be made, so that we can continue our research with some definite facts.

Acme-P & A Photograph

Gallant Fox, with E. Sande "up," preparing for the Kentucky Derby

GEORGE FISHER BAKER

1840-1931

THE Sixty-second Annual Report of the President of the American Museum, issued May 1, closes with a strong appeal to the third generation of Trustees to rise to the high standard set by the first generation who came together in the year 1869 at the call of Theodore Roosevelt, Sr., grandfather of Kermit Roosevelt, a recently elected member of the third generation. In point of age, our late Trustee, George Fisher Baker, would be classed with the first generation because he was only three years younger than John Pierpont Morgan, of the first Board, who was born in the year 1837. Thus, although Mr. Baker was not elected a Trustee until the Annual Meeting of February 2, 1914, forty-five years after Mr. Morgan's election in 1869, he distinctly belonged to the first generation type of Trustee characterized by the president as follows:

> The sterling men of this first generation were impelled by the strong religious and stern Puritanical code of their time which demanded that each should give a tithe of his income to benevolent purposes and a greater or less quota of his time to the public interest. Philanthropic and patriotic service was instilled weekly in every pulpit, for practically everyone attended church.

This unity of early training accounts in part for the close friendship which bound Mr. Baker and Mr. Morgan together. The most personal of the former's gifts was his tribute to his dear friend through providing the means for redesigning the Morgan Memorial Hall and the rearrangement of the collections of minerals and jewels presented by Mr. Morgan. The dedication of the hall is contained in a bronze tablet at the entrance which bears the following inscription:

MORGAN MEMORIAL HALL
PRESENTED TO
THE PEOPLE OF THE CITY OF NEW YORK
BY GEORGE FISHER BAKER, TRUSTEE OF THE MUSEUM
IN MEMORY OF HIS FRIEND
JOHN PIERPONT MORGAN
MCMXXI

Mr. Baker felt the full responsibility of Trusteeship in every line of the Museum's activity which was called to his attention. He became first vice-president in 1924 and served in this capacity until his death. He was a member of the Finance Committee from 1914 to 1926 and of the Special Committee on the Jesup Bequest for the years 1914 and 1915. Mr. Baker was successively elected a patron, an associate benefactor, a benefactor, and an endowment member of the Museum. He displayed a great interest especially in exploration in Central Asia under Roy Chapman Andrews and was a generous supporter of the Central Asiatic Expeditions since their inception ten years ago. He was a regular attendant at the annual meetings of the Trustees. His invaluable advice was freely given on many financial problems of the Museum, and he became one of the Museum's most generous supporters; his benefactions to the Museum total $661,200, including $500,000 contributed to the Endowment Fund.

Mr. Baker continued an active force in the financial and cultural life of America until the very end of his life. On the Monday preceding his death he attended the meeting of the Board of Trustees of our sister institution, the Metropolitan Museum. He passed away quietly on Saturday, May 2, shortly before the sixty-second annual spring meeting of our Board of Trustees, who immediately adopted a resolution of deepest sympathy to the members of his family.

The American Museum has been singularly fortunate in being guided from the first by men of leadership not only in local but in national affairs who have given it most wise and sound financial foundations in strict accord with the original charter and contract of the State and of the City, "of establishing and maintaining in said city a Museum and Library of Natural History; of encouraging and

GEORGE FISHER BAKER
1840–1931
Trustee of the American Museum of Natural History, 1914–1931;
First Vice-President, 1924–1931

developing the study of Natural Science." Accordingly, both the spirit and the letter of the original agreement with the City have been observed with fidelity. Step by step from early and difficult financial, scientific, and educational beginnings, such great leaders as Theodore Roosevelt, the elder, John David Wolfe, first president, Robert L. Stuart, second president, Morris K. Jesup, third president, J. Pierpont Morgan, chief financial advisor and most generous contributor during his entire life, Joseph H. Choate, chief legal counselor, have aided in building up the present financial and educational structure in which the individual contributions of Trustees and members more than balance the contributions of the people through taxation.

George Fisher Baker's name stands high in this honor roll which constitutes an ever-to-be-remembered standard for the present and future generations. Like many of his friends and associates of the first generation, Mr. Baker will long be remembered not only as one of the leaders of American finance but as one of the finest examples of American citizenship and patriotism. By those who had the privilege of knowing him personally, will be fondly recalled as a man who he cealed a forceful character under an ever gentle manner and quiet personal charm.

—Henry Fairfield Osborn.

THE PROPOSED PACARAIMA-VENEZUELA EXPEDITION

By G. H. H. TATE
Assistant Curator of South American Mammals, American Museum

FOR the first time in the history of the field reconnaissance work of the American Museum, aëroplanes are to be employed by the joint expedition, led by H. E. Anthony, which will be sent this summer to Venezuela by the American Museum, the New York Botanical Gardens, and the American Geographical Society. Use of flying machines will enormously facilitate the expedition's approach to an unmapped area of 40,000 square miles in the southern part of the country. The machines will be further used in developing a new system of mapping by means of oblique aërial photography, and will be available for moving members of the expedition from base camp to subsidiary camps and from one local station to another.

A Lockheed-Vega, a Fokker, and a small amphibian will form the trio of planes which are to carry the party into the Upper Caroni area. To cut down expense the machines will be flown south from New York to Trinidad, following the well-known route of the Pan-American Airlines. Most of the expedition's staff, together with all the baggage will, of course, travel by steamer. From Port of Spain the short flight to Ciudad Bolivar in Venezuela can be accomplished in a few hours. There the entire party will be concentrated and organized. From Ciudad Bolivar, the Angostura of history, preliminary flights without cargo will be made up the Caroni for the purpose of selecting a suitable interior base and to establish as quickly as possible friendly relations with the Indians of the highlands. These matters once settled, the two large planes will convey the entire party of perhaps twenty persons and their many tons of equipment to the base camp. The amphibian will be used for general reconnaissance and will be particularly valuable on account of its slow landing speed and slight draft for coming down upon the small streams of the uplands.

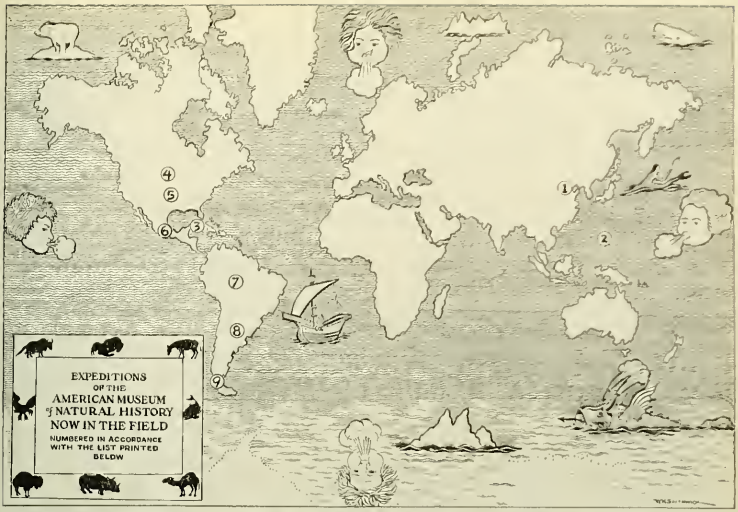
The complete plans of the expedition have been submitted to the Venezuelan Government and to General Juan Vincente Gomez, ex-president of Venezuela, through the kindness of Dr. Juan Ramon Guerra, President of Congress. The Government, Doctor Guerra states, is very favorably disposed toward the undertaking and is ready to give the party all possible facilities.

The part of Venezuela to be visited is perhaps one of the least known areas in South America today. Museum expeditions in 1927 to Mt. Roraima and in 1928 to Mt. Duida reached the eastern and western ends of the region, while the collections and information gained then, coupled with data furnished by early explorers such as the brothers Schomburgk, Im Thurn, McConnell, Andre, and others have served to draw attention to the extraordinary biological conditions present in the area. From what little is known of it the Guiana region of Venezuela may be pictured as a former elevated land having about the area of the state of Maine, large parts of which have been dissected into rather mature valleys, while other parts, which have to a great extent resisted erosion, remain today as scattered sandstone mountains, flat-topped and sheer-sided. Conditions in the western portion of the region can be only surmised. It seems likely though that the land is less mature and that the more rugged topography is generally forested.

Venezuelan Guiana, cut off from the well-traveled Orinoco by a belt of about one hundred miles of dense forest, is the home of a number of Indian tribes derived from Carib stock, among whom may be mentioned Arecuna, Maquiritares, and Macusi. They are friendly and quite intelligent folk, who pass their lives in almost complete ignorance of what we term civilization. Less can be told of the people of the forested area in the west.

As shown in the recently issued prospectus of the expedition, the field staff will comprise some sixteen men, everyone of whom is not only a specialist in some line of work, but is thoroughly fitted in physique and experience to accompany such an undertaking. After organizing the base camps, which will be situated as far up the Caroni as the planes can safely operate, the party will reconnoiter the near-by area for suitable local stations to be occupied successively by various members of the expedition. Meanwhile, the aërial mapping will be commenced and photographs taken over a wide area will help in the selection of subsequent stations.

It can be predicted with confidence that the results obtainable in six months by such a large and well organized party as the Venezuela-Pacaraima Expedition, Incorporated, will exceed what could be achieved in several years by any of the old type expeditions which traveled by foot and canoe.



1. Central Asiatic Expeditions; 2. Whitney, South Sea, Island of Kuasie, for birds; 3. Bockelman Shell Heap Project; 4. Frick-Falkenbach, Wyoming, for fossils; 5. Frick-Rak, Santa Fé, New Mexico, for fossils; 6. Vaillant, Valley of Mexico, archæological research; 7. Ollala Brothers, Brazil, for birds and mammals; 8. Naumburg-Kaempfer, Southern Brazil, for birds; 9. Scarritt, Patagonia, for fossil mammals

AMERICAN MUSEUM EXPEDITIONS AND NOTES

EDITED BY A. KATHERINE BERGER

It is the purpose of this department to keep readers of NATURAL HISTORY *informed as to the latest news of the Museum expeditions in the field at the time the magazine goes to press. In many instances, however, the sources of information are so distant that it is not possible to include up-to-date data*

CENTRAL ASIATIC EXPEDITIONS.—The eighty-four cases of fossils, representing the 1931 field work of the Central Asiatic Expeditions, arrived at the American Museum early in April, and laboratory work on them is well under way.

THE captain and owner of the ill-fated yawl "Basilisk," Mr. Gilbert C. Klingel, has returned to the American Museum with a large collection of reptiles and amphibians. The "Basilisk," described in a previous number of NATURAL HISTORY, struck a reef off the coast of Inagua Island last December, and, although the vessel was a total loss, Mr. Klingel retrieved most of his equipment and continued his studies both on Inagua and Santo Domingo. Since the loss of his vessel, he has shipped more than 2000 specimens to the Museum, including a number of rare species. A report of Mr. Klingel's work is to appear in a later number of NATURAL HISTORY.

THE O'DONNELL-CLARK AFRICAN EXPEDITION was brought to a successful conclusion early in April after a strenuous trip in search of eland for an American Museum group.

On April 7 a cable from Mr. Clark announced that the party was homeward bound, and that five bull and five cow elands had been secured, as well as accessories and paintings, and that 10,000 feet of film and many photographs had been taken. A fuller account of the expedition will appear in a later issue of NATURAL HISTORY.

MADAGASCAR EXPEDITION.—A cable from Mr. A. L. Rand of the Mission Franco-Anglo-Americaine states that he and Philip Du Mont sailed from Madagascar on May 11, and will arrive at Marseilles on June 15. This is

the completion of a two-year expedition collecting birds and mammals on the island. At least one specimen of every bird known to occur there has been collected, with the exception of *Heliodilus*, *Cochtolhraustes delandei*, and *Mesites unicolor*. A new genus, a new species, and a new race of birds have been described by M. Delacour and Mr. Berlioz. The genus has been named after Mr. A. L. Rand, and the species after Mr. Richard Archbold.

NOTES

ASTRONOMY

THE AMATEUR ASTRONOMERS ASSOCIATION continued its activities through the month of May. On May 6 Prof. J. Ernest G. Yalden spoke on "Sun Dials," and on May 20 Prof. Caroline E. Furness, of Vassar College, spoke on "Astronomy Around the World." During June, July, and August the Association will suspend its activities, to take them up again on Wednesday, September 16. The last Amateur Astronomers Association radio talk of the season over WOR was given on May 16.

The Association is happy to send to anyone interested all information concerning membership and activities as well as sample copies of *The Amateur Astronomer*, the journal of the society.

A SMALL PLANETARIUM has been presented to the Amateur Astronomers Association—the gift of the maker, Mr. Albert Fassberger, a member of the society.

A SUBSCRIPTION DINNER was given in honor of Sir James Jeans, the noted British astronomer, on May 28, at the Hotel Astor, under the auspices of the American Institute, the Museum of Science and Industry, the American Museum of Natural History, the *Scientific Monthly*, the New York Academy of Sciences, and the Amateur Astronomers' Association. Dr. Michael I. Pupin, the noted inventor and professor of electro-mechanics at Columbia University, presided at the dinner.

CONSERVATION

RECENT DEVELOPMENTS IN THE PARC NATIONAL ALBERT.—The history of the development of the Parc National Albert of the Kivu district, Belgian Congo, to the end of 1929 has already been discussed in this magazine. It was in that year, it will be remembered, that King Albert installed the Commission du Parc National Albert—a body of eighteen scientists chosen from Belgium, England, Sweden, France, the Netherlands, and the United States. This international direction of a great scientific undertaking was unique and without precedent in the history of the world.

In 1930, the American Committee for the Parc National Albert was formed to coöperate with the International Committee in the work of scientific research. His Highness, Prince Albert de Ligne, at that time Belgian Ambassador at Washington, who, from the beginning has taken an active and energetic part in forwarding the plans for the Parc, was named by His Majesty, chairman of the American Committee; Mary L. Jobe Akeley was appointed secretary. In addition to the two American members of the International Commission, Dr. Henry Fairfield Osborn and Dr. John C. Merriam, Prince de Ligne has appointed as members of the Committee, Mr. Stanley Field, president of the Field Museum of Natural History, Chicago; Dr. Vernon L. Kellogg, of the National Research Council, Washington; Dr. Robert M. Yerkes, of Yale University; Dr. George W. Crile, of Cleveland; and the Hon. James Gustavus Whitely, Belgian Consul General at Baltimore.

At a meeting of this Committee, held recently at the American Museum of Natural History, New York, Prince de Ligne, who was leaving America to take up his duties as Belgian Ambassador at Rome, resigned his office. Doctor Merriam was elected president to succeed him. At this time it was decided to enlarge the American Committee in order to afford a national representation. The Committee's purpose now is to bring the Parc National Albert and other similar undertakings in Belgian Africa in closer contact with American scientific and conservation organizations, as well as to secure support for these projects.

Dr. J. M. Derscheid, now Administrateur-General of the Parc, was present at this meeting and reported to his colleagues plans for the further extension of the park system in Belgian Africa, and told them of the progress of the Kivu park. In addition to the Parc National Albert, there will be created a new park, Parc Leopold, near the northern border of the Congo. It will comprise an area of 1,000,000 acres. Lying north and east of the Parc National Albert will be another new park, the Parc Ruwenzori, an area of 500,000 acres in the Ruwenzori Range, adjoining the Belgian Congo-British Uganda

Boundary. These new regions are of particular interest to scientists since they are the home of such rare mammals as the white rhino (*Ceratotherium cottoni*), the okapi (*Okapia johnstoni*) the giant eland (*Taurotragus gigas*) and the Nile lechwe [Mrs. Gray's Antelope] (*Onotragus megaceros*). Here also occur such interesting birds as the secretary bird, (*Saggitarius serpentarius*), the hornbill (*Lophoceros melanoleucos stegmanni*), the Gelo River crowned hornbill (*Lophoceros melanoleucos geloensis*), the Ruwenzori lourie (*Ruwenzoriis johnstoni johnstoni*), the Uganda brown parrot ((*Poicephalus myeri saturatus*), the Southern little bee-eater (*Melittophagus pusillus meridionalis*), the Ruwenzori kakelaar or wood hoopoe (*Phæniculis purpureus ruwenzorae*), the Swahili wood owl (*Striz woodfordii suahelica*) and many others.

Pending the official establishment of these new parks, activity has been concentrated in the Parc National Albert. Patrols of native scouts are on guard to prevent the killing of any wild animal and the destruction of plant life. Meanwhile the Belgian Government has appropriated ample funds for the maintenance of the Park Service, and has advanced a loan of two million francs to begin immediate construction of a Central Station for Scientific Research. This station will be erected on a grant of twenty acres in the heart of the Government Post at Rutshuru. The buildings will rise on the banks of the deep-flowing Rutshuru River, and will give a broad view of both active and extinct volcanoes. The station is in the geographic center of this naturalist's paradise.

Here will be the central library, containing a collection of all the scientific treatises relating to the fauna, flora, and geology of Central Africa; a study museum, for which will be collected all the animals indigenous to the immediate vicinity; laboratories, equipped for the use of zoölogists, botanists, seismologists and geologists. Adequate provision, as well, is being made for a chemical laboratory and a photographic wing. Near by will be an assembly hall, administrative offices, and living quarters. All these buildings are designed for the use of white men unaccustomed to the tropics. Although barely one degree from the equator, Rutshuru is actually white man's country, because its 5000-foot elevation brings it out of the torrid zone.

Approaching the Parc National Albert
in the distance may be seen the volcanoes within the parc. this view was taken from behungi

This Central Station, moreover, will very shortly be connected with the outside world by a motor road to Redjaf-on-the-Nile, and thence by water and rail to the Mediterranean. Another road will connect with Kisumu, and thence by train to Mombassa, the port of entry on the Indian Ocean. However, quickened avenues of approach to this region will by no means result in letting down the barriers into the Parc, so far as the outside world is concerned. One of the most important points in the scientific creed of the Parc is that therein *the primitive shall be preserved*! Accordingly, the natural conditions in the Parc will not be disturbed by contact with grazing or agriculture; and, lest the fauna become half-

domesticated by the familiar presence of man, certain limited areas will be set aside, free from human intrusion except as emergency may require.

In our great American National Parks, animals are all too often semi-domesticated. Bears, demanding sweetmeats or manufactured food "hold up" passing motor cars; they live in the main on hotel refuse, and are in many ways changed from their primitive ancestors in general behavior psychology and even in physiological habits. Such a state of affairs will never be permitted to exist in the Parc National Albert. Only scientists will frequent the Parc, and even they are barred from at least one-quarter of its area. Thus, the gorillas of that region, as well as other wild species, will not become accustomed to man, and thereby influenced or changed by contact with him.

This intention to preserve the primitive, wholly unaffected by the aggressive march of civilization, is indeed a recent attitude. It is the spirit motivating those who now carry on the fight to save vanishing Africa. Theirs is not a sentimental interest. It is a sympathetic understanding and a realization of the urgent need for action. In Africa, at least, Carl Akeley's dream, now become a reality, has halted the Juggernaut of mass destruction. Belgium's whole-hearted response is an epochal instance of the international possibilities of conservation and of scientific inquiry. —Mary L. Jobe Akeley.

THE American Committee for International Wild Life Protection is made up of an executive committee which meets from time to time and an advisory committee which meets once a year. It has represented on it the following organizations:

Boone and Crockett Club
New York Zoological Society
American Museum of Natural History
Museum of Comparative Zoology
Field Museum of Natural History
Smithsonian Institution
Academy of Natural Sciences of Philadelphia
California Academy of Sciences
American Society of Mammalogists
Camp Fire Club of America
Wilderness Club
University of Michigan Museum

The Committee is in close touch with the British Society for the Preservation of the Fauna of the Empire as well as with the continental movement for nature protection which is sponsored by ten European countries and has its headquarters at Brussels. It also has contacts in Australia, Africa, and India, as well as with the Committee for Nature Protection in and around the Pacific. The Committee has already a record of accomplishment by investigating and interceding in such matters as the Zululand game massacres, the smuggling of rhino horn into Somaliland, and the bringing closer together of the British and continental organizations working for international nature protection. It has financed and conducted: an investigation by most competent American doctors into all the work so far done on the tsetse fly problem in Africa; the summarizing of this information for the first time, and the study of it with a view to determining what further investigations are indicated and what degree of hope there is for future game preservation in the infected regions. This report is now completed.

It has sponsored the visit to this country of Doctor Derscheid, who is chief of all the parks in the Belgian Congo, as well as director of the International Informatory Office for the Protection of Nature at Brussels. This Bureau has published the game laws of many colonies for the first time in a compact form and actually helped to revise the laws in several colonies to make them more effective. It has active contacts with individuals in more than 150 different countries in various parts of the world and receives regularly more than 400 publications dealing with game matters. With Doctor Derscheid when he visited this country came Mr. Van Tienhoven. The latter is a prominent Dutchman who is one of the founders in Europe of the whole idea of international conservation. He has been very successful in making parks and shooting preserves in Holland. The Committee was so impressed by the valuable work that these two men were doing at an expense of $10,000 a year, that it pledged $5,500 to support the Brussels Bureau in 1931. This money has been collected and mailed to them.

Among the Committee's various activities may be mentioned the following: Taking an active part in the interest of whale conservation; looking into the matter of the preservation of the chinchilla from extinction; helping to enforce the Australian government law against the exportation of the koala, which is a fur that has hitherto been sold widely in the United States.

The Italian government has notified our Committee that negotiations are now going on to try to stop the smuggling of rhino horn into Somaliland. The Committee was pleased with the recent report submitted by Major Hingston to the British Fauna Society on the present status of game preservation in the African colonies. They are urging that his recommendations be carried out and the game reserves be given a permanent status by being made into national parks much like our own.

The American Committee is very pleased with the coöperation it has received from the organizations belonging to it, and needs the moral and financial support of all who are interested in its important work. It has received the fullest backing from many foreign governments and is fast increasing its activities and influence.

MEMORIAL TO NOTED PARK DIRECTOR. The U. S. Department of Agriculture announces that the work of the late Stephen T. Mather, former director of the National Park Service, is to be commemorated in a striking way by the Mather Memorial Parkway authorized recently by order of Secretary of Agriculture Arthur M. Hyde.

Stretching through the Rainier National Forest, Washington, a distance of nearly fifty miles and extending approximately one-half mile on either side of the Naches Pass Highway, the Mather Memorial Parkway comprises 24,300 acres of forest land in which outstanding scenic and inspirational quality is combined with timber and land values of economic importance. The highway, when completed this year, will provide a new entrance to the Puget Sound region from the Yakima Valley and the East.

AT their February meeting, the SOCIETY FOR THE PRESERVATION OF THE FAUNA OF THE BRITISH EMPIRE appointed Dr. Madison Grant vice-president of the Society in recognition of the great work he has carried on for many years in regard to the wild life protection, and also as a personal tribute to his assistance to the Society in initiating active coöperation in America by the foundation of the American Committee.

MEETINGS OF SOCIETIES

THE SIXTEENTH SESSION OF THE INTERNATIONAL GEOLOGICAL CONGRESS will be held in June, 1932, in Washington, D. C., the definite data to be announced later. The general sessions will be preceded (late in May), and followed (in June and early July) by a series of excursions designed to afford the members and attendants opportunity to see features of special geological interest in the United States. During the sessions short excursions to interesting places in and near Washington will be made.

The Congress has elected Prof. Henry Fairfield Osborn as honorary member of its organization committee.

Inquiries relating to the activities of the Congress should be addressed to the General Secretary, 16th International Geological Congress, U. S. Geological Survey, Washington, D. C.

THE THIRD INTERNATIONAL CONGRESS OF EUGENICS will be held at the American Museum of Natural History, New York City, August 20–23, 1932, under the presidency of Dr. Charles B. Davenport, director of the department of genetics of the Carnegie Institution of Washington and organizer of the Eugenics Record Office. An exhibition covering the present status of eugenical research will be held in the Museum from August 22 to September 22.

THE SIXTH INTERNATIONAL CONGRESS OF GENETICS will be held under the presidency of Prof. T. H. Morgan at Ithaca, New York, beginning August 24, 1932.

CURATOR FRANK E. LUTZ represented the American Museum at the April meeting of the Academy of Natural Sciences of Philadelphia when the Academy awarded the Leidy Medal to Prof. Wm. M Wheeler. Professor Wheeler was formerly curator of invertebrate zoölogy at the American Museum and is now research associate in its department of entomology. Curator Lutz also attended the annual meeting of the National Research Council's Division of Biology and Agriculture as advisory representative of the Entomological Society of America.

DISTINGUISHED GUESTS

PÈRE TEILHARD DE CHARDIN, newly appointed research associate in Asiatic Exploration at the American Museum, recently visited the Museum when on his way from Paris to Peking. He will start from Peking on a large automobile expedition on which he is planning to cross Asia, and finally to reach the Mediterranean shores.

THE AMERICAN MUSEUM was honored late in April by a visit from COMMANDER ATTILIO GATTI, famous Italian archæologist. Commander Gatti has led expeditions to Africa during 1927 and 1929–1931 in which as many as twenty-one European scientists participated. The expedition traveled in motor trucks from Cape Town to Cairo, and made long stops at various points, especially in Rhodesia where they excavated several localities containing evidences of habitation by prehistoric man.

The party took measurements of several thousand natives, collected more than 22,000 zoölogical specimens, 60 skeletons, of which 12 were those of Bushmen, and also made ornithological collections. About half of these specimens were given to the museums of South Africa while the remainder went to the Museum of Florence, Italy. Commander Gatti also presented five cases of archæological material and several zoölogical specimens to the American Museum.

MEMBERS' VISITING DAY

OPPORTUNITY to see the latest developments in the American Museum was afforded to its members and their friends on the occasion

of the Third Annual Visiting Day for Members, Wednesday, April 22. The guests were escorted in small groups through some of the research laboratories and preparation studios, and then visited several of the newer exhibition halls, and the Hall of Ocean Life, which just now is at an interesting stage in its preparation.

Following the inspection, the guests assembled in Education Hall, where they were greeted by Director Sherwood, and where refreshments were served.

THE NEW WHITNEY WING OF THE AMERICAN MUSEUM

ON April 17, President Henry Fairfield Osborn broke ground for the construction of the Whitney Wing of the American Museum of Natural History. This new addition to the Museum buildings which will connect with the Roosevelt Memorial, now under construction by the State of New York, will be devoted in its entirety to the exhibition of oceanic birds, and in addition to laboratories and study rooms, will include aviaries for living birds so that their habits may be intensively studied.

For eleven years Mr. Whitney has maintained an expedition among the South Sea Islands in search of all forms of oceanic and island birds, and during this work there have been secured many species new to science and a number which hitherto were thought to be extinct. This field work which has been directed by Dr. L. C. Sanford and Dr. R. C. Murphy, has had as leaders in the field such well known collectors as Rollo H. Beck, Jose G. Correia and Hannibal Hamlin. At the present time Mr. William F. Coultas is at the Island of Kusaie, in the Japanese Mandate region, continuing the work.

MUSEUM ACCESSIONS

DUPLICATES FROM THE DRUMMOND COLLECTION.—Early in February, 1931, Dr. I. Wyman Drummond, whose collection of Chinese carved objects in jade, amber, and other mineral materials is celebrated among collectors, intimated his wish to donate to the gem collection of the American Museum certain of his duplicates.

This gift in three installments has now been presented to the Museum, and includes about one hundred pieces of very exceptional beauty and interest. Many of these are representative of the older Chinese periods, comprising carved jade in the rich brown and ocher colors so characteristic of early Chinese worked jade. Among the latter is a magnificent disk, symbol of the diety of heaven, a beautiful example of the cubic symbol of the deity earth, and some beautifully inscribed tablets.

It is proposed to install this series in two upright cases of the smaller units used in the Morgan Hall, in close proximity to and in continuation of the jade series at present displayed.

In recognition of this splendid gift Doctor Drummond has been elected a Patron of the Museum.

MEMORIAL TO CLARE ELLSWORTH PRENTICE.—A beautiful bronze bust of Roald Amundsen by the Norwegian sculptor, T. Hammer, has been presented to the American Museum by Mr. Bernon S. Prentice as a memorial to his wife who was Clare Ellsworth, sister of Lincoln Ellsworth. The bust will be installed in the Arctic and Antarctic exhibits at the American Museum.

AN EMPEROR PENGUIN, captured by Paul Siple, boy scout member of the Byrd Antarctic Expedition, has been presented to the American Museum by Commander Byrd. The penguin, a handsome male specimen, which in life weighed 70 pounds, has been prepared for exhibition by Mr. Raymond B. Potter of the department of preparation of the Museum, and is now on display in Memorial Hall.

HONORS

ON March 13 last, the Hubbard Gold Medal, the highest honor the National Geographic Society can bestow, was awarded to Dr. Roy Chapman Andrews with special ceremonies at the Washington auditorium. Five thousand persons were present to witness the event.

This is the ninth time in forty-five years that the Hubbard Medal has been presented, the other recipients being Rear Admiral Peary, Capt. Roald Amundsen, Capt. Robert A. Bartlett, G. Carl Gilbert, Sir Ernest H. Shackleton, Vilhjalmur Stefansson, Rear Admiral Byrd, and Colonel Lindbergh.

The medal was presented by Dr. Gilbert Grosvenor, president of the Society, who made the following address:

MEMBERS OF THE NATIONAL GEOGRAPHIC SOCIETY:

Our Society welcomes with extreme pleasure tonight Dr. Roy Chapman Andrews, whose brilliant career as an explorer of all the seas and of many lands we have followed with sympathetic interest and admiration since his first address to our Society exactly twenty years ago.

Many in this audience I am sure recall that remarkable and beautifully illustrated lecture on the whale which summarized his studies of the world's greatest living creature.

In ensuing years he has many times returned to present to the National Geographic Society a fascinating report on some new line of investigation in Japan, Korea, Dutch East Indies, Alaska.

But we all associate Roy Chapman Andrews' name most vividly with the long series of expeditions which, beginning in 1916, he organized and led to Central Asia for the American Museum of Natural History.

By patient inductive reasoning, by a rarely gifted exploring instinct and keen observation, with splendid courage and resourcefulness, he has achieved discoveries in the heart of Asia that have pushed back the horizons of life

upon the earth and filled in gaps in the great ancestral tree of all that breathes.

On the Central Asian plateau he has discovered many geological strata previously unknown; he has found and uncovered some of the richest fossil fields in the world. Here he discovered the first dinosaur eggs; skeletons of the oldest known mammals, and of the largest known mammal, and extensive evidences of primitive human life. His explorations have proved that this region was one of the chief centers of origin and distribution of the reptilian and mammalian life of our globe.

He has carried a survey base-line for 1500 miles from the Kalgan railway through the heart of the Gobi desert, mapping many thousands of square miles *for the first time*.

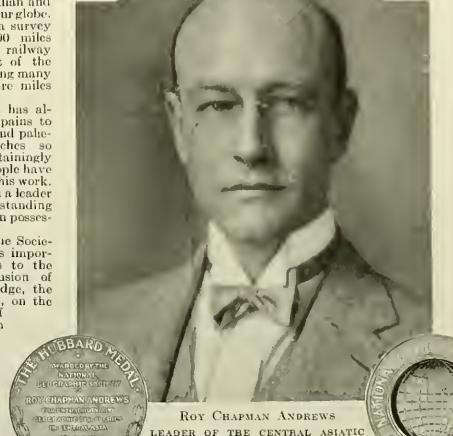
Doctor Andrews has always taken great pains to explain his profound palaeontological researches so clearly and entertainingly that millions of people have been entranced by his work.

Thus he has been a leader in making an understanding of science a common possession.

As evidence of the Society's esteem for his important contributions to the increase and diffusion of geographic knowledge, the Board of Trustees, on the recommendation of the Committee on Research, have awarded him its highest honor, the Hubbard Medal, granted by the Society only eight times in forty-three years.

With most hearty and unanimous congratulations from the entire membership, I now present to you, Doctor Andrews, this medal, on which is inscribed:

AWARDED TO
ROY CHAPMAN ANDREWS
FOR EXTRAORDINARY GEOGRAPHIC DISCOVERIES
IN CENTRAL ASIA



ROY CHAPMAN ANDREWS
LEADER OF THE CENTRAL ASIATIC EXPEDITIONS, AND NINTH RECIPIENT OF THE HUBBARD MEDAL AWARDED BY THE NATIONAL GEOGRAPHIC SOCIETY

Doctor Andrews, receiving the medal replied:

MR. PRESIDENT AND MEMBERS OF THE NATIONAL GEOGRAPHIC SOCIETY:

I deeply appreciate the recognition of your Society indicated by this award of the Hubbard Medal. In itself it is a signal honor to be numbered among the distinguished explorers who have received this Medal in the past. I feel, moreover, that the honor extends beyond myself to those comrades in the field who by their courage, loyalty and devotion to the ideals of science have made possible the success of our explorations in Central Asia.

The fact that our work has been stamped with the approval of this Society which exerts such a profound influence upon geographic science and education throughout the world, will send all of us back into the desert with new enthusiasm to meet the problems of further exploration. Again, I thank you Sir, personally and on behalf of my colleagues of the Central Asiatic Expedition.

Exploration has of necessity entered a new phase. The great pioneer lines of discovery have been thrown across the continents in every direction; now only a few comparatively small areas of the earth's surface remain unknown. The task of the future is to fill in the blank spaces on the world's map and to study intensively the little-known regions of which there are many; to learn what has been the history of their making and what they can contribute to science, to education and to human welfare. It is of such intensive explorations that I wish to speak tonight, I shall try to give you a kaleidoscopic picture of our ten years' work in the Gobi Desert. The scope of the Expedition included seven sciences—geology, palaeontology, archaeology, zoölogy, topography, botany and photography. Our problem was to make an intensive exploration of Mongolia from the standpoint of all these sciences. Press reports of our work have perhaps unduly emphasized palaeontology because the fossil animals discovered stirred the interest and imagination of the public. It may not be known that the Expedition has mapped more accurately than it has ever been done before a great part of the Gobi Desert, much of it new. that it has brought back ten thousand specimens of the living mammalian fauna; that its collections of fish, reptiles and amphibians are the largest ever taken out of Asia; that it has identified and correlated many new geological formations; that it has discovered the evidences of hitherto unknown primitive human cultures or that its studies in botany and palaeobotany have helped to give us a picture of the climate and physical conditions of Central Asia during successive geological ages millions of years before man appeared upon the earth. Still this has all been just as important a part of our investigations as have the collections of fossils. We have always been hoping to find strata which would yield some evidences of man's origin, which we believe to have taken place in Central Asia. During the past eight years we sought for such strata in vain in Central and Western Mongolia. It was not until 1930 that we discovered an enormous extent of Pliocene strata in Eastern Mongolia. This is the period just preceding the Pleistocene or Ice Age. It seems not to have been preserved in the west if it was ever present. It is in this formation that we might hope to find the remains of primitive man, if he lived in Central Asia. The possible ultimate success of this part of our work depends upon an intensive investigation of this area. We hope to be allowed to continue. I am sorry to say that the future is somewhat in doubt due to the not wholly sympathetic attitude of the Chinese authorities. If we are forced to end our explorations when the possibility of success is in sight, it will be a scientific tragedy.

The Expedition, as you know, has employed motor cars and camels. The Expedition was divided into five units, each with its own car, camp equipment and Mongol interpreter and capable of maintaining itself alone for several weeks. Thus we could work either together or separately as conditions demanded. The camels acted as supply caravan for the cars. It was sent out a month or two in advance of the motor party. Sometimes it was in front and sometimes behind us. As collections were made they were given to the camels to carry, which in turn gave us food and gasoline.

I have arranged the pictures tonight to give you a glimpse of our methods of travel, of the caravan, of our own camp life and the different aspects of our work.

Doctor Andrews then gave an illustrated lecture on the work of the Expedition.

Earlier in the day Doctor Andrews was the guest at luncheon of the Congress Club.

IN recognition of meritorious service in his field of science, DR. CLARK WISSLER, curator of anthropology at the American Museum, received the honorary degree of Master of Arts from Yale University.

LIBRARY ACCESSIONS

THE first four months of the year have brought some important additions to the Library's shelf of new accessions. Included among them are several files of periodicals, the result of recently established exchange relations with the Royal Francis Joseph University of Hungary, the Ashmolean Natural History Society of Oxfordshire, the Preussische Geologische Landesanstalt and others; two new magnificent volumes of the famous work by Edward S. Curtis on *The North American Indian*, gift of Mr. J. P. Morgan; Philip Ainsworth Means' scholarly work *Ancient Civilizations of the Andes*, gift of the author; Volumes 5 and 6 of Rex Brasher's interesting depictions of the *Birds and Trees of North America*, gift of Mrs. Wheeler H. Page; *Peru from the Air*, an impressive collection of aërial photographs of the topography of that country, gift of President Henry Fairfield Osborn; four important Memoirs of the Egypt Exploration Fund, gift of Mr. Childs Frick; a number of Metropolitan Museum publications pertinent to the work of our Museum, made available through the generosity of that institution; a number of monographs on travel, geology, mineralogy, and zoology, gifts of friends and patrons. Added to these are such other recent or classic scientific contributions as have been called for by the Staff for immediate use in research. Some of the most outstanding are:

Codex Vindobonensis Mexic. I. Edited by Walter Lehmann and Ottokar Smital. Wien, 1929

Crania Britannica. Vols. I and II. By J. B. Davis and John Thurnman. London, 1865

Anatomie Descriptive et Comparative du Chat. By Hercule Straus-Durckheim. Paris, 1845

Internal Constitution of the Stars. By A. S. Eddington. Cambridge, 1926

One Thousand Kinds of Shells Existing in Japan. Vols. I–III. By Yoichiro Hirase. Kyoto, 1914–1915 (published before the great earthquake of 1923)

Rhipiphoridum Coleopterorum Familiae Dispositio Systematica. By A. Gerstaecker. Berolini, 1855

A Monograph of the Anopheles Mosquitoes of India. By S. P. James and W. G. Liston. Calcutta, 1904

Publications of the Mysore Geological Department. 1900

Every one of these items fills an important gap on the Library shelves and thanks are due those who are helping to make it increasingly valuable to science.

MAMMALIAN PALÆONTOLOGY

SURVEY OF PLIOCENE FORMATIONS IN NORTH CHINA.—Père Teilhard de Chardin was introduced to the Osborn Research Club on February 10, 1931, as one of the most eminent palæontologists of our time. President Osborn characterized France as the "home of vertebrate palæontology" and referred to the work of the earlier scientists there. Père Teilhard has been particularly interested in Palæocene faunas of Europe since 1916, groups which are of great importance because of their wide geographic distribution and great antiquity.

In 1924 Père Teilhard made his first trip to China and has made repeated trips since, the last one when he accompanied the Central Asiatic Expedition during the summer of 1930. In China most of the formations which he has studied have been Pleistocene and Pliocene, and it is with the latter that his address dealt.

A good deal of work had been done in a locality in the northwestern part of Shansi Province near the Yellow River where there is a limited area of Upper Pliocene and Lower Pleistocene exposures. Père Teilhard described a hard floor of Palæozoic sediments, covered by a thick series (reaching 300 meters in depth) of Quarternary deposits; these lowest beds are much more complex than those of simple loess origin. Directly overlying the Palæozoic beds occurs a red clay of Upper Pliocene age which, for convenience, is called Member 3 of the later series. A few fossils are found in it, including *Hipparion* and *Aceratherium*.

The next higher series, Member 2, consist of reddish clays, rich in limestone nodules. These concretions are found in pocket layers, sometimes in gravels, covered by loess or reddish clay; fossils are not very common in these reddish clays except in the concretions which are full of rodent skulls and skeletons. These are mostly of the mammal genus *Siphneus* represented by several good species, and very similar to a mole-like rodent now common in that region. A few specimens of horse, wild cattle, and deer were secured, but they were scarce in this locality. Père Teilhard considers this Member 2 series an older, sometimes banded, loess, of either Upper Pliocene or Lower Pleistocene age.

The uppermost layers of loess, Member 1, are of Lower Pleistocene age and contain more recent species of *Rhinoceros*, *Bos*, *Equus*, etc. The loess deposits of Member 1 and probably also of the older Member 2 were apparently formed because prevalent winds from the northwest drifted the dust from the Mongolian deserts over this section of China.

Another basin appearing to be the same as the

Member 2 beds was discovered, where fossils of horse, bison, water buffalo, deer and sheep were abundant and a study of the fauna seems to link it with Upper Pliocene times.

The Tung Gur beds near Iren Dabasu, where the Central Asiatic Expedition has collected, are also supposed to be the same age as these reddish clays of Member 2. They are extraordinarily similar, lithologically, and in the vertebrate and invertebrate faunas to the beds of an Upper Pliocene lake which Père Teilhard has described in his most recent paper "Les Mammifères Fossiles de Nihowan (Chine)." He supposes that in the Upper Pliocene there was a series of lakes in the eastern Gobi which retreated southward with advancing desiccation.

Abbé Breuil and Père Teilhard de Chardin (right) January, 1931

In southern China, Père Teilhard believes the Upper Pliocene is represented mostly by cave deposits, and in northern China by gravels. The Yellow River has cut through in various places so that the sections are clearly shown and he thinks similar sections can be found both to the north and south along the river. He also made mention of a Palæolithic flint which was found, covered by loess, near the bottom of the Member 2 series of reddish clays, about fifty meters above the river level, where it had apparently been washed down from a higher level.

SCIENCE OF MAN

FLORIDA Shell Mounds.—Mr. William Rawle Brown, a member of the American Museum and a correspondent of the department of anthropology, visited Daytona Beach, Florida, and volunteered to collect material from the shell mounds in that vicinity which are now in process of excavation by highway builders, the material in shell mounds being particularly adapted to road building.

Mr. Brown found one of the mounds especially interesting since its cross-section, as made by the excavators, revealed in its interior a band of black soil that must have accumulated on the surface of the mound as it stood at that time. The thickness of this layer of black soil is about equal to that of the soil on top of the mound as it now is. It takes a long time to accumulate such a layer of soil and consequently it is safe to infer that the shell mound grew for a time because of the shell fish consumed by the inhabitants of the site but later the inhabitants moved away and no one occupied the place for a long time. No doubt the accumulation of soil was slow and perhaps trees may have once stood there. Then must have come a time when people again lived upon the site and began to cast shells upon the spot, thus building a much larger shell heap which was abandoned later on, some time before the discovery of America by Columbus. Mr. Brown's notes, photographs, and specimens are on file in the department of anthropology.

THE Laboratory of Anthropology at Santé Fé, New Mexico, each year presents scholarships to its graduate students. Under expert supervision the recipients of these scholarships are given instruction in field methods in physical anthropology. This summer, Dr. H. L. Shapiro, associate curator in physical anthropology at the American Museum, will conduct the field party which will investigate an old French community in Quebec, Canada.

MEXICAN Architecture.—Four models of temples in Mexico and Guatemala, lent by the department of anthropology of the American Museum, were included in an exhibit of Mexican architecture, which was one of the important features at the annual exhibition of the Architectural League of New York, held at the Grand Central Palace, April 18–25.

NEW PUBLICATIONS

Ancient Civilizations of the Andes. By Philip Ainsworth Means. New York, Charles Scribner's Sons, 1931.

THAT part of South America which fringes the Pacific has for some two thousand years been the scene of the rise and decline of a series of civilizations more or less comparable to the high cultures of Mexico and Central America. In fact, the civilizations of all three regions undoubtedly go back to a common origin, though the archæologist is having difficulty in tracing the courses of the historical streams which flowed back and forth along the highlands from Mexico to Chile. Mr. Means has, however, added many an item to our understanding of this difficult problem.

Beginning with a description of the geographical setting, the author then proceeds to give a series of sketches of the civilizations of Nazca, Chimu, Tiahuanaco, and Inca, and adds several extremely illuminating chapters on the economic, social, and political aspects of the Inca Empire. The Inca genius for conquest, colonization, and administration certainly rivals that of the Romans. "However stern the Incaic rule may have been, it was never unjust; however much the greatness and splendor of the highly placed may have been served and enhanced, the well-being of the humble was never lost to sight; however much may have been demanded of the people in the way of personal labor and of tribute, society as a whole was well compensated by the measure of peace and security, of plenty and leisure that was assured to it by the Incaic rule." Even a pacifist might be persuaded to assent to imperialism under such conditions!

The last chapters of the book are given over to a discussion of the religious and intellectual life and to an analysis of the art of the loom in ancient Peru. In all these, the achievements of the Andean peoples stir the admiration. Their religion fitted well into their pragmatic philosophy of life, though we might quibble at some of its workings. Their sense of the æsthetic is well attested by the truly wonderful objects wrought by the weaver and the potter. Such poems as have come down to us show us that they held a world-view worthy of their achievements in other aspects of life.

Mr. Means has at once given us a superb account of two thousand years of Andean history, a trenchant analysis of a series of cultures, and a sympathetic picture of life under conditions which are now frankly barbaric, now peculiarly civilized. It is, in fact, a series of well executed portraits of a vanished race. He has achieved the difficult task of writing a book which is a delight to the average reader and a storehouse of knowledge for the specialist in this field. The value of the work is heightened by a splendid bibliography, an index, and by more than two hundred illustrations.—R. L. O.

Game Animals of the Sudan. By Capt. H. C. Brocklehurst, F.R.G.S., F.Z.S. Gurney and Jackson, London, 1931

CAPTAIN BROCKLEHURST has written a valuable and interesting manuscript which the publishers, with the help of illustrations, have made into an attractive book. The author, who has been Game Warden to the Sudan Government for some years, is well qualified by training and field experience to discuss the many varieties of game mammals which are found in the vast expanse of territory included in the Sudan. He states that he has written mainly for the novice, and the chapters deal not only with descriptions of the mammals themselves, where they are found and how they behave, but give useful pointers on the hundred and one matters that will be of vital interest to the sportsman and nature lover about to visit the Sudan. Incidentally, this volume will be an exceedingly helpful reference for the specialist as well, for Captain Brocklehurst has not permitted his solicitude for the novice to mislead him into a casual treatment of the subject. The greater part of the book is taken up by a careful presentation of what might well be called standard statistics, except that the term statistics connotes dry, dull facts, which these certainly are not.

The Captain might well have titled his work "Game Mammals of the Sudan," substituting the much more exact "mammals" for the comprehensive group word "animals," because he discusses mammals alone of all the animals. The game birds, the hosts of ducks, geese, guineafowl, bustards, etc., are all game animals, and this loose usage of terms by the author is not a fair index to the scholarship displayed in the text.

Taking the chapter on the elephant as representative of most of the volume, we are given the English and the Latin names, followed by no less than six different native names. The distinctions between the African and Indian elephants are well brought out. The dimensions, weights of tusks, period of gestation, years to reach maturity, and such data of general application are recorded in an entertaining fashion. Then follow interesting extracts from the author's field experience and that of others relative to whether the elephant lies down to sleep, the ringing of elephants by fire, the present scarcity of large tusks as contrasted with their former abundance, the structure and variation in tusks, the possible existence of four-tusked elephants, and so on.

Novice or experienced sportsman, either may read these pages with pleasure and profit.

Near the close of the volume occur brief chapters on how to kill an elephant (a difficult feat unless one knows how to locate the relatively small vital areas), how to distinguish between the tusks of male and female elephants, how to bleach skulls, and to soften skins; clothing and camp equipment, native hunters, et cetera.

The book is illustrated by twelve color plates by W. R. Riddell, forty-five sketches by H. R. Millais, W. D. M. Bell and F. Wallace, all of which are unusually well done. In addition, there are a few photographs and a map of the region. While all of the photographs are interesting and some quite good, others suffer by comparison with the fine, sharp, well illuminated exposures which have been coming from Africa in such abundance in recent years.—H. E. A.

Djuka—The Bush Negroes of Dutch Guiana. By Morton C. Kahn. New York. The Viking Press, 1931.

WHEN Dutch, Spanish, and English colonies were started along the northern coast of South America in the Seventeenth Century, it was in the nature of things that "Black Ivory" was imported to do the work of the plantations. It was also in the nature of things that these slaves were cruelly treated. But the plantation clearings were hemmed in by a vast jungle and in that jungle the black man saw freedom, for there runaways were able to hide out, to live, to avoid capture. The jungle was a home to the Black, but only a death-trap to the White.

As the number of runaways increased, they formed themselves into tribes, and under their leaders made forays upon the hated plantations. For a long period, open warfare between the fugitives and their former masters prevailed, but at last, so powerfully did Nature aid the renegades, treaties were signed which stipulated that the Blacks were to receive an annual tribute from the Dutch government! This tribute is still paid to the descendants of the liberty-loving Negroes of those far-away days, for the Negro tribes prospered in a jungle which was much like that of their native African Gold Coast. The communities of runaways were formed before memory of life and times in Africa were entirely forgotten. Hatred of the white man and his ways and primitive conservatism have served to preserve them as the only example of Negro culture transplanted to the New World.

It is the story of the slaves' rebellions, of the formation of their tribal communities, and of their present-day customs that Doctor Kahn relates to us in *Djuka*. His six trips to Dutch Guiana (three of them under the auspices of the American Museum of Natural History and financed by Mr. Myron I. Granger) have served to give not only "atmosphere" to the tale he tells but have given him the knowledge of Djuka ways necessary to the telling.

One of the chief delights to the Djuka soul is a beautifully carved object of wood. In fact few other pursuits give evidence of æsthetic appetite among these people. But on a comb, a bench, or a pot-stirrer, the artist will lavish long hours or days in order that the finished product may be pleasing to the eyes of his beloved—for most carvings are done only to be given as presents with which to win the affections of a woman desired.

Djuka culture is a strange mixture of African, American Indian, and European. Despite the fact that only a few years of slavery were endured before the Negroes set up their curious communities, but little of their African heritage was incorporated into the new order of things. Even their language—the "talkee talkee"—is a hodge podge of English, Dutch, and so on, with little carrying over from their native Tschi or other dialects. One wonders if the Djukas are not another instance of the Negro's perverse eclecticism, his inability to hold fast to his own cultural heritage or to take that of strangers with facility and understanding. One might expect more of a people canny enough to give us as an explanation as to why they lavish small care on the carvings of their gods that "If the god is a good god, . . . he doesn't care whether his fetishes are well-executed or not. If he is a bad god, he is going to continue bad, regardless of whether much time is spent on his fetishes or not."

While *Djuka* gives us far less than a complete picture of Bush Negro life and culture, it balances this lack by flashes of insight into the racial and group psychology which make Djuka culture an entity in itself instead of a drab mixture of Negro and White civilization.—R. L. O.

Thirty Years War for Wild Life. By William T. Hornaday. Charles Scribner's Sons, New York, 1931

DOCTOR HORNADAY has long been a figure of international prominence in matters of wild life conservation. His adherents are many and even his antagonists have been free to admit his ability and aggressiveness in the interests of wild animals. An account of his activities during the last thirty years sheds a graphic side light upon all of the major controversial issues of conservation during that time. He has never been one to sit quietly by when the tide seemed set against the project he favored, and in his recent volume we find him an able advocate of the theory that

an offensive is the best defense.

The author has the faculty of phrasing his chapters in a terminology that touches all of the high-lights. The attention of the reader is arrested and held by forceful diction and apt simile. One can have little doubt that the Doctor has made the enemy sit up and take notice.

The book is an historical account of the progressive stages in the threatened extermination of wild life and the various tactics which have delayed or hastened the process accordingly as the conservationists or the wasters have dominated the situation. Various constructive movements, such as the stopping of the sale of game, the passage of the Migratory Bird Treaty, and the establishment of sanctuaries and refuges, were launched in the face of difficulties, and Doctor Hornaday picks out the milestones in the march toward accomplishment.

The first part of his story tells of the dark side of wild life conditions, the second half discloses the bright side, and one discovers that a number of truly vital advances in conservation have been achieved in North America in the last thirty years. The fight for our native fauna is by no means at an end, however, and the author successfully develops the premise that the forces of civilization (?) are continually creating new dangers to wild life, millions are spent to destroy life and but a pittance to protect it, and that the future holds far more of menace than of promise to wild creatures unless the general public awakens to the true inwardness of the situation.

—H. E. A.

CREDIT

IN the article "The Mysterious Natives of Northern Japan," in the March–April issue of NATURAL HISTORY, the photographs of Ainus on pages 195, 197, 198, 199 (top), 203, 204, 205, and 206 were made in St. Louis at the time of the Louisiana Purchase Exposition by A. Tennyson Beals of New York City. The woman with the dog, shown on page 197, was the "chief" of a group of Patagonian Indians included among a group of foreign peoples, as were the Ainus, who were brought to St. Louis for the period of the Exposition.

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NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total membership 12,047.

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77th STREET and CENTRAL PARK WEST
NEW YORK, N. Y.

NATURAL HISTORY

Vol. XXXI, No. 4 1931 July-August

A HOWLER MONKEY OF PANAMA

JOURNAL OF THE AMERICAN MUSEUM OF NATURAL HISTORY

NEW YORK, N. Y.

Fifty Cents a Copy

Three Dollars a Year

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VOLUME XXXI
NUMBER 4

NATURAL HISTORY

JULY–AUGUST
1931

The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor

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Published bimonthly by The American Museum of Natural History, New York, N. Y. Subscription price, $3 a year.

Subscriptions should be addressed to James H. Perkins, Treasurer, American Museum of Natural History, 77th St. and Central Park West, New York, N. Y.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

THE RUINS OF MACHU PICCHU

This ancient Inca ruin, four thousand feet above the roaring torrent of the Urubamba River, is dominated by high rocky spires in the near distance and by snow-clad peaks along the sky-line

(*See "From Cuzco to Machu Picchu," Page 388.*)

VOLUME XXXI

NATURAL HISTORY

NUMBER FOUR

JULY-AUGUST, 1931

SEEN FROM A TROPICAL AIR CASTLE

The Big Almendro Tree Plays Host to an Interesting Assemblage of Forest Guests

By FRANK M. CHAPMAN

Curator-in-Chief, Department of Birds, American Museum

Photographs by the Author

TREES have so many human-like attributes that one who is responsive to their influences inevitably endows them with personality. Their haunt, their size and shape, the appearance of their bark, the form and color of their leaves and blossoms, the nature of their wood, their sap, their fruit, even the movement of their limbs and the sound of the wind in their foliage combine to create the character through which a tree speaks to us—for that trees have voices no tree-lover will deny. It is the endless diversity of their pronounced characteristics and the confusion of their voices that overwhelms one in a tropical forest. The luxuriance of the vegetation sets no limit to their powers of expression.

The relentless cruelty of a strangler fig, the rigid uprightness of a palm, the benevolence of a tree-fern, the hospitality of a ceiba bearing an aërial garden on its huge, wide-stretched arms, the dignity and nobility of an almendro are among the more familiar illustrations of tree character in the forests of Barro Colorado. Among them all my closest friendship is with the almendro—and to one almendro in particular do I pay homage. Standing among many great trees of a mature forest, it nevertheless dominates its neighbors. Although fully grown, it shows no signs of age. Rather is it in the prime of virile treehood. Six feet in diameter two yards from the ground, its splendid, smooth-barked trunk ascends column-like with but slight decrease in size seventy-five feet before it branches. Its limbs are open, symmetrical, graceful, and tapering. They stretch upward rather than outward, and their tips are not less than 150 feet above the ground. Few parasites grow on its clean, brown limbs; it suffers no loss of individuality from a draping of vines, and in the calm dignity of its pose stands a prince among its fellows. Beneath its spreading arms grow trees with slender, limbless trunks and rather compact crowns, and beneath these are palms and an open undergrowth of saplings. The forest floor, at this dry season, is thickly strewn with dead leaves.

But if the almendro refuses hospitality to orchid, aroid and fern, it gives it unstintingly to the animals of the forest. It bears annually, but in greater abundance every other year, a flattened, elliptical nut about two inches long and half

THE BIG ALMENDRO

The tree is 22 feet in circumference at the man's head and about 150 feet in height. The foreground was cleared to give an unobstructed view of the trunk

as wide, covered with a thin, fleshy coating and enclosing an almond-shaped kernel, whence (though the tree is not even a member of the almond family) it derives its common name.

The outer covering of the nut has a slightly sweetish taste and is eaten by coatis, kinkajous, and howling monkeys. Judged by human standards it is inedible, but I fully share the liking of squirrels, agoutis, and peccaries for the contained kernel. Dried and roasted, it combines the flavor of a peanut and chestnut, with equally palatable qualities of its own. Some day, doubtless, a place will be given to it on the dinner table, bringing its delectable flavor but no suggestion of the majesty of the tree that bore it or of the romance of its associations.

During January, February, and early March, the period of its fruitage, the Big Almendro supports a large family, and I visit it frequently, not alone for the inspiration of its presence, but also to meet its guests. Chief among them is that raccoon-like animal, the coati. An adult coati weighs as much as thirteen pounds. He is thickset, short-legged, and rather clumsy in appearance. He has a long tail but it is not prehensile, and serves only as a balancing rod when he climbs. Nevertheless, with surprising agility he clambers about the outermost and uppermost limbs of the almendro, picking the fruit direct or drawing in the branches to bring it within reach. Often, in this act, he breaks them, and a bearing almendro much frequented by coatis has, in consequence, many small terminal branches of dead brown leaves.

There is no apparent difference in the external appearance of ripe and unripe almendro nuts, and the coati seems to be guided in his selection of food solely by his remarkable sense of smell. He walks slowly along a limb, curling up his elongated snout as he sniffs on this side and

that, passing cluster after cluster of pendent nuts without picking one, but when he does help himself his choice is invariably to his liking. Then he stops or seeks a better resting-place, takes the nut in his forepaws and quickly gnaws off the brown skin, leaving an inner bright green covering which adheres to the shell too tightly to be removed. Then he drops the nut. This is an important part of the food-cycle. Not one almendro nut in a hundred falls with its covering intact. The ground beneath a bearing tree may be thickly sprinkled with nuts, but one may hunt in vain for one from which the brown outer coat has not been removed. Vainly I stalked almendro trees to discover the evidently abundant animal that fed on these nuts until one day a green, freshly eaten nut fell on me and I found that it had been dropped by a coati in the branches overhead.

Kinkajous, or so-called "honey bears," also pick almendros, but they feed only at night, and I am unable to say what share of fallen fruit is theirs. Howling monkeys feed largely on leaves, but at times add almendro nuts to their fare. It is these animals, therefore, that the agoutis, peccaries, and squirrels have to thank for the food that daily and nightly falls to them. The first two are not concerned with the covering of the nut, but with its kernel—and dearly must they love it.

An almendro nut is hard as stone and it takes a sledge-hammer blow to break it. Agoutis and squirrels reach the kernel by gnawing through the hard shell—a well-earned prize—and, with experience, one may tell which animal is at work by the key and the rhythm of its gnaw; the note of the squirrel being higher, the time faster. The peccary, on the other hand, cracks the nut along the lateral seam that divides it into halves, a tribute to the hardness of his teeth and the power of his jaws. He also eats it unbroken, doubtless for what remains of its outer covering, since it passes through the alimentary canal entire. These animals,

THE PALM-TREE BLIND

Note the steps at the left and the partly concealed figure above

therefore, must play an effective part in the distribution of almendro nuts and hence in the perpetuation of the species.

The *Cativo* (*Prioria Copaifera*), a common neighbor of the almendro, bears large nuts which are evidently little, if at all, eaten by animals, and in the dry season the ground beneath these trees is densely grown with seedlings—a little forest of them. But one may look in vain beneath an almendro for a nut which has rooted. All, apparently, have been destroyed by the animals which frequent these trees so persistently during the season when its nuts ripen. It is of importance, therefore, that some of these nuts be removed from the area of their greatest abundance and essentially complete destruction. This the peccary does in a manner that seems especially designed to ensure their germination. The observed facts in this case relate to the collared peccary, a diurnal species. But it is probable that the white-lipped peccary, a not uncommon but apparently largely nocturnal species on Barro Colorado, occupies a similar relation to the almendro.

My love of the Big Almendro, and my interest in its guests prompted me to seek a place among them. Obviously I could not hope to enter their circle on the ground floor, but it seemed quite possible that I might join the ranks of the tree-dwellers.

I shall not attempt to explain the significance of my inborn and life-long desire to occupy some kind of seat, perch, or platform in trees. These arboreal habitations were the delight of my boyhood and after fifty years and more the tree-haunting habit is still strong. Various have been my tree abodes. I recall a hollow chestnut large enough to give an uncomfortable but nevertheless enjoyable night's lodging; a "moss"-hung cypress in a colony of

A COLLARED PECCARY

(An automatic flashlight)

Feeding on nuts dropped from the Big Almendro. The peccary gets at the kernel by cracking the nut along the lateral seam that divides it into halves, a feat that proves the hardness of his teeth and the power of his jaws

AGOUTI

Their rhythmic gnaw, as with their sharp teeth they cut through the hard shell of an almendro nut, is a characteristic sound beneath the Big Almendro

egrets and a mangrove roost shared with spoonbills, but none of these equalled in fitness and naturalness, charm and potentiality of environment, the tree-blind beneath the Big Almendro.

It was in a small group of palms that the blind was placed. Four of them formed the corners of a square about two feet across at the base and nearly twice as large at a height of ten feet. To the two trees on one side of this square crosspieces were nailed by way of steps. Ten feet above the ground similar pieces were nailed to the remaining three sides of the square, and small limbs laid on them made the floor of the blind. On this a seat was arranged, and by drawing in and tying the long, pinnate leaves of young palms growing below I secured complete concealment without perceptibly altering the surroundings. It was an ideal hiding place. Perched within it one felt indigenous.

FRUIT OF THE ALMENDRO AND MONKEY COMB

At the right a complete almendro nut; at the left the same after the outer covering has been eaten by a coati or kinkajou, and the kernel has been extracted by an agouti or squirrel

I might now present a composite sketch of what I saw from this lookout, creating the impression of a nicely balanced play with events occurring in controlled succession as though each animal waited in turn to act its part or speak its piece. In truth there was no confusion of life at the Big Almendro and in any event one can speak of only one thing at a time, but I believe I can give a truer, more realistic, if less readable, account of events as I record them by merely presenting, with some comment,

THE BIG ALMENDRO FROM THE BLIND
The small trees and vine at the right were used by the coatis in their ascent of the almendro

my observations as they were written in the blind.

The first day I ascended to my post (February 2, 1930; 7.50 A.M.) I learned how coatis reached the topmost branches of the almendro. Its trunk is obviously too large for them to climb, and it was evident that they must use some other stairway. I was barely settled when I heard footsteps on the dry leaves that cover the forest floor at this season, and a band of eight coatis appeared. When seen without their being aware that they are under observation, coatis impress one as being thoroughly at ease—like a skunk. They make no attempt to conceal their movements, dig here, root there, sniff and snort, and, apparently fearing no foe, exercise no caution and betray no suspicions. So, with long tails erect and waving jauntily, these eight animals came loping through the forest. They made no stops to look for food by the way but, as though traveling a familiar route, went straight toward the base of the almendro. When about ten feet from its trunk, without pause or consultation, the leader went up a sapling about three inches in diameter to a height of ten feet, left it there for a near-growing tree twice as large, ascended that for twenty-feet, and then transferred to a pendent, rope-like vine, or liane, not more than an inch and a half thick. Up this he climbed for some thirty feet and then disappeared in the leaves of the lower tree-tops. No sooner was the leader's tail clear of the ground than he was followed by the next member of the band and he, in turn, by a third, so that before number one was lost to view all were climbing and several were on the vine at the same time. The almendro seemed festooned with coatis.

In ascending the small trees that formed the first stages of their journey, the coatis progressed with a galloping motion, that is the front feet were thrown forward together, the hind feet followed,

and the advance was made by jerks. But when they reached the ropelike vine they climbed hand-over-hand, following the movement of each fore-paw with an exaggerated right and left wagging of the head which to one who knows the serious nature of coatis was very comical. I sat in my palm-leaf shelter entranced by this performance.

The animals traveled cautiously, with frequent rests, for the coati is terrestrial rather than arboreal and one can almost believe that, in spite of his agility, he has learned to climb at a comparatively recent period in his history. He seems never to feel at home when in trees and, if discovered there, loses no time in reaching the ground. Only a few days since (February 13, 1931) I found a group of coatis in the upper branches of the almendro. So far as I was concerned, they could not have been in a safer place. But as soon as they saw me they left the tree to seek various routes to the ground. On one occasion a half-grown coati, in its haste to follow its elders from the tree in which I had surprised them, missed its footing and fell for about forty feet. It landed in a bush-top, lay motionless for nearly a minute, then, as I advanced, jumped to the ground and scampered away.

From my blind I could observe only what transpired beneath the almendro. Its top was as hidden from me as the roof of a house from its cellar. It soon became evident, however, that the coatis were seeking their breakfast directly above me and I was shortly bombarded by the nuts they dropped. Fortunately the force of the fall of these stonelike fruits was broken by the tops of my palm-trees, but thereafter I brought a peak-crowned hat to the blind.

COATIS

(An automatic, nocturnal flashlight)

Chief among the large family supported by the almendro tree is the coati, the most common and interesting animal on Barro Colorado

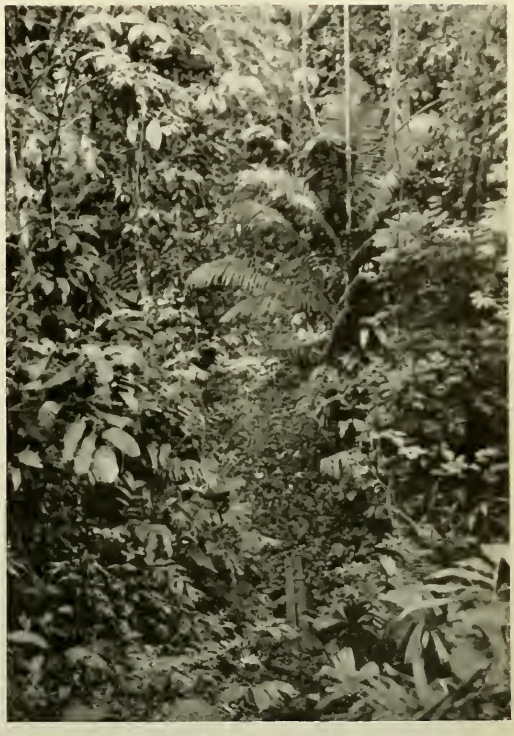
From somewhere in the shadows came the sound of gnawings and crunchings. They were doubtless made by peccaries and agoutis, but I was unable to see them. These animals had finished their morning meal before the sun was high enough to penetrate openings in the forest roof and fleck its floor with golden patches. Then the great Amazona parrots called *stop it, stop it quick-quick-quick* in a voice so loud and harsh that even as they flew through the tree-tops it was in truth ear-splitting; black-billed pigeons uttered with ceaseless fervor their emphatic *Je t' adore*, and often followed this avowal with an unloverlike growl; trogons cooed and cowed, toucans yelped their *Dios té de*, or croaked like frogs; fruit crows cawed, guans, locally known as pavos, piped and drummed, but *Lathria unirufa*, the sentinel, was apparently the only bird to observe me. From a perch almost overhead he challenged with his staccato, explosive *see-you,-I-see-you*, a long, sweeping silvery whistle which in volume, clearness and commanding quality, I have never heard equalled by a bird. One marvels that so loud a note can be produced by so comparatively small a bird (he is only nine inches long) but like every good vocalist he sings without apparent effort. In color he is uniform brown. I was doubtless trespassing on his territory, possibly he had a home near by, for invariably he challenged my right to be there.

THE BLOSSOM OF ARISTOLOCHIA
It measured eight inches across and grew on a vine in dense shade near the ground. The darker parts are colored shades of ochre and buff

Like most highly musical mornings it was calm. Not a leaf fluttered and a passing airplane shattered the silence with more than usual violence. The howling monkeys have not yet become accustomed to this intruder and invariably roar defiance at their only rival in sound producing. A clan not more than one hundred yards away now gave voice and another, distant about two hundred yards, added protest. It is unusual to find groups of these ani-

mals so near each other. Doubtless they were close to the boundary line which separates their respective territories.

At 8.30 the coatis, half sliding, half galloping, began to descend. All of them did not return, but at nine o'clock nuts ceased dropping and, as I afterward learned, a number of coatis slept in the almendro. Possibly they passed the day there, coming to earth after their evening meal. A glittering morpho butterfly, the bluest thing in the world, passed erratically below me; *Lathria*, still suspicious, occasionally questioned; a squirrel near by, holding an almendro nut in both paws, gnawed persistently. At 10:30 the forest slept to the droning hum of cicadas and I returned to the laboratory.



FOREST NEAR THE LABORATORY

Pearson Trail No. 1. The two planks in the central foreground bridge a brook twenty feet below the camera. A collared peccary runway crosses the trail this side of the bridge

It was 7.15 on the morning of February 26, when again I climbed to my perch in the palm-trees. The sun was just entering the forest and the air was vibrant with the calls of toucans, doves, parrots, and ant-birds. *Lathria*, whistling sharply, soon discovered me. Peccaries were feeding beneath the almendro but left as I approached. No coatis appeared, and in the absence of falling nuts I assumed that none had arrived. But at 7.45 the bombardment began and, first putting on my hat, I tried in vain to see its authors. A coati at about my level was viciously attacking a large air-plant growing in a neighboring tree. He literally tore it to shreds with his long, powerful claws in a search for insects, their eggs, or larvæ. There was an outburst of hoarse squawks from a passing band of white-faced monkeys, who seem always to be bound elsewhere, and from somewhere in the great canopy overhead I could hear the low conversational tones of howlers.

The nuts ceased falling. There was the sound of animals leaping in the upper branches, and a band of howling monkeys, who had apparently been feeding in the almendro came into view as it passed near

my blind. Familiar as I am with these remarkable animals, this was my first encounter with them in their element. Knowing that they rarely leave the upper limbs of the taller trees, a person on the ground listens to their astounding vociferations with composure, but having now assumed the rôle of an arboreal creature, I found that my point of view both literally and mentally was considerably altered. Moreover, I was now the unquestioned cause of their deafening uproar. An old male seemed particularly threatening. Descending to within fifty feet of me he roared until he choked, then, gasping, roared again. His teeth shone, his lips dripped saliva, his large, luminous, protruding eyes set far apart in his broad, ebony face gleamed with savage ferocity to which his appalling bellow gave eloquent expression. Reason assured me that he was harmless, but, fortunately for the range of our mental experiences, reason is not always in control of them, and I was sufficiently moved by this encounter to enjoy it thoroughly.

A mother with a baby clinging to her breast, both its arms and tail encircling her body, struck a lighter note. Hanging from a limb by the tip of her tail, she swung to and fro and half revolved in response to the vigorous motions of her arms and hands as she "batted" insects swarming about her head. Insects, especially botflies, are among the howlers' chief enemies. One might imagine that in time they would have developed an immunity to them but in the absence of predatory foes there must be some checks to prevent their undue increase.

There was never as much activity in and about the almendro in the afternoon as there was in the morning. But the early nightfall is the time when pumas seek their evening meal, and it was with a hope that the agoutis usually beneath the almendro might prove a lure to pumas that I climbed to my perch at 2.30 on the afternoon of March 1.

At this hour the animal world was still wrapped in the silence of its mid-day slumbers. But the trade wind was awake and as its voice rose and fell soothingly in the gently swaying tree-tops the motion of the palms holding my blind seemed to make me a part of the scene. The sky was nearly cloudless but, except for little flickering patches of sunlight here and there, the ground below me was in shadow.

At three o'clock, in response to some unknown cause, a clan of howlers toward the Wheeler Estero announced their presence. Why the howler howls no man can always say. There are howls of song —as at day-break—and there are howls of protest—as when an airplane passes. But there are also periods of howling not connected with time and for which the event is not apparent. Such outbreaks are led by the old males, and as their raucous roars rise and fall, the long-drawn howls of the females and young carry on the strain until again, with impressive surging rhythm, the voices of the males swell the chorus.

The forest now awoke. *Lathria*, evidently asleep at his post, challenged sharply and with as startling effect as though I had not been expecting him. From near by I could hear the fine, even gnaw of a squirrel patiently grinding his way to the kernel of an almendro. A blue-headed parrot flew over and a shrike-vireo began to whistle *one-two-three* with tireless persistence On the ground below the blind a teetering northern water-thrush, fellow winter visitant, tossed the leaves right and left with as much energy as he might display in Canada. At five o'clock a single peccary fed, crunching on the far side of the almendro. The blind did not give me that intimate view of peccaries which I expected to have from it. It was unusual to approach the almendro at this season without finding a

band of these animals beneath it. Nevertheless, few came while I was in the blind and, for peccaries, they seemed to be ill at ease. It is their nose, not their eyes, that puts peccaries on guard, and it is possible that my blind was not high enough to prevent them from getting my scent.

It was ten minutes of six when two agoutis appeared. They advanced with characteristic caution, a step at a time, eternally vigilant and ready to flee. I have seen agoutis numbers of times when it was reasonably certain that they were not aware of my presence and always they seemed frightened to the verge of flight. Their color blends closely with the dead leaves and, when motionless, they are almost invisible; but none of the forest animals is shyer or takes to its heels with less cause for alarm. A similarly colored bird would not fly until it was almost stepped on. But the agouti's lack of faith in the protective value of his coloration may be accepted as proof that it has none. Unlike a bird, he always lays a trail behind him that reveals his hiding place. The bird, when flushed, takes to the air and disappears, but the agouti, no matter how quickly he springs or how rapidly he runs, is earth-tied and leaves his scent behind him.

While the startling *whirr-r* of a flushed grouse or tinamou may be only the unavoidable result of the rapid impact of the bird's stiff wing-quills on the air, it is quite probable that this sound may have a certain protective value as it alarms a foe about to spring! But the agouti's alarm cry, as with astonishing rapidity it bounds off through the forest, seems definitely to be uttered as a means of frightening its enemies. Certainly no more threatening sound ever proceeded from so harmless an animal. It is a loud, explosive, rasping

A COATI

The erect tail and quizzical, inquiring expression are characteristic of this raccoon-like animal

squawk that by mere force of suggestion creates a picture of curved claws tearing flesh. The first time I ever heard it I could almost see an ocelot, and after years of familiarity it invariably stops me in my tracks with a perceptible heart jump.

I wished the two agoutis beneath the almendro no harm but the hope was strong, as the shadows deepened, that a puma was on the track of at least one of them. I had flash-lighted puma on this trail within a hundred yards of both sides of the almendro. I used no bait, while here were two animals that evidently rank high on the puma's bill-of-fare. As if reading my thoughts one of them suddenly fled, but the other sat on his hind legs beneath my blind and, holding an almendro nut in his paws, gnawed industriously and with as much contentment as an agouti ever exhibits.

There was still light in the tree-tops, where toucans yelped and croaked, but although I could hear the agouti I could not see him. As abruptly as though under command the toucans ceased calling and with the silence one received an impression that night had fallen.

Descending to the ground, I was conscious of an equally sudden change in my mental attitude toward pumas. Only a moment before I had searched the undergrowth eagerly for a sleek form; now I felt that, on this occasion at least, we might cancel any engagement we may have had to meet beneath the Big Almendro.

At the same time I found that I possessed a much keener appreciation of the agouti's point of view. Indeed, there were moments during the mile and a half walk through the now darkened tunnel of the trail to the laboratory when I felt that I *was* an agouti.

A PUMA ON THE LUTZ TRAIL
(*An automatic, nocturnal flash-light*)

Caravan in the Sand Dunes at Tsagan Nor

CAMP LIFE ON THE GOBI DESERT

Incidents and Experiences in the Daily Lives of the Men of the American Museum-Central Asiatic Expeditions in Mongolia

By WALTER GRANGER

Curator of Paleontology, Asiatic Exploration and Research, American Museum, and Second in Command of the Central Asiatic Expeditions

IT'S a common belief among the stay-at-homes that explorers and scientists who travel into the more remote parts of the earth must of necessity suffer hardship and privation, and those of us who have helped to carry on the Central Asiatic Expeditions in Mongolia during the past ten years have received our full share of credit for having encountered and survived many harrowing experiences.

I am something of an old campaigner at field work, having made my first expedition for the American Museum in 1894, and I wish to go on record as saying that never during this long experience in the open have I lived so comfortably or so well as during the five seasons spent in the Gobi under the leadership of Roy Chapman Andrews.

I do not mean to belittle the dangers and discomforts of exploration in certain regions of the earth, particularly the very cold areas and the very hot and humid ones, nor do I mean to picture the Gobi as a mild, gentle sort of place in which to live; it can be, and sometimes is, a terrible place in which to be and on more than one occasion it has shown its teeth to us. What I do mean to say is that to men accustomed to looking out for themselves and to observing reasonable precautions, being well-equipped, as we have been, with all of the necessities and many of the luxuries of camp life, and more particularly going in, as we have done, for the five warmer months—from mid-April to mid-September, we have found the Gobi to be a delightful place in which to live and carry on scientific exploration.

Mongolia is a high plateau country. It rises abruptly out of North China and extends northward, first as rolling grass-covered prairie, then as real desert, then another wide band of grasslands, and, finally, in the north forested mountains which extend on across the Siberian border. Our work has been pretty much confined to the central desert area, known as the Gobi, and it is about this region that I write.

The parallel of 44° north passes through the center of the region and the average elevation is between 4000 and 5000 feet. Because of this combination of

PERSONNEL OF THE 1923 EXPEDITION

The Chinese members are seated in the foreground, the Mongols stand at the back. Three visitors from the Legation Guard, Peking, are in the middle row. The Commandant, Gen. J. H. Dunlap U.S.M.C., fifth from right, recently met death under a crumbling wall in France

latitude and altitude the Gobi is essentially a cold country. During the long winter the temperature frequently drops to 40° below zero, with a fierce northerly wind which adds many more degrees in actual discomfort. The summer is limited to the months of July and August, and we always notice a tendency of spring to encroach upon July and of autumn to eat into the end of August.

The first two years I kept daily temperatures, and the highest recorded were on two days in early August of the first season, when the mercury reached 98°. In subsequent years at somewhat lower altitudes and a bit farther south in the desert we have seen the thermometer go above 100°, but in a perfectly dry climate even this heat brings no distress; it is mild as compared with the summer weather in our own Southwest. As in all high, dry countries, the nights are almost invariably cool and there are very few evenings when the members of the party do not resort to sweaters.

There is just one thing about the Mongolian climate which makes me hesitate to use the word "delightful" in recommending the place for summer residence, and that is the wind. It doesn't spoil Mongolia entirely but it certainly does reduce its attractiveness. For the first two months of our stay in the desert the winds are almost incessant during the daytime and frequently they forget to die down at evening. The ordinary heavy winds are often punctuated by howling gales lifting coarse sand into the air and carrying it with a force that almost cuts the skin—true desert sandstorms. At such times all field work ceases and travel is stopped; even the camel caravans, unless they are traveling with the wind, must go into camp and wait for the storm to abate.

The Mongol portable dwelling, the yurt, is admirably adapted to withstand even the severest of these winds, but as it is both heavy and bulky, being made of thick felt mats laid over a collapsible framework of wood, we have had to

resort to the Mongolian tent of coarse cotton cloth, supported by two uprights and a horizontal ridgepole of wood. These tents are made by the Chinese in the frontier towns and serve their purpose very well. They are not absolutely waterproof, but in a country where the annual precipitation is only two or three inches this doesn't so much matter. The important thing is that both the sides and ends of the tents come down from the ridge to the ground in one slope and so present no vertical surface to the wind.

For two years we thought that these tents simply could not be blown over by anything which the Gobi could produce in the way of wind, but during the third season we were disillusioned, suddenly and completely.

It was along in mid-summer, past the ordinary time for heavy winds. The party was all in one camp and our eleven tents were pitched in the bottom of a broad, shallow valley in the dinosaur-egg country at Shabarakh Usu. Just before daybreak one morning, after a night of dead calm, we were disturbed by a series of powerful gusts of wind coming down over the edge of the peneplain to the south of us, crossing the valley at our camp site, slapping our tents about a good deal and then passing on to the northward.

The first of these gusts was nothing very unusual, but the second, coming a few minutes later, was stronger. The thing seemed cumulative, and by the time the fourth one had passed it became evident that this was a determined effort on the part of the Wind God to level our camp. So when, now a bit after daybreak, we heard the roar of the fifth gust bearing down upon us, I knew we were in for it.

One thinks quickly at approaching danger, and my own thoughts flashed to a suitcase lying on the ground at the foot of my cot. In this suitcase were several small paper packages containing some of the most precious of all our Mongolian fossils—skulls and jaws of the tiny mammals which we had discovered in the dinosaur-bearing strata near by. I remembered that the grip had been

THE EXPEDITION EN ROUTE
The eight motor cars of the 1928 Expedition drawn up before the yurts of the Prince of East Sunnit

left unlatched and with visions of this grip being capsized and the little packages dancing along over the desert headed for Urga, I rolled out of my cot and threw myself onto the grip and let things happen. And they did happen.

Fifteen seconds later, when I had dug the sand out of my eyes, I looked about. Everyone of the eleven tents was flat. The Wind God had been avenged, and we never more talked about these tents as being invulnerable.

About thirty other men looked out on the scene of desolation with me, some from their cots, which had been left standing, and others from the ground where they had been dumped when the falling tent poles had taken the cots along with them. At first sight the camp looked like a complete wreck, but we soon found that no really serious damage had been done, and no one had been injured. The cook tent was badly ripped and so many victrola records broken that the machine was turned over to the caravan for the balance of the season, but the scientific records, instruments, and other essentials were intact and, above all, the little Cretaceous mammal skulls were safe.

MR. GRANGER BUSY WITH HIS NOTE-BOOK
Camps were usually made close to the fossil beds, and it was frequently possible to make geologic sketches and studies from the mess tent door

A lot of our light clothing, cooking utensils, camp chairs, and other easily moved objects had been taken along by the wind and strewn in a wide swath for a half mile, but here a friendly grove of tamarisk trees came to our aid and filtered out our belongings so well that not a single object reached the opposite side of the grove. One picture of this storm which will always remain stamped on my memory was of our six months' supply of back copies of *Saturday Evening Posts*, which had been lying about in various tents, plastered against the side of this tamarisk grove—one sheet in a place. After this affair was over and the camp reëstablished, everyone looked upon it as just one of those things which serve as a diversion to break the monotony of camp life.

The Gobi is a real desert with a slight rainfall and scanty vegetation, but it differs from most of the other great deserts of the world in that it is well-watered. This sounds like a contradiction in terms but, while it is true that one could travel for several hundred miles in many directions and never see a drop of water on the surface, he would be, for a great part of the journey, within a few feet of water—underground.

The Gobi is an inland drainage area, no outlet to the sea, and made up of a series of large and small depressions, each one being an entirely independent drainage system. Such water as falls sinks into the ground immediately and, soon striking an impervious layer of clay, forms what is known as a water table. The presence of this underground water, not far below the surface, is a vital thing to the explorer and traveler and to the nomadic herdsmen who inhabit the Gobi. Local Mongols have put down

wells at frequent intervals. Along the main caravan routes we have learned to expect them about every ten miles and we have never traveled more than forty miles without encountering one.

The average depth of the wells is probably less than fifteen feet and the water is excellent. There is rarely a suggestion of the "alkalai" so common in the plateau region of our West, because there have been no marine invasions of the Gobi since the beginning of the Age of Reptiles, and the later sediments in which the underground waters occur are all fresh-water deposits.

WINDY WEATHER

Servants making an unsuccessful attempt to stake down the mess tent which had just blown over

Occasionally we find a well which is being used by many Mongol families and serving an almost continuous stream of horses, cattle, camels, sheep, and goats during the day. Here we sometimes get animal contamination in the water which makes it somewhat unpalatable but, I think, not dangerous. Ordinarily we have not taken the trouble to boil the water in Mongolia, as everyone does, for good and sufficient reasons, in China. Last year, however, we had as surgeon, a pathologist, a man accustomed to thinking in terms of "bugs," and I dare say that he visualized our well water as a saturate solution of deadly microorganisms. At any rate, being responsible for the health of the party, he instructed the cooks to boil all drinking water, and our health remained about as usual.

We have seldom camped close to the well from which we got water, preferring to camp near the fossil beds where our work lay, and haul the water to camp, usually a distance of one to four miles, but on one occasion as far as ten miles. Once or twice each day a water truck, with a Chinese driver and one or two Mongol camp assistants, is loaded up with two or three water casks and about twenty five-gallon gasoline tins, and makes the trip to the nearest well, or at least to the well which can be reached with the least expenditure of gasoline.

The wells are all a good deal alike, except for their varying depths. I presume that in the old days they were dug by the Mongols themselves. Now, when a new well is wanted, Chinese well-diggers are employed. If stones are available they are used for the walls of the well and the curbing at the surface; if not, a tough fibrous sod is employed. The water is brought up entirely by hand —with us, a bucket on the end of a rope, with the Mongols, a rawhide bag on the end of a long pole. Heavy wooden troughs, supplied by the ubiquitous Chinese traveling merchants, are at every well for the watering of the stock.

Water is the most vital thing in the desert, and for us, since we bring all essential foodstuffs along, fuel becomes of next importance and here again the Gobi furnishes a bountiful supply. On the treeless plains of our western states the early settlers, in the absence of any wood, burned the dung of the bison and later of domestic cattle, and "buffalo chips"

GOBI NIGHTS
A victrola, with amplifying apparatus, added to the enjoyment of the wonderful, calm, summer evenings

are probably still used by the farmers who live a long distance from a railroad.

In the Gobi where there is very little woody growth, domestic cattle, camels, and sheep furnish about the only fuel to be found. The Mongol name for this is *argol*. Its importance to the Mongols is great, for without it, they would hardly be able to dwell there, even during the summer, let alone during the long and terrible winter. It is burned both by the natives and by our own cooks in open circular stoves made of three or four horizontal iron rings, supported a few inches apart by vertical bands of iron.

The novice generally has a difficult time with his first argol fire, but after he learns to maintain an open space in the center for draft he finds it an excellent fuel. We never cease to marvel, however, at our Chinese cooks, who, with two of these primitive fires augmented by an oven made of a gasoline tin, can turn out the remarkable dinners they do and at the same time furnish hot water, on demand, to the entire party.

It is a common custom among the Mongol dwellers in the Gobi to visit newcomers as soon as their tents are up and to bring them some useful present. As there is nothing much more needed in a newly-made camp than fuel, their present generally takes this form, and many times we have been thus favored. The good-will offering is made usually by old women who trudge up to our tents with the present of argol in huge baskets on their backs. This we accept partly for its intrinsic value and partly because it means the establishment of friendly relations with the people among whom we may have to live for several weeks.

The last two seasons our cooks have been using a condensed form of argol which is cut in large bricks from the floor of the corral where the sheep and goats are confined at night during the winter months. The Mongols use such bricks for building up the walls around the corral, but apparently do not care for it as fuel. Possibly this is because the admixture of goat and sheep hair adds no

improvement to a fuel which already has a decidedly pungent odor when burning. However, anyone who has seen and smelled the Mongols, hesitates to credit them with objecting to anything on that score. I fancy that the reason our own servants prefer the argol bricks is that one trip with the motor truck to the nearest abandoned corral brings in enough fuel for five or six days and saves them many miles of tramping over the desert.

While we can look to the desert for an abundance of water and fuel, it gives us only one article of food and that is fresh meat, which, after all, is a most important contribution.

The Mongols of the Gobi sustain life on a purely animal diet, meat in the winter, and milk, butter, and cheese in the summer. They never attempt agriculture and the country affords practically no natural vegetable food.

It is necessary, therefore, for us to take with us from China, the supplies which go to make up a balanced diet and the quantity required for the thirty or forty men over a period of five months makes up a good part of the load for our 125 camels. It is exceeded in bulk only by the gasoline, for our motor cars are even more ravenous than the men and just as insistent on their daily ration.

Although it is always possible to buy a sheep from the neighboring Mongol villages, our main subsistence is on the game of the country, which consists principally of two species of gazelles and a bird known as the sand grouse.

Every two or three weeks, feeling that the party may be getting a bit tired of game, we purchase a sheep which lasts about two days and then back we go with pleasure to the gazelles. I think that we could subsist very happily for

CAMP SERVANTS

The three cooks are proudly exhibiting the frosted chocolate layer cake which they have baked in a gasoline tin over an *argol* fire. The Fourth of July and birthdays of staff members always call for something fancy from the cook tent

the full five months on gazelle meat with an occasional mess of sand grouse thrown in. There are very few game animals of which this can be said.

Perhaps the Chinese methods of cooking have something to do with this loyalty of ours. They have the trick of preparing the meat in several different ways and making each dish taste different. For the first two or three meals we get the most delicious dish of all—fillets cut from the tenderloin, then follows a day or two of roasts, then chopped meat, and finally gazelle hash. We know then that the end is near, but to make sure that we understand the situation, the Number One Boy appears at the door of the mess tent in the evening and announces:

"Please, Master, tomorrow must wantchee catch antelope; just now no have got many meat." So on the morrow two men, one to drive and one to shoot, start out in the touring car and after an hour or two return with "many more meat."

As the motor car plays an important part in the water and fuel supply, so it does in the obtaining of fresh meat. Gazelles, which abound in most parts of the Gobi, are wary creatures and extremely swift of foot. Stalking them in open country is a difficult and slow business and only a few are taken in this way. But with a motor car it is a different story.

The car can travel over most of the country which the gazelles inhabit. It cannot, except under the most favorable conditions, actually run them down, and then only after six or seven miles' chase, but gazelles seldom run straight away; they have a fatal habit of insisting upon crossing over in front of any fast-moving object which is traveling in their general direction, and in the case of hunters in a motor car, this is their undoing.

AT A MONGOL WELL

Wells in the Gobi are encountered about every ten miles along the caravan trails, and the water bags, two or three on each car, are always kept filled for emergencies

The gazelles seem to be quite aware of the fact that they are the fastest animals of the desert and apparently they take pride in it. We always feel that this crossing the bows of the car or of the running horse is done for the joy they get in showing off their fleetness. Frequently they are not satisfied with just one crossing but turn and cross again or even a third time, and then, having shown just what they can do in the way of speed, they go off contentedly to graze.

The experienced hunter does not chase the gazelles with the car but runs slowly along parallel with the herd until it is apparent that it is about to cross over, then he puts on full speed, swings slightly away from the herd and tries to force it to cross within 200 yards. At the point of crossing the driver puts on all brakes, and the hunter, who is already out on the running board, steps off and usually gets in three or four shots before the yellow streaks are out of range.

In the early days of the Expedition we hunted for specimens as well as meat, but now that the Museum collections are

well supplied with both species of gazelles and the thrill of the chase has worn off, we take only what we need for food and the hunting becomes a matter of camp routine.

There is one exception to the statement that the Gobi furnishes us only with meat. In certain low-lying areas—the bottoms of the depressions—there is a flat, creeping vine covering the small dunes, which in early July produces quantities of a small dark-red edible berry. I do not know the botanical name but it is known to us as the "dune berry."

Throughout our work our relations with the Mongols of the desert have been most friendly. On occasions we have met with insolence from Buriat officials along the Inner-Outer Mongolia border and twice we have been on the verge of serious rows with these same people, but from the local residents we have had nothing but courtesy and kindness.

The Mongols are a simple, primitive people, subsisting entirely on their flocks of sheep and goats, their horses, cattle, and camels, the care of which is their chief occupation. Their houses are the portable felt tents or yurts, and they move about from place to place as grazing conditions demand, but always within the limits of the Principality to which they belong. Their wants are few and such things as cannot be supplied by their livestock are brought to them by small Chinese traders who travel in ox-carts during the summer to all parts of the desert, carrying brick tea, cloth, leather goods, tobacco, and other less important things, which they trade for livestock, wool, camel hair, and hides.

Aside from these Chinese traders and the great caravans which travel through along the ancient silk and tea routes, almost no one goes into the region in which we have worked. The coming of a party like ours is, therefore, an important

A BABY GAZELLE

One of Mack Young's pets, which he attempted to rear on condensed milk from a bottle. The fingers from one of the surgeon's rubber gloves furnished the nipple

THE BABY WILD ASS TAKES ITS FIRST MOTOR RIDE
It wasn't as contented as it looks, and Shackelford had many struggles to keep it in the car

event; so much of an event in fact that on our first trip in 1922, when we took the first motor cars into the Western Gobi, we struck terror into the hearts of these people. To see five strange black things bearing down on their village was more than they could stand and those who could, fled to the near-by hills, to return as soon as they discovered we were friendly folk and not Russian brigands bent on their destruction. Then would follow visits to our camp and an exchange of gifts. After that first year, our cars were well known throughout the central Gobi, and when we returned over our first-year route we were welcomed as old friends.

Our camps have always been a source of entertainment to the Mongols. Everything is strange to them—the cooking utensils, the cots and camp chairs and the dinner table, everything in fact but our tents and our camels, which belong to the desert. Their greatest delight is to crowd into the mess tent at meal time and watch us eat, but as the Mongol is one of the dirtiest, most unwashed of humans, this favor was usually granted to only one at a time.

Field glasses always excite their interest, and they have great admiration for the powerful telescope of a theodolite or a transit. They understand the use of field glasses and we occasionally saw them in possession of one tube of a pair of glasses—a whole pair of glasses being rather too much for one man to own.

The victrola astonishes at first, but after a few records the Mongols become decidedly blasé and pay no more attention to it; the mechanics of the thing are entirely beyond their understanding; the music doesn't please them; and the language is foreign. The radio interests them even less because it is less understandable, and listening with ear phones to a Sunday night concert in Vladivostock gives them no thrill whatever.

None of our staff has ever attempted to learn the Mongol language, and so we have always had to rely upon interpreters. This has not been highly satisfactory, but we have managed to carry on. With those of us who do not speak Chinese

fluently, two interpreters are required—an English-speaking Chinese and a Chinese-speaking Mongol—both from our own staff of servants.

If we have an important question to ask of a local Mongol, we first put it in English to our Chinese, he passes it on in his own language to our Mongol, who in turn gives it to the local man in the local dialect. The answer comes back over the same route, and to anyone who has tried to get precise information from an Oriental even when addressing him directly in his own language, it will be quite understandable that our replies reach us pretty well garbled.

We usually ask a question three times. The first answer may be "Yes," the second "No," and the third "Yes." Then we assume that two affirmatives are better than one negative and act accordingly.

I think that there is never any intention to deceive us about direction, condition of roads, position of wells, and other things we wish to know, but there is a tendency toward that trait strongly developed in the Chinese, to give the inquirer an answer which they think will please him, regardless of the facts.

THE INQUISITIVE CHOUGH

The choughs are great explorers themselves, and their long, curved, red bills are thrust into every nook and cranny they can find. Mr Granger's ear is being examined just now

The success of an expedition such as ours is due in no small measure to the servants and the native technical assistants of the party. The leader and his staff plan the work, lay out the itinerary, make the scientific observations, and record results, but the efficiency of their staff work is dependent to a degree greater, I think, than we usually realize, upon the smooth running of the camp. In good weather and with good traveling, things run on almost automatically, but in times of bad weather or trouble on the road, the quality of these men shows up.

The Central Asiatic Expedition has been most fortunate in its native staff during all these years. No better group of men has ever been brought together in China. Usually we have about twelve Chinese, as follows: two mess boys, one of which is the Number One Boy in charge of the whole camp menage, three cooks, and one or two chauffeurs; then there are five or six assistants in the scientific work. In addition to the Chinese there are three camp Mongols whose duties are to help make and break camp, to tend to the supply of water and fuel, to act as interpreters, and to do all sorts of odd jobs about camp.

All these men leave their homes and families for five months, and through thick and thin they remain steadfast and loyal to the tasks for which they are engaged. They are ready to roll out of their beds in the dead of night and lash down our tents at the approach of a storm. They cook and serve our excellent meals, often under most trying conditions. They do our laundry, air our beds, serve wash water in our tents, and attend to a dozen little things which make for our comfort and convenience and help to keep the

machinery of the expedition in good running order.

To our six technical assistants our debt increases each year as they become more and more efficient in the fossil-collecting which from the first has been the chief object of the Expedition. These assistants come from various walks of life. Buckshot, the leader of this group, whose real name, by-the-way, is Kan Chuen Pao, was our Number Two mess boy in 1922. Liu Hsi Ku, our second assistant, came with us first as a motor-car mechanic. One boy I had trained in fossil work in Szechuan in 1921 before our first Mongolian trip, and the other three were taxidermists during our first and second years in the Gobi.

BUCKSHOT AND A FLEDGELING EAGLE
This boy, who is the Number One technical assistant of the Expedition, possesses to a remarkable degree the fondness for pets which all Chinese have

There is something about fossil-hunting which makes a universal appeal and the six assistants took to the work like ducks to water. Their training in the field and in our Peking laboratory has been under such highly skilled men as Peter Kaisen, George Olsen, and Albert Thomson, of our department of vertebrate palæontology, and they have developed a keenness and ability for this really difficult work which has surprised us.

One important thing is that they understand what it is all about—why we go half way around the earth to dig up "Dragon Bones." To make sure they would understand this, we brought Buckshot and Lui back to the American Museum in 1924 for eight months' laboratory training and the venture proved a success. They now know what is to become of the specimens which they excavate with such care and I dare say that they visualize the more important of these in their proper place in the exhibition halls and perhaps even with their names on the labels. During the last two years of our work, fully three-fourths of the specimens taken have been found by the Chinese assistants and the greater part of the excavation work has been done by them. They have become so efficient that Mr. Thomson and I have found it profitable to devote most of our time to supervision and leave the prospecting to younger, keener eyes, and more active bodies.

To any group of men who live together isolated from civilization for many months, a little community by themselves with no outside contacts, there is necessity for something beyond the ordinary routine of work, rest, reading, and conversation—something to help divert one from a tendency to peevishness toward one's colleagues which is likely to develop even in the most agreeable men under such circumstances. The most popular and successful diversion of our parties has been that of camp pets, and here again the friendly desert comes to our aid.

The list of creatures that have entertained us is an extraordinary one. It ranges from grasshoppers and crickets which sang to the servants from their tiny cages in the cook tent and which could be carried in the pocket when we

moved camp, to a baby wild ass which fought everybody except its foster mother and which occupied most of the back of the touring car when we were on the road.

We have had two young wild asses in different years, both caught when only a day or two old, and both remained entirely untamed, in spite of their close contact with us. The first one lived nearly two months and up to the time of its death would kick and strike and strain at its little camel's-hair halter whenever anyone but Buckshot approached it.

Buckshot was the one who mothered it and fed it condensed milk from a canteen several times a day, and it always recognized him as a friend. During its last few days when it was ill it was a rather pitiful sight to watch it follow the boy about camp, sometimes even into the cook tent. Buckshot returned this devotion and was disconsolate when the little creature finally died. True to his Chinese instinct he gave it proper burial and erected a big slab of rock to mark the lonely grave on the northern slopes of Artsa Bogdo.

The second wild ass stayed with us only a few days. It was taken in charge by McKenzie Young, who gave it real motherly care and went so far on occasions as to keep it in his tent during the night. There came a chilly evening, after it had been with us about a week, and Mack, always solicitous about his ward's comfort, borrowed someone's felt-lined leather vest and slipped the baby's front legs through the armholes and buttoned the vest together underneath. It happened to be picketed outside that night and somehow it managed to slip its moorings and at daybreak it was gone. A thorough search with the motor car was made directly after breakfast but it could not be found. The local Mongols were informed that if they should see a baby wild ass wearing a halter and a gentleman's leather vest that it was ours and to please return it to camp, but we never heard of it again.

Baby gazelles, the loveliest of all pets, we have tried to rear on several occasions—the last with success, because then, instead of attempting to bring him up on tinned or dried milk, we bought a mother goat as a foster parent, and as the gazelle thrived and grew to maturity, a strong bond of attachment was developed between these two widely different animals.

"CONNIE"

This black vulture arrived in camp as an ugly nestling, but soon won the interest and respect of all members of the party. She has been with the Bronx Zoo since 1925

Many kinds of birds have entertained us in camp during our five years. The list includes sand grouse, choughs, ravens, falcons, kites, owls, and eagles. All of these have been successfully reared from fledglings with the exception of the kites and owls. We failed with the kites because they have a perverse nature and with the owls because their time of activity does not coincide with ours.

The most extraordinary of all our pets was the black vulture, "Connie." She was taken out of a nest in the rocks at the foot of Bogo Bogdo by Ralph Chaney, botanist of the 1925

"BUCKSHOT" ASSISTING IN THE EXCAVATION OF A FOSSIL
Six of these Chinese boys, under the leadership of "Buckshot," have been trained to a high degree of proficiency in both field and laboratory work

party, and carried by him on a camel for two days back to the main camp. An inspection of the new arrival by the members of the party brought forth the unanimous comment that this was, without much doubt, the ugliest bird that ever lived. In fact her ugliness was so extreme that it was almost fascinating. As a result, Connie from the start received more attention than any other pet we have ever had. She soon began to outgrow this ugliness, however, and developed along with a changing plumage a most kindly and highly inquisitive disposition, and endeared herself to everyone.

When we were ready to leave the plateau in the fall, Connie had become a magnificent bird—one of the largest of the birds of flight, almost coal black in color, with a crown of soft down on her head and a great ruff of pointed feathers around her neck. To our friends in Peking, Connie was the most interesting thing we brought back that year, and later she became the most popular passenger on a trans-Pacific steamer. In recent years she has been holding forth with her usual solemn dignity in the Bronx Zoological Park.

For five seasons, now, our parties have gone through much the same program, leaving Peking each spring with the bursting of the apple blossoms in our compound, enduring the same winds of early spring on the plateau, and finding the same relief in the calmness of the short summer, enjoying the same old thrills over new fossil discoveries and then, with the first approach of frosts, looking forward to the return to China with the same eagerness. The seasons have been somewhat different, it's true. There has been a different personnel each time, the route traveled has never been twice the same, and there have been various incidents and experiences which

distinguished each trip, but still there has been a remarkable similarity in all of the five years' work.

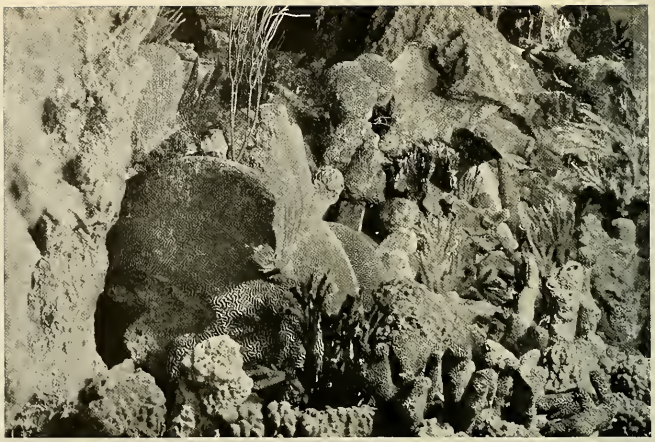
Probably the memory of Mongolia which will last longest with us will not be that of sandstorms, of exciting moments with Buriat officials, of new and startling discoveries in the fossil field, or of the hunts for gazelles, wild ass, and ibex, but it will be of those wonderful, calm Gobi evenings in mid-summer, when, after a marvelous sunset, such as only the desert can produce, and after a dinner such as only Chinese cooks can prepare, we light our pipes and draw our camp chairs in a semi-circle in front of the mess tent and either listen to a symphony or just sit and enjoy the quiet and solitude of the place.

A GOOD-WILL OFFERING

Three old Mongol women arrive at our newly made camp with a gift of *argol* (dried cow dung), the common fuel of the Gobi

Whether or not the Central Asiatic Expedition is now more than just a memory remains to be seen. Much work is still to be done, and all that is needed is permission to do it. In any event the task as outlined ten years ago has been accomplished and with a success beyond our hopes. We feel that the job has been well done and, in the language of one of America's foremost outdoor men, we have had a bully good time doing it.

Camp on Kholobolchi Nor



Fantastic Growths of Coral in Weird Formations Crowd the Sea Bottom

FORTY TONS OF CORAL

The Story of the Preparation of the Immense Coral Reef Exhibit Now Under Construction in the New Hall of Ocean Life at the American Museum

By ROY WALDO MINER
Curator of Living Invertebrates, American Museum

FORTY tons of coral trees growing on the ocean floor, bathed in the crystal waters of tropic seas, three fathoms below the surface, amid waving sea plumes and schools of brilliantly colored fishes flitting between their branches!

Forty tons of coral ripped from the heart of a hundred-mile submarine forest of tinted limestone, hauled to a snowy beach, bleached, embedded in sponge clippings, packed in huge crates, and shipped to the American Museum!

Forty tons of coral rising from the floor of the Hall of Ocean Life, their serrated branches interlaced as of old and once more invested with the delicate hues that gave them their pristine beauty, while above them again spreads the mirroring quicksilver of a simulated watery surface overarched by the blue of a painted tropic sky!

Such, in brief, is the story of the great Bahaman Coral Reef Group which, for several years past, gradually but steadily, has been approaching realization in the largest and most imposing of the Museum's exhibition halls. The expeditions which secured the specimens and other data for the group, replete with romance and adventure, have been described in previous issues of Natural History. It is not my purpose in this article to repeat these incidents in detail, but, though the exhibit, which is their fruit, is not yet completed, it may be of interest to summarize briefly the chief events of these voyages and then to recount the principal steps in the actual building of the group itself, an undertaking of unusual magnitude.

The idea of building a replica of a Bahaman coral reef had been in my mind

for a number of years, but first took definite shape during the year 1922 when the steel structure for the new Hall of Ocean Life was in process of erection and I was informed by President Osborn that the department of lower invertebrates was to have an important share in the exhibits to be housed in it. At the same time he requested me to submit suggestions for an invertebrate exhibit of outstanding character which also should be typical of oceanic life.

The reef-building coral polyp with its associates, has probably produced the most significant and conspicuous results of all the lower inhabitants of the seas. Its castellated structures of limestone may rise from depths of twenty or thirty fathoms to the ocean surface, and, in the case of the Great Barrier Reef of Australia, extend for more than fourteen hundred miles in length. They are dotted over tropic seas where they are perilous to vessels approaching them from without, while the difficult entrances through their submerged barrier walls, when mastered, lead to harbors of safety. Hence, they must be accurately mapped on navigators' charts. As world-builders, the coral and its associates have taken part in the construction of many oceanic islands forming the abode of men, and during past geologic ages, were an important source of the continental limestone deposits of the world.

It was natural that I should jump at the opportunity of building a coral reef exhibit for the new hall, and so, under my direction, Chris E. Olsen, modeler in my department, prepared a scale model of a proposed installation for the new group adapted to the architecture of the hall and embodying my ideas for the exhibit. This was presented to the President and Board of Trustees early in 1923 and was unanimously accepted by them, and I was authorized to prepare plans and to make negotiations for

SKETCH MODEL OF THE CORAL REEF GROUP

Designed by Doctor Miner and modeled by Chris Olsen on the scale of $\frac{3}{4}$ inch to the foot. The model represents the central portion of the western end of the Hall of Ocean Life, showing a representation of the proposed coral reef group in position

PALMATE CORAL WITH BEAM-SHAPED BRANCHES

A characteristic growth of coral under exposed condition near the surface of the sea. This ten-foot specimen was collected by B. E. Dahlgren and Herman Mueller from the Andros Reef in 1908, and was brought to New York by Joshua Slocum in his famous sloop "Spray," in which he had just returned from his remarkable voyage around the world

the necessary expeditionary work.

Four expeditions to the Island of Andros in the Bahamas were undertaken in the interests of the group between the years 1923 and 1930. The first, in December, 1923, was of a preliminary and exploratory character, in which I made arrangements for the first main trip which took place during the summer of 1924.

Early in June, I arrived in Nassau, accompanied by three artists and modelers of the American Museum staff: Messrs. Herman Mueller, Chris Olsen, and Dr. George H. Childs of the department of lower invertebrates. We allied ourselves there with Mr. J. Ernest Williamson, who generously put himself and his wonderful under-sea tube at our disposal, and with the cordial coöperation of the Bahaman Government we set sail for Andros.

Here, skirting the eastern shore for more than one hundred miles, is the finest coral barrier reef in the West Indies, and here, seated in the spherical steel submarine chamber of the tube, we gazed out through a plate glass window at a magnificent submarine forest towering above us everywhere. We made water-color sketches, instantaneous photographs and motion pictures through water so transparent that we could see one hundred and fifty feet through the weird tangle of sea growths before our vision was obscured by the luminous, pearly blue fog beyond.

Aided by diving helmets and a chain hoist mounted on pontoons, we attached chain or rope slings to the coral masses

FAN CORAL

This fragile variety (*Acropora muricata* var. *prolifera*) often is found clustering thickly on the floor of the sea outside the great forests of elkhorn, in strangely exposed positions without danger to its fairy-like beauty

we desired, and dragged them to the surface. Our largest specimen weighed two tons and was twelve feet in length. We towed our catches to the sheltered beach of our little Cay and there we bleached them. This process consists in keeping the surface of the corals wet until the thin outer layer of animal tissue decays and sloughs off, leaving the white limestone skeleton exposed.

PALMATE ELKHORN CORAL

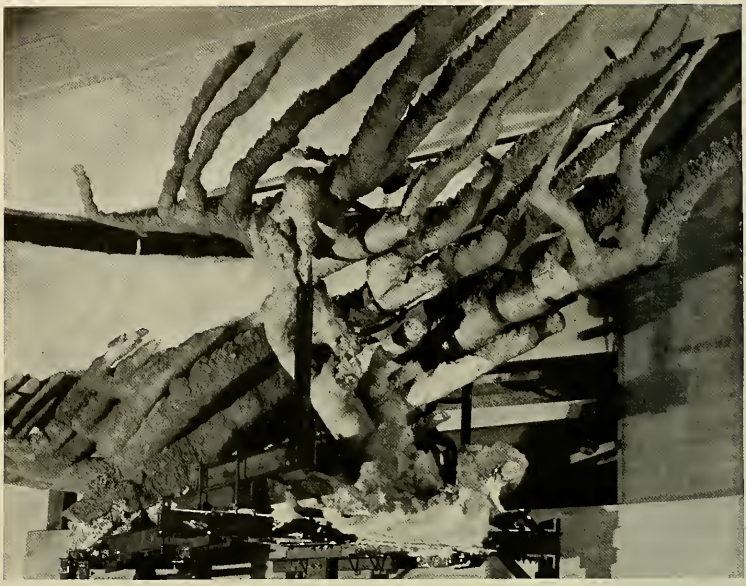
This beautifully symmetrical specimen (*Acropora muricata* var. *palmata*) grow in a sheltered position, so that its branches spread out evenly in broad fronds, contrasting sharply with the twelve-foot specimen shown on page 378 which grew in an exposed position on the outer reef, in which case the most rapid growth is with the direction of the prevailing oceanic currents

When we had completely covered the beach with gnarled and twisted branches of elk-horns, spike-like tangles of stag-horns and the delicate and fragile clusters of fan corals standing out among dome-shaped specimens of orb and brain corals, we sent natives to Nassau to bring us boatloads of heavy pine timber, from which we constructed crates and packed our specimens in them, embedded in sponge clippings. These were finally shipped safely to New York.

The third expedition was devoted to obtaining the reef fishes for the group. It was conducted with the coöperation of Mr. John S. Phipps, who lent us his fine houseboat yacht, "Seminole," and several smaller motor boats. The seagoing motor launch, "Iolanthe," was also with us during part of the time. Mr. Phipps's son, John H. Phipps, accompanied the expedition, and was in general charge of the fleet. Mr. Phipps, Senior, and several members of his family and guests visited us while at work. I was accompanied by my wife, son, Roy W. Miner, Jr., Chris Olsen of the Museum modeling staff, and Mr. F. L. Jaques, Museum artist. We were on the Andros Reefs from the latter part of June until

FINGER CORAL

This species (*Porites clavaria*) grows so prolifically that it sometimes rises in dome-shaped colonies thirty feet in diameter. The finger-shaped branches are closely set. A detail of the Coral Reef Group



THE TWO-TON CORAL SPECIMEN IN PLACE

This immense coral tree rises from a contorted cluster of trunks and now dominates the entire summit of the stony forest forming the center of the group. This specimen, with branches spreading twelve feet horizontally, was torn from the sea bottom in front of the coral barrier reef at Andros

the end of July. We set fish traps among the reefs, and used granges, gill nets, hand nets, and hook and line to obtain our specimens.

As soon as the fish were caught, living specimens were placed in aquaria and sketched in colors by Mr. Jaques before their brilliant hues faded. These and other specimens then passed through the hands of Mr. Olsen and my son who constructed plaster molds from them, and the specimens themselves were preserved in alcohol and formaldehyde for future reference.

In this way we secured molds and sketches of sixty-five different species of typical reef fishes. Later on, wax casts will be constructed from these molds, which, colored from the data furnished by Mr. Jaques' accurate sketches, will bring to life once more in the Museum group the multitudinous gaily colored fish population of the Andros Reef. During this expedition, Mr . Jaques made sketches for the cyclorama to form the great above-water background of the future group.

During our stay we experienced a severe hurricane but came through without damage to ourselves or our collections, and reached New York just in time to escape the second hurricane of that year which wrought such havoc in Miami.

The fourth trip was undertaken during the early spring of 1930, when Mrs. Miner again shared my experiences with me. We spent the month of March as

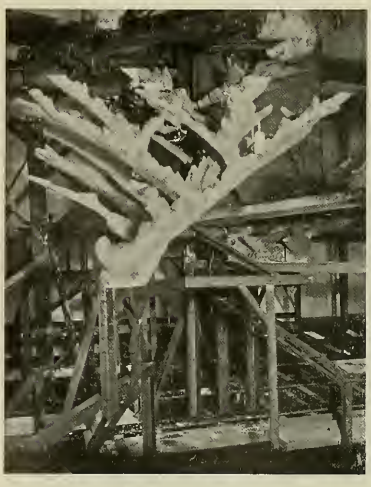
MAKING THE SKETCH-MODEL FOR THE CORAL REEF GROUP

Chris Olsen is modeling the coral specimens in minature under Doctor Miner's direction. They are placed in their correct position in the model; measurements are taken with reference to fixed points; and then the massive corals of the real exhibit are hoisted into exactly corresponding positions guided by similar measurements in the large group

LOOKING OVER A PART OF THE FORTY TONS OF CORAL

It took six months to clean the specimens in preparation for coloring. Those shown here have received a thin coating of wax, colored to simulate the living animal tissue covering the corals in life

MODELING "DEAD CORAL" ARCHES OVER THE STEEL WORK
Plaster of Paris over wire screening is used for this purpose. Later on a thin coating of beeswax and oil colors gives the surface effect of the natural formations as they appear on the sea bottom. The steel worker is constructing steel supports



ELKHORN CORAL
This unusually perfect specimen shows the typical method of branching

guests of Mr. and Mrs. Daniel Bacon on their interesting island camp, "Pirates' Nest." Through their courtesy, we established our headquarters here while gathering and preparing sea plumes and sea bushes for the new group.

Later on, we were joined in Nassau by Dr. and Mrs. Charles J. Fish, of the Buffalo Museum of Science, and with them explored the beautiful coral reef at Rose Island. This work was greatly facilitated by Mr. Hugh Matheson, of Coconut Grove, who put his ketch, the "Marmion," at our disposal. Utilizing diving helmets, we descended to the base of the reef at a depth of three fathoms, and made many observations and motion pictures of great value for the group.

So much for the field work. Difficult and arduous as it often is, and beset with unexpected and unusual problems, the work in the field is nevertheless the most romantic and enjoyable stage in the

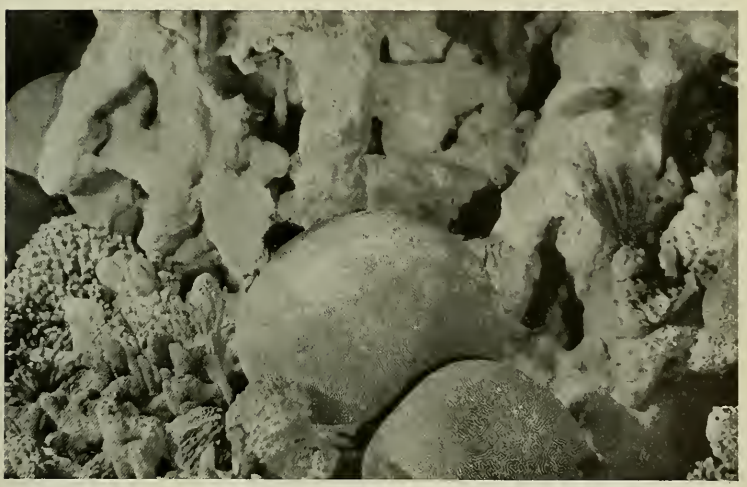
preparation of Museum groups. More than this, however, it is absolutely essential for the production of museum groups conceived in the modern spirit.

The ideal museum group is not merely a work of art. It is a record of living beings in their natural state and environment, depicted in their proper relations to their surroundings, and emphasizing the truth that the real unit in nature is the association rather than the individual.

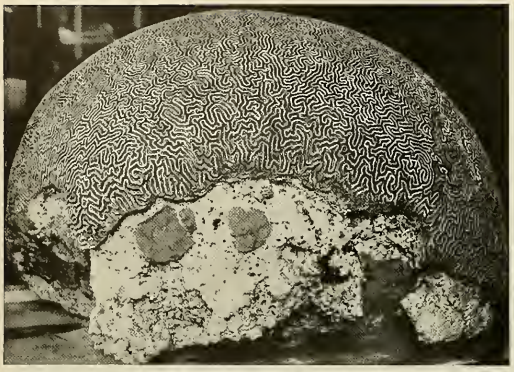
To make these groups accurate portrayals of reality, the modern Museum finds it necessary to send out well equipped expeditions to all parts of the world to gather the facts of nature at first hand. Consequently, if it is desired to build a group which will faithfully depict the life of the sea bottom, one must descend to the bottom of the sea to obtain the material and the observations to make this possible.

The preparation of the group in the

A DETAIL OF THE GROUP
Showing the steel framework anchoring a specimen of elkhorn coral in position



BRAIN CORALS GROWING AT THE BASE OF DEAD CORAL BEAMS
Welded together by overgrowths of *Lithothamnion*, a calcareous alga, or sea plant, which encrusts the dead coral with an overlying blanket of additional limestone, thus adding materially to the bulk of the reef



A LARGE HEAD OF BRAIN CORAL (*Mæandra cerebriformis*)
Showing the intricate pattern produced on the surface of the coral limestone built up by the rapidly dividing coral polyps

Museum, while not so romantic as the field work, nevertheless is full of interest and is beset with fascinating problems. Often these present special difficulties involving original and unprecedented methods, which, however, give greater zest to the work. This has been especially true of the Coral Reef Group.

In order better to understand our aims, let us first try to visualize the exhibit as it will appear when finished. We pass through the archway leading to the Hall of Ocean Life and find ourselves standing on the gallery surrounding an enormous hall 160 feet long and 130 feet wide. The lofty ceiling is surrounded by skylights and springs from a series of arches enclosing lunettes. These form the settings for murals depicting on one side of the hall various species of whales in their oceanic environment, and on the other, scenes illustrating the capture of whales by the old-fashioned whaling ship of bygone days. Skeletons and models of whales are suspended from the ceiling. An extensive shell collection occupies the gallery, and beneath it are caught glimpses of a series of pictorial groups illustrating the life of walruses, sea elephants, seals, and other marine mammals.

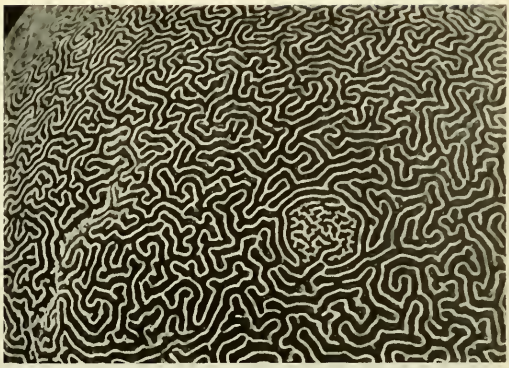
These features become apparent as the visitor has time to examine the hall in detail, but what first strikes his attention and holds his eye as he enters the hall is the enormous, brilliantly lighted group immediately facing him at the farther end.

The exhibit is framed in a great arch rising from the floor of the hall sixteen feet below the gallery and, passing through the latter, it sweeps in an enormous half-circle thirty-five feet above the main floor. Apparently one looks through the portion of the arch above the gallery into a tropical lagoon overarched by a brilliant sapphire sky with towering trade-wind clouds

TOUCHING UP THE MENDED BRANCHES
Doctor Childs is skilfully repairing an elkhorn coral specimen that was broken in transit

drifting by. In the foreground is a cay overgrown with shrubbery and plumed with wind-blown coconuts. In the distance is the long, low-lying shore of Andros.

We walk around the gallery and approach the arch from the right. The half-domed cyclorama, the masterpiece of F. L. Jaques, depicting the scene, discloses a new vista with every step. Now, we are looking out across the coral barrier marked by long lines of gleaming white breakers at the dark-blue, deep waters of the Tongue of the Ocean. As we come nearer, the emerald green shallows just within the reef meet our view, intersected with long, arching lines of rippling wavelets caused by the surges dying out over the obstructing barrier.

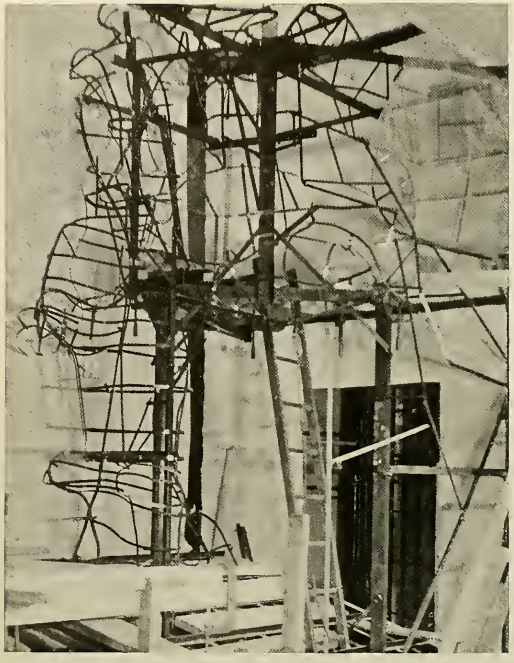


A "CLOSE-UP" VIEW OF BRAIN CORAL
Showing a remarkable labyrinthine growth around an enclosed nodule of more closely contorted pattern

COLORING A HEAD OF ORBICELLA CORAL
Chris Olsen is not only an expert modeler but also an artist of unusual attainments

As we face the arch, turquoise and green slicks of quiet waters spread out beyond the white, sandy point on the inner side of the cay, mirroring in the distance the alternating clouds and luminous sky colors along the horizon. Overhead, a long line of roseate flamingos sails above the palm trees, the birds lazily and majestically flapping their black-bordered wings as they follow the direction of the wind toward Middle Bight, an inland sea piercing the distant land-mass with its quiet waters.

Glancing downward, we see that the foreground is of transparent glass simulating the water surface, through which penetrate the tips of submerged elk-horn corals. We are looking into the heart of a coral reef, the treelike growths giving us glimpses of a fairy world between their branches. Our curiosity whetted, we note there are descending staircases on either hand. Down one of these we pass beneath the gallery and find ourselves looking through a coral forest, the tangled branches of which rise above our heads. We are standing on the floor of the sea!



THE STEEL FRAMEWORK OF THE "CORAL CAVE"
The heavier channel irons form the main structure and the lighter framework gives shape to the outline of the submerged coral cliffs, shown in nearly completed condition on the opposite page

I shall leave a further description of this weird and strangely beautiful world until the group has reached its completion. At the present time we are still struggling with the problems of partial accomplishment, and our imagination has filled in the unfinished details, as we are continually doing in the actual process of preparing the group. Let us now review some of the steps which have brought it to its present stage of preparation.

Let us imagine we have just returned from the expedition of 1924. Our forty tons of coral have arrived. In the courtyard outside the Hall of Ocean Life are thirty-one huge cases of hard pine. Our men carefully remove the planks from the tops of the cases, and disclose the soft masses of closely packed sponge clippings in which our corals are imbedded. Each case contains a large specimen blocked and braced in its center, while around it the lighter and more fragile specimens are closely packed, separated from one another by the elastic cushion of the sponges. As the specimens are laid out in long rows in the courtyard, we are delighted to find that but very few of them are broken after their long voyage of a thousand miles over a rough sea.

After all are unpacked, the next step is to clean the specimens thoroughly. There are so many of them, and they are frequently so complicated in their branching structure, that it takes six months of industrious work to accomplish this process properly.

Next, each specimen is coated with a thin layer of beeswax to simulate the animal layer, which in life invests the coral. This also serves to fill and seal the minute crevices with which coral is permeated, thus keeping the crumbling limestone dust within and furnishing a proper surface substance for coloring.

Now, each specimen is colored with oil colors, following sketches made from life. Each species has its appropriate color combinations and it is necessary that they should be faithfully represented to give

a lifelike appearance. Some of the brain corals are peculiarly difficult, for three main colors are involved, one of which, a green hue, must be applied in the bottom of the sinuous winding valleys with which the huge heads are covered in a most complicated pattern.

Some of the delicate fan corals were quite broken, and these had to be mended. All the broken tips had to be saved and carefully matched to their proper stumps, drilled and pegged with wire pegs, cemented with litharge, and the joints colored so that they could not be detected when finished. This was accomplished most successfully, Doctor Childs and Bruce Brunner showing an especial aptitude for this work, while the coloring by Mr. Olsen and Mr. W. H. Southwick is remarkably true to nature.

LOOKING INTO THE HEART OF THE CORAL CAVE
A detail of the group in an advanced state of completion. The cave shows in the center of the picture, its entrance overarching a projecting shelf of sage green brain coral (*Mæandra*)

Meanwhile, Olsen busied himself in constructing miniature models of each essential coral mass on the scale of three-fourths of an inch to a foot, and these were built up into a miniature composition according to the design which I had projected. This gave us a working model. Fixed points were designated upon this model and corresponding points were plotted in the great space $30\times16\times16$ feet which the group was destined to occupy.

A skilled iron-worker was assigned to our work, and began erecting a sloping steel framework in the form of a grid, to hold our heavy but fragile corals.

The largest coral masses were suspended by powerful chain-hoists in their proper places above this, using the sketch-model strictly as a guide. Each was carefully adjusted in a lifelike position, with due regard to the growth of each branch as determined by the prevailing oceanic currents, and then the steel structure was built up to support it properly, each piece, whether I-beam, channel iron, or T-iron, being carefully cut to fit.

It was always a case of try and cut and try again, bending and fitting according to need, remembering always the over-

PREPARING THE HUGE TWELVE-FOOT SPECIMEN
The artists are mending and touching up the coral branches, while the iron worker is working with an electric drill on the supporting steel armature

hangs and caverns planned in the composition of the group, and yet compensating by braces judiciously placed according to need, or concealed rods bolted into the floor to act as check reins with turn-buckles adjusted to give the right tension.

This was a steel structure which no blue-print could map out beforehand and required the most continuous impromptu exercise of engineering ability and adaptable ingenuity, qualities for which Louis Beauvais has shown especial capacity during the three years in which he has been patiently fitting six tons of steel parts into this group with which to support our forty tons of coral in its proper anchorage.

Early in the construction of this part of the work two huge sheets of plate glass were raised into place to serve finally as translucent backgrounds. One of these is eleven feet in height and the two are together so contrived as to form a continuous backing for the group. On these finally will be painted a continuation of the submarine vista. A great curving opaque background behind them will depict the still more distant prospect. This will be illuminated by soft, concealed lights which, shining through the translucent screen in front, will give the soft, watery effect of the under-sea. Chris Olsen has been painting many studies of submarine effects most successfully in preparation for coloring these backgrounds.

The principal mass of coral trees rises in the left center of the foreground, the steel supports completely concealed by modeling representing eroded masses of dead coral branches forming arches and caverns.

To the right of the group a great cavern of eroded and welded limestone and coral has been modelled. This reaches the surface to form a cay of grotesquely eroded rock awash at low tide. These features have been modeled over the iron framework by Mr. Olsen, using first a base of stiff wire screening,

over which is spread plaster of Paris mixed with excelsior, forming a rigid matrix. Over this, in turn, is brushed a layer of bees' wax to form a finished surface, and finally the whole is colored with oil colors to represent dead coral limestone, coated with encrusting algæ, bryozoa, sponges, and other living forms of beautiful color tones, as in the actual reef.

Thousands of smaller and more delicate corals have been colored to be inserted at the proper time. Hundreds of sea fans, sea plumes, sea bushes, and sea whips have been prepared by special processes and colored, ready for placing. Our skillful glass-modeler, Herman Mueller, is constructing fragile glass polyps and other organisms for assembling in the foreground. Olsen is coloring, modeling, and assembling assorted varieties of details, and is devoting his ingenuity to the solution of all kinds of problems. Great sheets of rippled glass have been prepared, and a complex yet unobtrusive structure has been contrived to support them in such fashion as to simulate the water surface.

A carefully worked out system of light boxes with special illuminating units of daylight lamps is being installed, and two immense glass fronts are being ordered to enclose and protect the group both above and below the gallery.

Within the coral forest beneath the crystal water-surface, hundreds of reef fishes of all the typical species will be seen disporting themselves between the branches or darting in and out of the coral arches and caverns. These, as above mentioned, will be cast in wax, from the plaster molds made from actual fishes in the field, and colored to the verisimilitude of life.

Finally, it is hoped that the group, when finished, will create in the visitor the illusion that he has actually descended beneath the tropic seas—that, without leaving the metropolis, he has been able to witness a world of life that would otherwise require long voyages, special equipment, and the willingness to don diving helmet and leaden weights in order to lower himself into Davy Jones's Locker!

Coating the coral surface with melted beeswax

HUNDREDS OF YEARS AFTER ITS ERECTION, MOST OF THE MASONRY OF MACHU PICCHU STILL STANDS

FROM CUZCO TO MACHU PICCHU

The Wild Gorge of the Urubamba River in Peru Forms the Setting for the First Camp of the Ottley-Anthony South American Expedition

BY HAROLD E. ANTHONY
Curator, Mammals of the World, American Museum

PHOTOGRAPHS BY THE AUTHOR

The Ottley-Anthony South American Expedition left the steamer after a fifteen-day run from New York, at Mollendo, Peru, and started at once by train for Cuzco. The expedition was in South America for extensive collecting and reconnaissance of regions especially interesting because of their mammal life, and its first field trip was planned for the Urubamba Valley, a short distance out of Cuzco. An earlier article "Camping in a Prehistoric Forest" by Mr. Anthony, appeared in Natural History, Vol. XXX, No. 4, and describes the sojourn of this expedition in the araucaria forests of Chile.

THE two-and-a-half-day train ride from Mollendo to Cuzco is a unique experience in itself, for it presents opportunities for many interesting sights not to be seen in any other part of the world, but it must be passed over briefly here. We broke the journey at Arequipa, which we reached at the end of the first day from Mollendo, in order to make a short survey of conditions there. It chanced that our stop at Arequipa coincided with a religious festival on Sunday, November 10, the fiesta of Alta Gracia, and the devout towns-people were celebrating with fireworks in rather unusual fashion.

Along all of the streets about a certain church, in the district of Miraflores, long strings of large fire-crackers were laid on the sidewalks. Trains of gun-powder were poured along the cement for a distance of several squares and the fuses of fire-crackers laid in this powder. The crackers were made of sections of bam-

boo wound with cord, and were grouped in sixes, three on either side of the train, forming a series of crosses with the string of powder. Several hundred feet of this decorated the sidewalks and at a given signal the powder train was touched off at the end. Amidst billowing clouds of smoke from the powder, the crackers detonated with broad flashes of yellow flame and a soul-satisfying vigor of report, the smoke and noise marching steadily in toward the church for a grand finale.

In the meantime, a small crowd of men and boys were setting off rockets in a side street. The rockets were peculiar in that they were fired from the hand. The man grasped the rocket at the head, pressed a bit of smoldering rope or rag against the open, lower end of the head and blew against it until the charge of powder lit and began to hiss. Still holding the rocket, the operator waited until considerable pressure was developed and then flung the projectile upward, where it rapidly gathered speed for its long flight, from the burning charge. After watching this technique for several minutes, Mr. Ottley wanted to try his hand. He joined the group in the street and was given a rocket.

He lit it and carried out the first step without a hitch. Then the hissing stream of fire spurting out just below his hand made each second seem like an age, and he became too anxious to get rid of the thing. Too soon he gave it an upward flip, before enough pressure had been generated to carry the rocket. It promptly fell back into the street and the crowd scattered at once, like a covey of quail, seeking shelter in the nearest doorway or behind the corner. Mr. Ottley had the entire street to himself in the twinkling of an eye, except for a single individual. One small boy had been looking elsewhere and became aware of the situation only as

WHERE THE TRACK FROM THE HUARACONDO GORGE MEETS THE TRACK DOWN THE URUBAMBA VALLEY

It requires a sublime confidence in the future to inspire the construction of a railroad down the Urubamba Valley. Mile after mile the traveler sees only high, rocky ridges, with snow-capped peaks in the distance, and practically no evidence of a population to furnish traffic

THE SEMI-WEEKLY TRAIN STOPS AT OLLANTAYTAMBO FOR THE NOON MEAL
At this point there is a well-kept little hotel, run by a German, for the white-collar passengers, and all out-doors for the Indian travelers who make up most of the passenger list

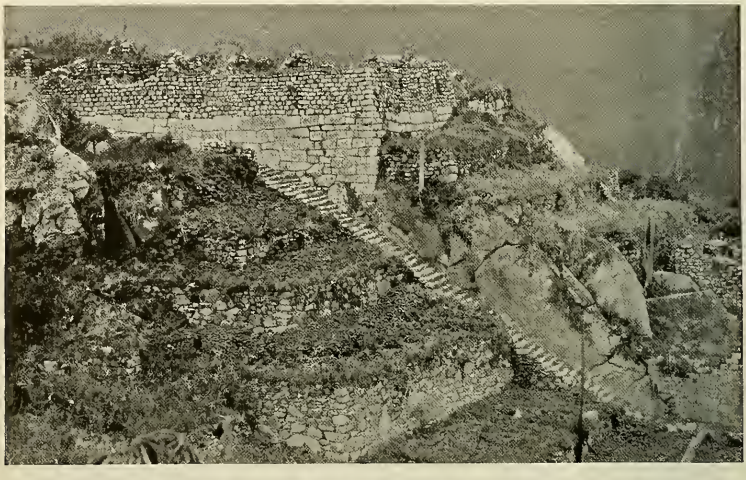
the rocket bounced upon the cobbles and suddenly became an erratic projectile of high speed. After one or two weak parabolas, the rocket gathered sufficient headway to clear the street and made straight for the surprised urchin. He was equal to the occasion and pelted as hard as he could for the first open doorway across the street. He had on the customary over-size pants worn by the boys of this country, and the appearance of these roomy trousers being propelled across the street by a very earnest small boy brought shouts of laughter. For an instant it looked as if the rocket might target on the very seat of these trousers, but instead, the hissing streak passed the fugitive and burst against an adobe wall. This entire episode proved a huge joke to the natives, but it might have been far from a joke if the boy had been hit. One irresponsible spirit acted out the incident in exaggerated pantomine which left us all weak from laughing.

At Cuzco we learned that we would be able to go by rail to Santa Ana, at the foot of Machu Picchu, a journey formerly of several days by mule. Unfortunately, trains ran only twice a week and we had just missed a connection. We contracted for an "auto-carril" or automobile with wheels for the railroad track, to take us from Cuzco to railhead at the foot of Machu Picchu.

We had to secure gun permits at Cuzco and pick up a few supplies. We had also a brief period to drive out to Sacsahuaman and to visit the most interesting sections of Cuzco, the ancient capital of the great Inca empire. Parts of the old Inca walls still stand and are used as structures of modern Cuzco. They are splendid examples of the durability of first-class masonry, the stones as firmly bedded as the day they were laid. There are several examples of stones with twelve

THE DWELLING PLACE OF THE CARE-TAKER OF MACHU PICCHU
The man who watches over the ruins has set up a thatched roof over one of the outlying stone structures, from which he commands a good view of the trail from the river below

ONE OF THE MANY INTERESTING OLD CHURCHES OF CUZCO
Cuzco, the ancient capital of the great Incan Empire, contains many imposing churches or cathedrals, some of which are very old



MACHU PICCHU IS A CITY OF MANY SLOPES AND FEW LEVEL AREAS
Long series of stone steps pass from one level to another, and the rocky hillsides are terraced off and retained by rock walls

separate angles on the face fitted so closely to their neighbors, without mortar, that the joints are perfect.

After the usual delays which always invest a departure in South America, we left Cuzco at 9:20 in the morning, Gilbert Ottley and I, with a fair amount of impedimenta loaded upon a species of gasoline-powered car. The engine had two cylinders both of which worked most of the time, but the sound of the exhaust was reminiscent of the days of early automobiling and made us wonder if the car would hold out to the top of the hill.

The hills began at the very outset and the narrow-gage railroad has to ascend several thousand feet above Cuzco in order to cross the great mountain ramparts that look down upon the city. The railroad engineers had a difficult problem in laying this track and resorted to switchbacks to make the climb. We ascended in a series of zigzags, running first forward then backward. The track runs as far as is practical in one direction and then ends in a spur. The vehicle enters upon the spur, a switch is thrown, and the vehicle starts up the other long arm that makes the angle at the spur. In all, we counted four reversals of direction before we emerged through the pass and with the car running forward. From the summit we had a glorious view of Cuzco spread out far below us, and in the other direction an equally fine vista down the valley we were to descend.

Once over the mountain range the track runs in long, straight stretches down an open valley, with extensive meadows and pastures through which a small stream flows. The bird life on the ponds and uplands was interesting, but no unusual topographic features were encountered until we passed the little station of Huaracondo and entered a ravine of the same name, the Quebrada Huaracondo. This is a deep, narrow defile with towering cliffs and ridges, rugged and desolate. The descent was rapid, the motor was cut off and the car

coasted, whirling about the shoulders of the ridges on an everchanging course and opening up a new vista every minute.

We got out our cameras and attempted to take pictures as the landscape raced past, not an easy task, for the car thundered and vibrated over the rough roadbed. Quite apart from the magnificent glimpses of the chasm itself and the high crags hanging over us, we were entertained by bits of comedy along the right of way.

There is only one way to descend the ravine of Huaracondo and that is to parallel the mountain stream at the bottom. The roadbed was laid along an old Inca trail and it is the only highway for the Indians of the district today. The Indians walk between the rails and drive their pack animals before them, with sheer cliffs on the one side and an equally impossible torrent on the other. Often there is no safe place to step off if one wants to leave the railroad. With trains running only two days a week and our "auto-carril" running as a special on a day when no traffic was expected, we came suddenly upon parties of Indians who had no idea that anything was behind them.

In spite of the noise made by our car, which was considerable, invariably the Indians traveling down the gorge failed to hear us until we were close at hand. Sometimes we were whisked about a turn to find our car right on the heels of an unsuspecting Quichua Indian. Most of the Indians were alarmed, and the pack animals without exception stampeded straight down the track. The driver had good brakes and never actually menaced the safety of man or beast, but took great pleasure in coming as close to this point as he dared. If he could ease the car down upon a family party close enough to announce our presence as a threat of immediate disaster, he always achieved a prompt and spirited result.

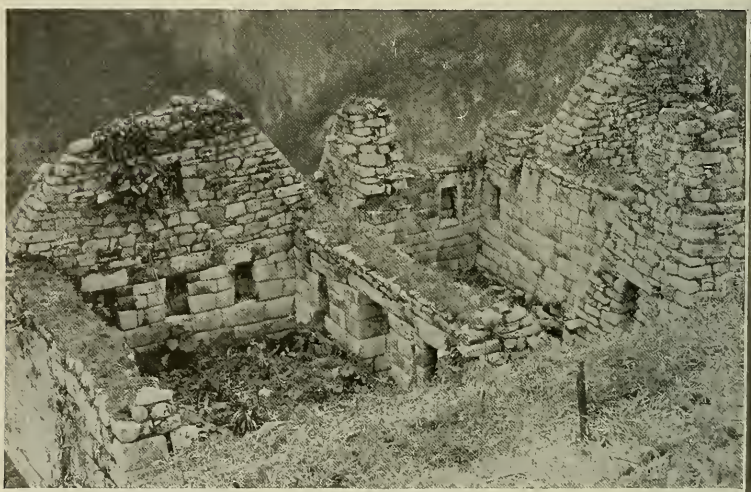
A SECTION OF THE GREAT STONE WALL OF SACSUHUAMAN

The massive walls of this ancient fortress which overlooks Cuzco are made up of huge, closely-fitting stones. The size of these blocks may be noted by a comparison with Mr. Ottley in the foreground

The Indian mind usually lagged behind the mule's and before a beast could be seized the pack train was off to a flying start. Close upon their heels followed the Quichuas in an attempt to head the animals and to drive them off the track so the car could pass. Sandals flew in one direction, bundles in another, and the entire cavalcade preceded us sometimes for a mile before we could pass them. As we rolled by we caught not a few dark looks, in spite of the fact that we had hastened their journey by our meeting!

Once we came upon two women and a little girl ambling down the track. The car was not more than forty or fifty feet distant when we were discovered by the child. She started running directly ahead but had recovered her senses enough to scramble down the bank to the left before her elders knew what it was all about. They scurried aimlessly for an instant, like chickens surprised on a road, starting for one side and then preferring the other. One of them grasped a hand of the child, by this time safely off the track, dragged her across the right of way so rapidly that the girl could not keep her feet, and bore her with an air of triumph down the embankment on the opposite side. As we passed I noted the hurt expression on the face of the child and a dazed look on the countenance of the mother gradually giving way to an apologetic realization that her violence had been unnecessary and that, after all, the child had behaved in a much more reasonable manner.

We coasted out of the gorge of Huaracondo into the wider valley of the Urubamba River, past Ollantaytambo where we stopped for lunch, and finally left the dry, arid hillsides with their cactus, at about the one hundredth kilometer post, to enter the fringe of the zone of dark green forests. Well on in the afternoon we arrived at our destination, a small collection of dwellings at railhead called Santa Ana.



THE KINGS GROUP

So named by Doctor Bingham. These structures have many openings in the walls to serve as windows or passageways, and have gable ends with projecting pegs of stone to which the roof was lashed

ANOTHER VIEW OF THE RUINS

Each bench or level area is the site of many structures set close to one another. Because of the limited area available for buildings, these early artisans planned to make the most of the situation, and a compact grouping is the result

Santa Ana is but a handful of shanties, roofed with galvanized iron and with walls of slats or palings. Filth and squalor met the eye in every direction; pigs, chickens, and dogs wandered about in the muddy lanes; and our lodging place, called by courtesy the Hotel Ferrocarril de Santa Ana, was enough to daunt even a hardened explorer.

We unpacked our gear, loaded up sacks of traps, and hurried out to run a trap line before dark. We were located but a few minutes' walk from the foot of the trail which leads up to the ruins of Machu Picchu, and had a good highway along the roadbed which was being constructed for the railroad down the Urubamba Valley. We were at the foot of great, beetling cliffs which the railroad skirted, just above the foaming mountain river.

It had been necessary to cut out rock from the bases of some of these cliffs for a roadbed and ponderous masses of slightly fractured rock hung poised over the track at several critical spots. The construction gang was blocking up with reinforced concrete in the attempt to safeguard such places, and men stood constantly on guard watching for dropping chips or a run of dirt which might foretell the descent of the entire mass. At one of these spots where men were clearing away tons of broken rock off the tracks, we were told that there had been a serious accident but a few days previous. A heavy fall of rock had occurred, and passing natives were warned not to gather at the spot but to hurry past. Some of them stopped their pack animals and loitered to look up at what was still hanging on the face of the cliff when a second fall dropped without warning. A few of the party escaped.

"How many were killed?" we asked.

"Nobody knows," was the answer, "we have not dug down deep enough yet to tell how many people and mules are under the stone."

We set out traps along the steep river bank and for a short distance up the trail

THE FIRST GLIMPSE OF THE RUINS FROM THE TRAIL

Some of the ruins extend down on the less precipitous slopes and are reached by long stone stairways. This view is taken from the trail which winds up from the Urubamba River and is the first close-up of the ruins of Machu Picchu to be had by the visitor

to Machu Picchu, and later extended our lines to include each likely spot in a reasonable radius from Santa Ana. Although the region seemed to offer attractions to small mammals in the way of abundant shelter and ample food, it was, like so many parts of tropical America, not a place where large numbers of animals could be taken during a short visit. We caught several very desirable species, however, and were able to record important observations as to faunal conditions. The event likely to prove of most interest to the average person, however, was our visit to the ruined city of Machu Picchu, on the day before we returned to Cuzco.

We arose at five o'clock, ran our traps and collected them for departure next day, and with three small boys to carry cameras, set out for the famous Inca site. The Peruvian government has shown a commendable interest in opening up the trail which climbs up from the river and in keeping the rapidly growing vegetation cleared away from Machu Picchu itself. Where formerly it was a most fatiguing climb to ascend to the site because of a poor trail, it is now possible to arrive on the spot in a little less than an hour, over a path with very few steep pitches.

For about a third to a half of the distance one traverses a heavy, tropical rain forest where the humid atmosphere takes toll of one's energies, but the trail finally leaves the timber and angles up over a brushy hillside, in the open sunshine. Beautiful flowers were conspicuous on these stretches, and most striking of all was a scarlet begonia growing in masses between the rocks. Specimens of these were collected and later sent by mail to the New York Botanical Garden where they are now growing and have blossomed.

Machu Picchu is situated on the crest and adjacent slopes of a short ridge that runs off about midway up the main slope. This ridge is inaccessible, apparently, from below, except in the general direction we had come, for the slopes

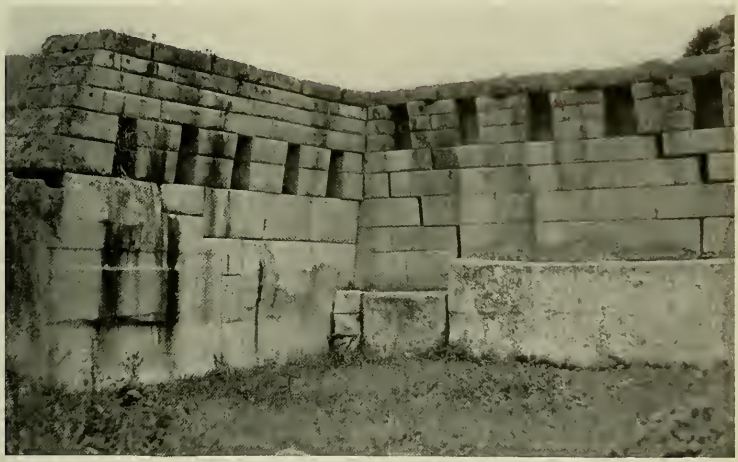
elsewhere are steep or even cliff-like. From Machu Picchu one commands a splendid view of the ravine of the Urubamba River and of the great ridges and divide opposite.

Much has been written about this ruined city and especially fine accounts, admirably illustrated, have been published by Dr. Hiram Bingham, who first cleared away the covering vegetation and made the serious studies which have yielded so much of interest. A few sentences from his latest book, *Machu Picchu, A Citadel of the Incas*, published in 1930, will serve to epitomize the history of this remarkable spot.

On the narrow ridge between these two peaks are the ruins of an Inca city whose name has been lost in the shadows of the past. Although magnificent in character and extraordinary in extent, these ruins appear to have been unknown to the Spanish conquerors, no specific mention of them being found in the writings of the sixteenth, seventeenth, or eighteenth centuries. Efforts to identify them with places famous in Inca history have been only partially successful. It is possible that they represent two ancient sites, Tampu-tocco, the birthplace of the first Inca, and Vilcabamba Viejo, the "University of Idolatry" of the last Incas."

* * * * * *

It seems probable, therefore, that at Machu Picchu we have not only the ruins of Tampu-tocco, the cradle of the Incas, the birthplace of Manco Ceapac, the first Cuzco Inca, but also the ruins of Uillcapampa, the sacred city of the last Cuzco Inca, the "University of Idolatry," and the home of a considerable number of the Virgins of the Sun and attendant priests. In the buildings and walls we have two distinct styles, probably separated several centuries in development—an early period when the citadel was small, a second period when the structures of late Inca design had to be built on top of ancient terraces and ancient walls. Second, in the more recent burial caves we have pottery of "Cuzco style," while in the more ancient part of the citadel we have different and earlier types, besides the problematical stone objects or record stones whose use does not appear to have been known to the Incas. Finally, there is the skeletal evidence. The bones of the original builders probably have long since disappeared and the remains found in the burial caves must be those of the more recent inhabitants of the citadel.



THE ALTAR IN THE PRINCIPAL TEMPLE

This fine bit of wall is part of a structure identified by the archæologists as the principal temple of Machu Picchu. Although the ground has settled in spots and opened up some of the joints, the greater part of these walls stands as an example of beautiful masonry

THE WALLS ARE BONDED BY A CLEVER USE OF INTERLOCKING ANGLES
The joints are broken, as in all good masonry, and the ashlars are so laid up that firm keying results throughout the wall

It appears that these are chiefly the skeletons of women and effeminate men. In the burial caves of the surrounding region a considerable proportion of skulls are those of males who had submitted to the surgical operation of trepanning, doubtless as a result of wounds received in battle. None such were found at Machu Picchu; doubtless because this was not a place where in its latest epoch soldiers lived and died. Undoubtedly in its last state the citadel was the carefully guarded treasure house where that precious worship of the sun, so violently overthrown in Cuzco, was restored and where there found refuge those consecrated women whose lives had from earliest infancy been devoted to sun worship and who had been sufficiently fortunate to escape the animosity of the bigoted *conquistadores* who turned the ancient Temple of the Sun into a European monastery.

* * * * * *

Surely this granite citadel which has made such a strong appeal to us on account of its striking beauty and the indescribable grandeur of its surroundings appears to have had a most interesting history. Selected as the safest place of refuge for the last remnants of the old *régime*, becoming the site of the capital of a new kingdom, giving birth to the most remarkable family which South America has ever seen, abandoned when Cuzco once more flashed into glory as the capital of the Peruvian Empire, it was again sought out in time of trouble when the foreign invader arrived—this time from the north—with his burning desire to extinguish all vestiges of the ancient religion, and so finally became the home and refuge of those consecrated women whose institution formed one of the most interesting features of the most humane religion of aboriginal America. Here, concealed in a canyon of remarkable grandeur, protected by nature and by the hand of man, the Virgins of the Sun gradually passed away on this beautiful mountain top and left no descendants willing to reveal the importance or explain the significance of the ruins which crown the beetling precipices of Machu Picchu.

Philip Ainsworth Means, in a later book, 1931, *Ancient Civilizations of the Andes*, comments on that fact that "almost nothing ante-dating the Incas was found" at Machu Picchu and, writing on the later reigns of the dynasty, remarks:

It seems likely enough that the earlier Incas had been deterred from conquering in that

direction by environmental conditions not propitious to highlanders. But by the time of Pachacutec, the Incas had perfected a military organization and a political system too efficient to be controlled altogether by such considerations as those, and it is quite logical that the great Inca may have deemed it politic to exercise at least some sort of power in the country between his "home counties" and the land of sylvan savages. Hence arose the construction of the magnificent border-citadel of Machu Picchu, not far from the lower margin of the *ceja de la montaña*, at a point where it commanded the narrow canyon of the Urupampa through which dangerous foes might attempt to come upwards towards the highlands.

The visitor to Machu Picchu cannot fail to be impressed by the evidences of orderly planning and efficient industry. With all of the equipment of modern engineering at his command, a present-day contractor would be daunted by the labor involved in creating a Machu Picchu on such a forbidding site. What a task it must have been for the Incas to quarry, dress, and move the great tonnage of stone to be seen there today. Bingham has described one of the walls in Machu Picchu as "the most beautiful wall in America."

Regardless of how far inference and conjecture may have influenced the interpretation of data discovered at Machu Picchu, the visitor can have no doubt that the city has had a most interesting history and that it would become one of the show places of the Americas if some means of transportation could only make it accessible to the general public.

Under existing conditions small parties of visitors are continually climbing up to the ruins, and one of the unfortunate concomitants of such visits is the threat of vandalism and the irresponsible urge which some persons have to place their names on record at inaccessible localities. Already scores of names have been deeply cut into the stones, and all too often the site selected is the fair face of some choice block. It is to be hoped that the Peruvian government will extend the care at present manifested in the improvement of trails and removal of vegetation to include a careful supervision of each visitor while he is at the ruins.

In Machu Picchu, Peru has not only a national monument of which she may well be proud, but more than that, she has jurisdiction over one of the most fascinating sites of pre-Columbian culture in the whole Western Hemisphere.

A Stone Stairway in the Ruined City

A DAY IN NAZCA

How Rain Came to the Mountains and Water to the Valley of Nazca After a Devastating Drought

By RONALD L. OLSON
Assistant Curator of South American Archæology, American Museum

The following sketch is an attempt to picture life and times in the Valley of Nazca, Peru, some fifteen hundred years ago, during the Tiahuanaco period. While I have utilized archæological data in the reconstruction, the humanizing of the material has, I fear, led me somewhat astray from the straight and narrow path of scientific accuracy. Aside from the general setting, the picture is largely fictional. I hope that it will be read in the same spirit in which it was written—as being nothing more than an archæological fantasy.—The Author.

THREE years it had been since more than a trickle of water had flowed down the stony bed of the River Nazca; three years since enough rain had fallen on the peaks of the Andes to bring water to the parched fields of the Coastland. Even one year without water for the fields was bad enough; but for one year the deep subterranean channels which drained the unwilling seepages from the underground waters, the *puquios*, furnished enough water for the maize crops. Now even the *puquios* were almost dry, though they still yielded a scant supply for household use.

Huayo, nephew of the chief of the upper valley, squatted at the door of his simple house of mud-plastered reeds and mused on these things. Three years now without water in the valley. Soon everyone would die. They would die unless they moved to another valley. Yes, Palpa and Acarí were better places after all; even though the fields there were narrow and it was hard to build ditches along the steep cliffs. Still, they had water almost every year. Only this year had they lacked. This year the people refused to sell maize or yucca to those of Nazca for fear that next year would be again without rain in the mountains. He could never come to like the people of those valleys. They were strangers and therefore not to be trusted. No, it was better to stay in Nazca, better to die in Nazca than among strangers.

He saw his brother and his brother's wife coming along the path. They were on their way to the fields and carried their digging sticks over their shoulders. He started to enter the house to avoid meeting them, for this woman seldom let pass a

chance to exercise her sharp tongue. But they had seen him, so he stood and waited for them to come up.

The woman's first words were typical of her.

"Well, my brother-in-law, I see you are idling as usual. And here it is almost sunrise. Perhaps you are waiting for breakfast before starting to work in the fields."

Huayo did not bother to answer, and the two passed on to their fields, which by the bad fortune of this year's allotments, lay next to his own. He hated this woman, and the thought passed through his mind:

"What if my brother should die, and I, by reason of the custom of my people, be forced to take her into my house as wife?"

In that event even his old age would be full of troubles and his house noisy with the chatter of women. But there was no use to worry now. Perhaps she would die, like everyone else, in this year's famine—if it did not rain.

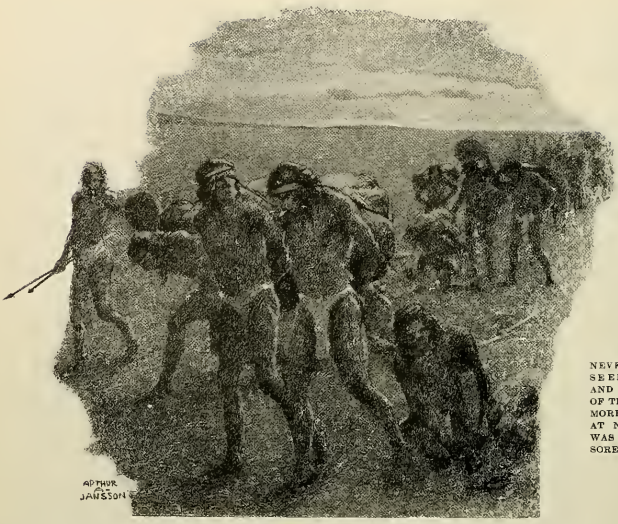
A man came up the trail leading from Cahuachi. This was the fellow from the uppermost village who had made the long trip to Ica when they had gone to trade for maize and yucca. He greeted Huayo in the customary way:

"My cousin, the day is good. The news also is good. The priests at Pacheco say that soon, very soon, there will be rain in the mountains and water for our fields."

But Huayo was in no mood to be cheered. "For two years now they have been making that same speech. But yet it never rains. If there is no rain in three days, our crops will die and we will starve for another year."

"But this time, even the chief priest says the same. He says it will rain of a

THEY STOOD GAZING BLANKLY AT THE STUNTED, WITHERED PLANTS



NEVER HAD A PACK SEEMED SO HEAVY, AND NEVER THE HEAT OF THE SUN AND SAND MORE CRUEL. EVEN AT NIGHT THE SAND WAS HOT TO THEIR SORE AND TIRED FEET.

surety. Today they sacrifice the sacred four-toed white llama. It cannot fail."

"His talk is as empty as the clouds. The same promises did the priests make in the days of our grandfathers when for five years there was no water, and more than half the people of Nazca died. I think it will be the same this time. The gods have forgotten us."

"Say not so, Huayo. It is an evil thing. Such talk may make Viracocha withhold his tears in anger."

The man started on, but Huayo called after him:

"It is child's talk which they speak. It is idle to think of rain when every day the hot wind blows across the valley. Even the priests know it can never rain until a wind comes from the sea and the black clouds gather on the peaks in the country of the Quilcatas. You will see, today as always, the wind will blow across the valley."

His wife spoke from the semi-darkness of the hut:

"Who was that? You should be more careful about speaking evil of the priests and gods before strangers."

"He was not a stranger. He was with us when we made the long trip last year in search of food. He is a friend. On the way home when I was near fainting in the desert of Huayirí he gave me a sip of water from his jar and took a part of my load until evening came."

"I heard what he said, that today the great rain ceremony, 'the compelling one,' is to take place, even to the sacrifice. We must go at noon, for you must play your flute while the priests make prayers to bring the up-valley wind. Perhaps today it will come."

Huayo did not answer. Instead he looked toward the Mountain-of-the White-Sands where the bright glow of the sun already touched the great ridges of wind-blown sands, and made them flicker in the heat. The valley was still in shade.

Yes, today again the sun would scorch the withered maize, and the burning

wind from the desert would curl its leaves. The dry dust of the field would feel hot to the feet instead of warm and moist. Today more plants would turn yellow and die. And tomorrow would be the same. Never would rain come to the mountain peaks. And one by one the people, like the plants, would grow weak and die.

Already the air shimmered in the heat, though the sun was still low above the horizon.

He sat idly watching the groups wandering listlessly about the fields. Some few were industriously working at their ditches or hilling the rows of maize. Others stood gazing blankly at the stunted, withered plants, their gestures, like the tones of their voices which drifted up to him, reflecting their despair.

"They, too," he thought, "are without faith in the words of the priests. The rain will never come."

There came to mind the struggle of these three long, lean years. The first had not been so bad. True, the crops had failed, but in the family and communal storehouses there had been enough to tide over the winter season. The following spring, the chiefs had commanded that every man plant his fields to maize, beans, and yucca, together with a few plants of the savory peppers. No land was to be wasted on cotton or on coca. People could wear their old clothes. Above all, no one was to touch the special granaries of seed maize—lest this year, also, fail to bring a harvest.

THE ROAD WAS STRANGE TO HIM, BUT HE FOLLOWED THE LINE OF STAKES WHICH STRETCHED IN AN ENDLESS LINE ACROSS THE DESERT TO GUIDE TRAVELERS OVERTAKEN BY SAND AND DUST STORMS

Not until the summer solstice of that year had there been actual hunger in the valley, though for many months only the children had been allowed their fill. Most of the men had joined a party going north to Palpa and Huayirí, even to Ica, to trade their household treasures for a little food. It was true that they had returned laden with maize—but it was traded at a dear price. For although the first year of the drought had not been felt in the valleys to the north, the second year had not seen a drop of water in the river beds. He remembered the long day and two nights of travel on the homeward journey. Never had a pack seemed so heavy, and never the heat of the sun and sand more cruel. Even at night—for they had not stopped to sleep the entire journey—even at night the sand felt hot to their sore and tired feet. Three men had died on that journey but their bodies had been left in the desert. Their loads were divided among the living to be given to the families of the dead.

And this year? This year all the valleys, both north and south, were without water. None could be found who would sell or trade. He had gone south to Acarí, and beyond to Ocoña, in search of food. The road was strange to him, but he followed the line of stakes which stretched in an endless line across the desert. These had been placed there by the Ancient People, it was said, to mark the road and to guide travelers overtaken by sand and dust storms. In Ocoña, he had traded his dearest treasures, two golden masks and a feather poncho, for a small net bag of maize. On the way home he had overtaken a man from Pañete, a fisherman, who likewise had traded for a small bag of maize. Him he had killed that same night as he slept. It was better that one's family have food than that strangers should eat.

"Come, my husband. I have made ready a little parched corn, and a bowl of good pepper broth."

It was his wife speaking to him from the gloom of the hut.

But even the mention of the broth could not tempt him.

"Today, my mate, I will not eat. There is barely enough food to last until the solstice moon."

Then he lied, with a fine disdain for the numb feeling of emptiness in his stomach.

"Tomorrow, perhaps, I will eat. Perhaps then I will be hungry. Today, I am not hungry."

"But today, my husband, is the long, the final ceremony. You will feel faint ere it is finished."

He was about to protest that he would not go. There was a long pause before he answered.

"Today, woman, I will not eat of food. But bring me one-half of the divine coca and my lime-gourd. With coca I will satisfy my stomach. Then let us go to the temple."

The temple at Pacheco was not a pretentious affair. Five years before, the splendid structure at Cahuachi had been destroyed in a sudden raid by the people of the valley of Ica. A new temple had been started at this spot. The site had been chosen because at certain seasons of the year fire could be seen issuing from the ground at this place. They had planned to build a large temple, but the drought had come and this rather simple structure had been built instead. In times of drought, none had the ambition or the means to erect large buildings, even for the gods.

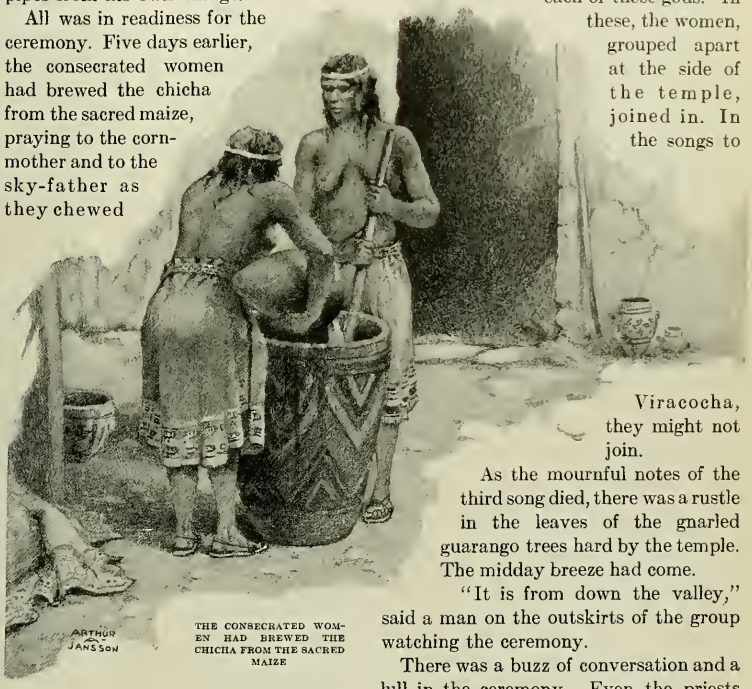
Viracocha was a comparatively new god to the people of Nazca. Huayo remembered his grandfather's account of how, at the time of the five-year drought, the priests of the old gods had failed to bring rain. Some men had gone to the people of the Highland to trade for maize.

They returned with tales of how the priests among the Quilcatas were able to bring rain at will. Their god, Viracocha, was the god of rain, able to water the earth with his tears. The high chiefs of the valley had been sent to bring some of these priests to Nazca. Within a month, there had come two heavy flows of water in the irrigation ditches. Since that time, the people had looked to Viracocha as the greatest of the gods, though many of the old people still worshiped the old monster-gods as well.

Huayo took his place among the other musicians. He knew them all: The player of pipes and the drummer from Cahuachi, the player of the sacred rattles from Cahuca, and the maker of the double pipes from his own village.

All was in readiness for the ceremony. Five days earlier, the consecrated women had brewed the chicha from the sacred maize, praying to the corn-mother and to the sky-father as they chewed the kernels and spat the mash into a bowl. With each mouthful a prayer, with each stir a sacred word as the water was added. Today the sacred chicha was ready. The large urn decorated with the likeness of Viracocha was full to the brim, and stood near the temple door.

The head priest gave the sign and the musicians struck up the preliminary song. Two priests dipped chicha from the urn and carried it within the temple to be offered to the images of the "helpers of Viracocha." Three goblets for the puma, giver of strength and courage; three for the condor-god who is able to cause lightning by blinking his eyes, and thunder by flapping his wings. And three for the serpent-god. Then a song was sung to each of these gods. In these, the women, grouped apart at the side of the temple, joined in. In the songs to Viracocha, they might not join.



THE CONSECRATED WOMEN HAD BREWED THE CHICHA FROM THE SACRED MAIZE

As the mournful notes of the third song died, there was a rustle in the leaves of the gnarled guarango trees hard by the temple. The midday breeze had come.

"It is from down the valley," said a man on the outskirts of the group watching the ceremony.

There was a buzz of conversation and a lull in the ceremony. Even the priests

became excited. Several men left the group to climb the knoll a short distance away, where they could more accurately judge the wind.

More men left the group to observe the wind. Now came a stronger breeze, unmistakably from down the valley. But it was followed by a hot puff from the desert pampa. The gods were undecided. Perhaps they were striving among themselves.

The breeze now sprang up in earnest. But it blew now from down the valley, now from across the sands. The excitement among the people grew. A priest gave a sign and again the music was taken up. There was a long series of songs to Viracocha. But they were sung in a new spirit, a spirit of both pleading and command.

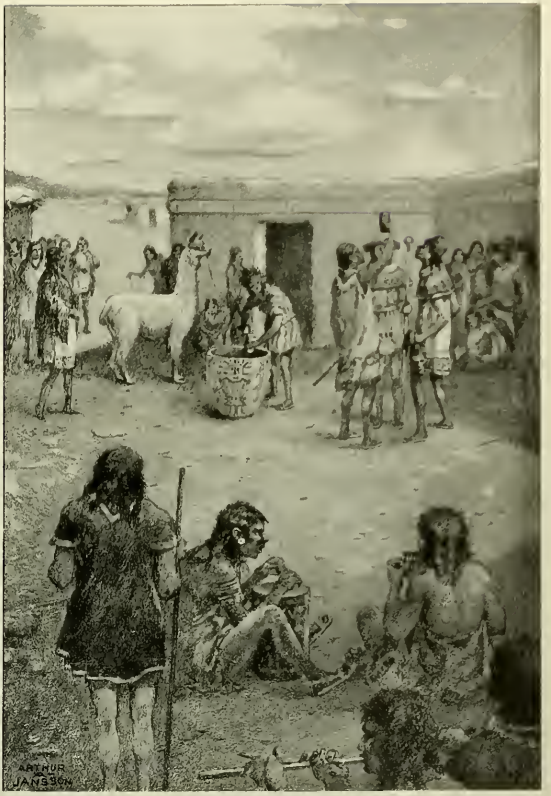
As song followed song and the many prayers were recited, the wind rose, then died again. It came in puffs, each stronger than the last, but it blew from the pampa as often as from the ocean. The rhythm of the music increased, and the tempo of the prayers was more rapid. Priests, musicians, and onlookers were keyed up to high tension—as if by added earnestness and intensity they could compel the gods to do their will.

It seemed as if the wind suddenly became stronger, a stiff breeze which caught up the dust and swept it up the valley in a cloud. Yes, the gods were at last listening. The wind was coming strong and fresh from the ocean. Already, gray clouds were gathering at the peaks of the Andes to the northeast. The songs were sung with even greater fervor and spirit now, and the prayers became almost hysterically earnest. More people came to the temple, the people of the north side of the valley. They, too, were anxious and expectant.

When the sun was low in the west, the chief priest brought the sacred four-toed white llama from the corral. Now was the climax of the ceremony. Now was the most sacred prayer. The trophy head and the ceremonial club were brought out by two priests wearing masks. The head priest raised high his goblet of chicha and while the musicians kept time to the chanted words, he offered the final prayer.

Viracocha, Lord of the Universe!
Whether male or female,
At any rate commander of heat and reproduction,
Being one who,
Even with his spittle, can work sorcery.
Where art thou?
Would that Thou wert not hidden from these sons of thine!
He may be above;
He may be below;
Or, perchance, abroad in space.
Where is his mighty judgment seat?
Hear us!
He may be spread abroad among the upper waters;
Or, among the lower waters and their sands
He may be dwelling.
Creator of the world,
Creator of man,
Great among our ancestors,
Before Thee
Our eyes fail us
Though we long to see Thee;
For, seeing Thee,
Knowing Thee,
Learning from Thee,
Understanding Thee,
We shall be seen by Thee,
And Thou wilt know us.
The Sun—the Moon;
The Day—the Night;
Summer—Winter;
Not in vain,
In orderly succession,
Do they march
To their destined place,
To their goal.
They arrive
Wherever
Thy royal staff
Thou bearest.
Oh! Harken to us;
Listen to us,
Let it not befall
That we grow weary
And die.
O conquering Viracocha!
Ever-present Viracocha!
Thou art without equal upon the earth!

Thou art from the beginnings of the world until its end!
Thou gavest life and valor to men, saying,
'Let this be a man.'
And to woman, saying,
'Let this be a woman.'
Thou madest us and gavest us being.
Watch over us, that we may live in health and in peace.
Thou who mayest be in the highest heavens,
Among the clouds of the tempest
Grant us long life,
And accept this our sacrifice,
O Creator.



THE HEAD PRIEST RAISED HIGH THE GOBLET OF CHICHA AND WHILE THE MUSICIANS KEPT TIME TO THE CHANTED WORDS, HE OFFERED THE FINAL PRAYER

As the prayer ended, the priest poured the chicha on the ground. The sacred llama was led within the temple to be strangled in sacrifice.

The ceremony was over. The priests went within the temple to continue their rituals. But these rituals were secrets to be hidden from profane eyes. The people who were gathered about the temple started moving toward their homes. The wind had freshened. The clouds now banked black along the distant peaks. Were the clouds black enough to bring rain? It was too early to know. Twice before this spring they had formed black and heavy. But there had been no thunder and no lightning and no water had come down the river.

It was dusk by the time Huayo and his wife reached their house. She asked him if he would like a few grains of parched maize, but he shook his head. This was no time to be eating. Instead, he took the last leaves of coca from the bag, stuffed them into his cheek, and leisurely, absent-mindedly applied stick after stick of lime to the cud. He was watching the clouds marshalling at the summit of the mountains. They grew blacker and blacker. There was hardly a doubt but that it would rain.

He looked along the rim of the valley, where the huts clustered at the edge of the

fields. The people were gathered in little groups, watching the clouds on the high peaks. No one had thoughts of anything save the coming of the rain. It was a tense hour. If no rain came tonight, it might mean another year of drought, another year of starvation. Only a few of the people could hope to survive a fourth year.

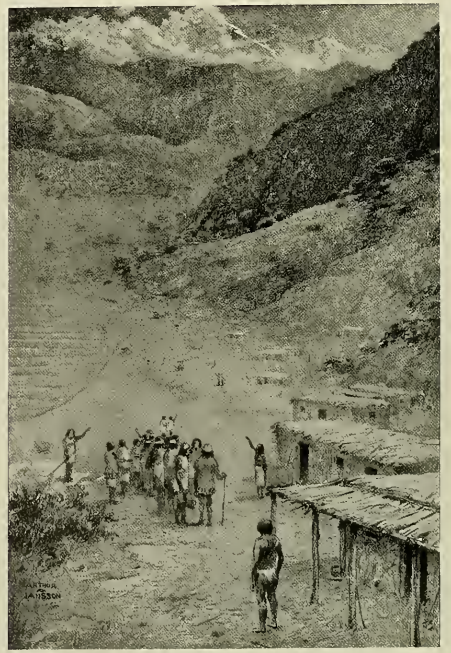
Suddenly there was a flash of lightning where the clouds were blackest. The highest peaks turned gray, as if the clouds had descended to them. It was the rain on the peaks. A half-shout went up from the people as they pointed to where the lightning had flashed. Some ran to their houses to get digging sticks, then out to the fields to put finishing touches on irrigation ditches, or to make little furrows between the rows of plants.

Huayo turned to his wife.

"By dawn the river will be roaring. Our ditches will be overflowing. Viracocha has heard; he is shedding his tears for his children."

There was another flash of lightning, followed after a time by a low, throaty roll of distant thunder. It was as if a huge underground monster had grumbled low in his throat.

The storm spread until the black clouds hovered over all the mountains, and the high peaks became gray with falling rain. The mother-corn was saved. Rain had come to the mountains, and water to the Valley of Nazca.



RAIN HAD COME TO THE MOUNTAINS, AND WATER TO THE VALLEY OF NAZCA

A Splendid Wild Reindeer Steer, Roped to be Broken for a Sled Deer

REINDEER FOR THE CANADIAN ESKIMO

Domesticating the Reindeer To Safeguard the Economic Welfare of the Natives of the North West Territories

By O. S. FINNIE

Director, North West Territories and Yukon Branch, Canadian Department of the Interior

IT is realized by comparatively few people that the North West Territories and the Yukon Territory, occupying the northern part of Canada from Alaska to Hudson Bay, and including the islands of the Canadian Arctic archipelago and Hudson and James bays, comprise nearly two-fifths of the total area of the Dominion, or that the land and non-tidal waters of these Territories are approximately one and a half million square miles in extent.

During recent years the trend of settlement has turned northward and as development proceeds, problems concerning the protection of the native residents and the resources upon which they depend are presented to those whose duty it is to administer the country. The investigations already undertaken have demonstrated that many natural resources of economic importance exist north of 60 degrees north latitude, the boundary line between the organized Provinces and the Territories. Ever mindful of its responsibilities, the Department of the Interior has formulated a policy which, while encouraging the development of the natural resources, also provides for the protection and welfare of the natives and the conservation of valuable game animals upon which they have depended for subsistence. Having also in view the steady retreat of wild animals before advancing settlement, the possibilities of the domesticated reindeer as a supplementary source of food and clothing were carefully investigated, and as a result of favorable reports, steps have been taken to establish such an industry among the natives.

A great part of this northern country is known to many people as the "Barren Grounds," few realizing that more than half a million square miles of sub-arctic forest are found within the Territories. Samuel Hearne, who, on his overland journey from Fort Prince of Wales near the present Hudson Bay port of Churchill to the Coppermine River, was the first white man to penetrate the vast treeless

A HERD OF ALASKAN REINDEER

This photograph shows only a part of the Lomen herd, rounded up on the range for the autumn kill. Reindeer have now become an important industry in Alaska, and suggest the probable success of the attempt to introduce them into northern Canada

country north of the transcontinental forest, was so impressed with the fact that no trees were found there that he coined the term "Barren Grounds" for these northern tracts. Modern travelers, however, all agree, that large parts of this country are far from being barren, since in most places the ground is well covered by vegetation which, in some locations, is luxuriant. The term "Barren Grounds" is therefore misleading, and more appropriate substitutes such as "Arctic Prairies" or "Northern Plains" have been proposed. The latter is now being adopted by present-day writers.

Investigations which have been carried on for a number of years by grazing experts of the North West Territories and Yukon Branch of the Department of the Interior have shown that large areas in Canada north of the tree line compare favorably with grazing lands in Arctic and sub-arctic Siberia and Alaska on which vast herds of domesticated reindeer are supported. The value as grazing land of large parts of the Northern Plains has been recognized for many years in Canada, since, for countless ages, these natural pastures have supported vast numbers of herbivorous animals of which caribou and musk oxen were the most numerous.

The inroads that modern firearms and advancing civilization have been making into these and other species of large game have become more and more noticeable during the present century. The musk oxen, which in historic times roamed over the entire northern part of the continent from the north coast of Alaska to the west coast of Hudson Bay, disappeared long ago from Alaska; and on the mainland of Canada they have been reduced to a few small herds, which, for a number of years have been under Government protection. The Barren Ground caribou are still numerous in many parts of northern Canada, but it is realized that, in

order to maintain and preserve this great and valuable food supply upon which the aborigines of the North depend, some measure of protection is necessary.

The game conservation policy of the Dominion Government, which, through the North West Territories and Yukon Branch of the Department of the Interior, administers the North West Territories and the Yukon Territory, has done much in educating the natives of the North to refrain from wanton killing of game in excess of their actual requirements, in regulating hunting and trapping, and in establishing and patrolling game preserves and wild-life sanctuaries.

The question of game conservation also has another aspect, namely the adequate and continuous food supply of the native and white population. Least dependent on the game supply in the North is the white man. The Indian, who lives in the timbered areas, has resources more varied and much larger in number to draw upon than has the Eskimo, who is limited to a few resources that are available during short periods only.

Before the rifle came into the hands of the Eskimo, the seal and the walrus were hunted from the kayak or on the ice with harpoon and spear, while the caribou were shot from ambush with bow and arrow. The caribou hunt especially was very often a laborious process. As a rule it involved days, or even weeks, of preparation in building ingeniously devised stone fences, the purpose of which was to direct the advancing caribou herds toward the shooting blinds, behind which the hunter was concealed, or into a river or lake where the swimming animals would fall an easy prey to the hunter in his kayak. The old Eskimo hunting method was practically as sure of results as the white man's way with the rifle; but for the preservation of game it was superior because it was silent

REINDEER OF THE YUKON DELTA

This portion of the Pastolik Herd shows a high type of reindeer. The meat of these animals is widely used in Alaska, and has been shipped as far as New York City

ESKIMOS OF THE COPPERMINE RIVER VALLEY
It is for the benefit of people such as these that the Canadian Department of the Interior is introducing reindeer into northern Canada

and economical. So much labor was involved in stalking and killing that seldom was more game killed than was actually required by the hunter and his family, and the hunting did not disturb the remaining caribou herds because it was silent. Year after year the caribou returned over practically the same routes and crossed the rivers in the same places, as indicated by huge piles of decaying caribou bones that mark all traditional crossing places where for centuries the Eskimos have been wont to go deer hunting. Nowadays the rifle tends to make the hunting too easy. It is true that but few Eskimos now depend exclusively on the game of the country, but, on the other hand, when occasion arises, very few can resist the temptation to kill as long as their ammunition lasts.

In the days before the locating of traders on the Arctic coast, vast numbers of Barren Ground caribou migrated north each spring and crossed on the ice to the Arctic islands before fawning season, and, when the straits again froze over in the fall, recrossed to the mainland, where better winter pasture was found to the south near the edge of the great transcontinental forest. The chief object of this seasonal migration of the caribou, undoubtedly, was to avoid predatory animals and particularly the insect pests of the interior during the fawning season.

Owing to the fact that hunting has become more intensive along the Arctic coast, due to the use of rifles and to the establishment of permanent habitations at comparatively short intervals of space, the wary caribou in the past decade has changed its migrational routes. Now the northward trek turns to the east before reaching the coast, and the herds spend the summer in the interior. The result, it is believed, is that larger numbers of fawns fall a prey to predatory animals or succumb to attacks of insect pests than when the herds crossed over to the Arctic islands.

With the object of broadening the basis of subsistence of the natives, especially in view of the rapid advance of mining activities into the North, the Department of the Interior, for a number of years, has been looking into the possibilities of increasing the number of the larger animals. To this end a Royal Commission on the Reindeer and Musk Ox was appointed in 1919, and since that body made its report a large amount of information has been secured through investigatory and experimental work.

Whereas in Arctic Europe and Asia the reindeer has been domesticated for at least 1500 years, the first tame reindeer were brought to this continent in comparatively recent times when the United States Government, as a relief measure for the Alaskan Eskimos, introduced a small herd from Siberia. So well did this experiment succeed in Alaska that from the small nucleus of 1280 deer introduced during the years 1891 to 1901 the country now has more than 750,000 domesticated reindeer and about 200,000 have been killed in supplying the native and white population of that country with meat and hides.

In pursuance of its policy of safeguarding the welfare of the natives, the Canadian Government, through the Department of the Interior, in 1929 authorized the purchase in Alaska of 3000 reindeer to be delivered in a selected range on the Arctic coast east of the delta of the Mackenzie. Preparatory to the purchase of the herd the Dominion Government carried out a thorough investigation of the grazing conditions, carrying capacity, and other factors of certain parts of Arctic Canada. In April, 1926, Mr. A. E.

ESKIMO MAN AND WOMAN OF MELVILLE PENINSULA

Formerly the herds of caribou ranged over enormous areas of northern Canada, but the introduction of firearms has decimated the herds and brought about a change in their migratory habits. It is hoped that the introduced reindeer may serve to take the place of the caribou, for without one or the other the lives of the Eskimos become much more difficult

A PART OF A COMMUNITY REINDEER CORRAL

The reindeer now ranges over hundreds of square miles of Alaska, thriving on a diet from which cattle and horses could derive little or no sustenance. Here and there such community holding pens as this have been erected in order to simplify the handling of the herds

Porsild, an experienced botanist of the North West Territories and Yukon Branch, was appointed to conduct this investigation with the assistance of his brother Mr. Robert T. Porsild. By reason of the fact that these gentlemen had the advantage, gained during many years spent north of the Arctic Circle, of being thoroughly experienced in traveling conditions in the North and of being able to speak the Eskimo language, they were well fitted to cope with the problems in hand. A total of thirty months was spent in the field in both Alaska and northern Canada and an aggregate of 15,000 miles traveled. The attention of the investigators was principally focussed on the area between the Mackenzie and the Coppermine rivers and from the Arctic Ocean south to Great Bear Lake. The grazing survey showed that in this part of the North West Territories about 50,000 square miles of excellent reindeer pasture is available, which compares favorably with the best reindeer pasture in Alaska, and which at a conservative estimate will accommodate at least half a million reindeer. Vast herds of wild caribou formerly roamed over this range, but, as a result of intensive hunting during the past twenty or thirty years, with the accompanying change of migrational routes, only a few thousand caribou remain in this area.

The results of the grazing investigations in the Mackenzie district were published by the Department of the Interior in 1929 in a preliminary report entitled "Reindeer Grazing in North West Canada," by A. E. Porsild. The same year the Dominion Government made provision for the expenditure necessary for the purchase of a herd of 3000 Alaskan reindeer and for the establishment and maintenance of an experimental reindeer station which has now been built near

Kittigazuit, on the Canadian Arctic coast east of the Mackenzie delta.

It is the intention of the Department to maintain this herd, and at the experimental reindeer station at Kittigazuit to train young Eskimos to become efficient reindeer herders. It is expected that a system will be adopted whereby the young Eskimo, after serving from four to five year's apprenticeship, will find himself the owner of a small herd of reindeer, which, if properly looked after, will increase and provide a generous food supply and income for himself and his family.

The selection of the purchased reindeer took place in the mountains near the sources of the Napaktolik River in the Kotzebue Sound region, on the range of the largest reindeer company in Alaska, and was under the observation of Mr. Porsild. Two months were spent in rounding up a large number of small herds, scattered over a range of more than a thousand square miles. By the beginning of December, 1929, a total of 10,000 deer was corralled. In the selection each deer was carefully examined before passing inspection and a total of 2890 females from one to three years old, 317 bulls, and 308 steers were selected.

A few days before Christmas the caravan was under way on the first leg of the 1600 mile trek from Napaktolik to the Mackenzie delta. During the winter of 1929–30 the vendors who have undertaken to deliver the deer at the Mackenzie delta, experienced many difficulties in overcoming the natural homing instinct of the reindeer, and every precaution had to be taken to prevent small bands from breaking away from the main herd. Again and again during the initial stages of the drive the herders found themselves foiled, and weeks or even months of painstaking

"SANTA CLAUS" REINDEER AT GOLOFNIN, ALASKA

At Christmas time many Alaskan reindeer are shipped to cities in the United States and Canada, in order to play their part in building up the Christmas atmosphere. To the Eskimos of northern Canada, however, the reindeer will probably become a useful animal throughout the year

driving would be frustrated, when, during a blizzard, or through a false move on the part of some of the helpers, or for no apparent reason at all, a part of the herd would break away and return to the range whence it had started weeks or months before. The first stage of the drive ended in March, 1930, when the herd came to a halt in the Hunt River valley in the Endicott Mountains. Fawning season was then at hand and prevented further movement until the next freeze-up when traveling again became possible.

New and perplexing difficulties presented themselves the following winter (1930–31) in transporting the supplies and equipment of the caravan through the mountains, but the latest reports indicate that these difficulties have been successfully overcome by the aid of airplanes and that the herd has at last crossed the mountains and is on the Arctic slope on its way toward the Colville River delta where it is expected that it will remain during the fawning season and summer of 1931.

It is still premature to foretell the possible outcome of this undertaking. It is certain, however, that many difficulties will have to be overcome and much patience exerted before Canada's Eskimos will have progressed from hunters to husbandmen. On the other hand, great possibilities are anticipated in the development of this new industry. Further investigations into the grazing possibilities of other parts of the North West Territories indicate that in the Keewatin district also large areas are available which are suitable for reindeer. It may be safely assumed that Arctic Canada has room for millions of domesticated reindeer in areas where, due to the severity of climate and inferiority of soil, other forms of agricultural development are at present out of the question, and where the country, aside from mineral possibilities and as a fur producer, would otherwise be unproductive. It is quite possible that the industry may even become of economic importance to other parts of Canada, particularly the district of Keewatin and the northern parts of Manitoba, which, through the new railway and shipping port at Churchill on Hudson Bay, have been brought within reach of world markets.

A MELVILLE PENINSULA ESKIMO FAMILY

The Floating Home of the Pied-Billed Grebe

SAC-A-PLOMB

The Elusive Little Pied-billed Grebe That Nests in the Inland Ponds and Lakes of Our Northern States

By ALFRED M. BAILEY
Director, The Chicago Academy of Sciences

Photographs by the Author

IT was a gray day in springtime and many waterfowl were winging their way northward along a little inland river, on their way to their breeding grounds. A boy crouched behind a willow stub, and as two small water birds flew swiftly along just above the surface of the stream, he raised his gun and fired. The charge of shot spattered over the surface several feet behind the fast moving birds, but at the report, they both struck the water head foremost, and disappeared.

The boy jumped to his feet and ran to the river's edge, his heart pounding rapidly. He had gotten them both! He waited expectantly. Surely they must come to the surface soon if they were wounded—his first wild ducks. But he never saw them again. He returned home, saddened with the thought that he had lost his first real opportunity for game.

Many more skillful hunters than the youngster have failed to bag the pied-billed grebe, which has earned various nicknames. In many places it is called the "dab chick," or, because of its elusiveness, the "water witch." Hunters usually refer to it as the "hell diver," but of all its names, I like best the one applied by the French people of the Louisiana gulf coast, "sac-a-plomb" (sack of lead). How often we have watched these little fellows swimming in shallow, reed-grown ponds, riding buoyantly upon the water like corks, and how quickly and easily they disappear when they become alarmed! One moment they are floating high, and suddenly they begin to sink, body foremost, fading from view, as the "cajuns" say, "like a sack of lead."

The pied-billed grebe is not a game bird. He is one of the divers, a common one over most of North and South America, and yet, in spite of its wide distribution,

EYEING THE BLIND

The pied-billed grebe nests on many inland ponds and lakes, and it is not unusual to find six or seven pairs breeding on ponds of only a few acres in extent

RETURNING TO THE NEST MOUND

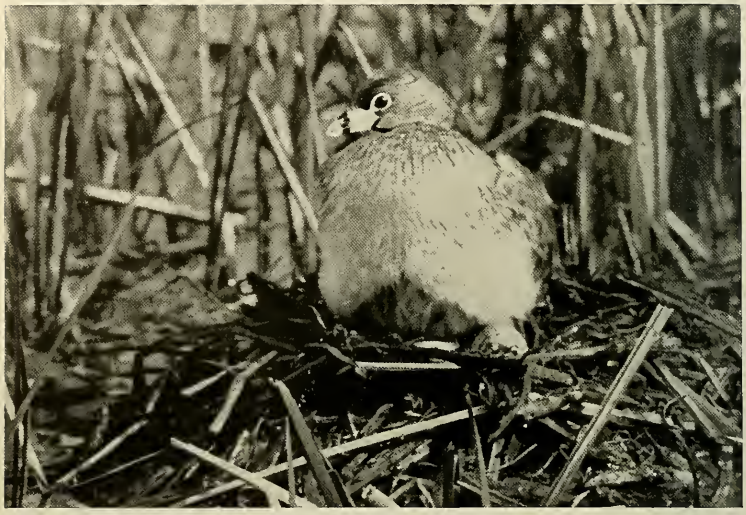
The nest is made of soaked débris which is piled into a mass and anchored to growing vegetation wherever possible

CLEARING AWAY THE COVERING

The parent bird climbed awkwardly upon the nest, and with half-open beak began to push away the nest covering

INTENT UPON HER DUTIES

As she worked, she circled about the nest with her head toward the center. After she had made two rounds, the eggs seemed to be cleared to her satisfaction



BROODING

She obligingly faced the camera, raised herself, and spread her breast feathers so that the eggs would come in contact with the bare skin—and settled

few people are acquainted with its habits or have pried into its family affairs. Many still believe that the eggs are partly incubated by the heat of decaying vegetation, because they are usually found covered with water-soaked vegetable matter—and the adults are rarely seen about the nest.

These little water sprites nest on many inland ponds and lakes, and it is not unusual to find six or seven pairs breeding on ponds of only a few acres in extent. They start building the latter part of April in northern states, the nest being made of soaked débris which is piled into a mass and anchored to growing vegetation, if possible. Often-times, however, the nests are built in open water and are floating, so it would seem that the dull, bluish-white eggs would be very conspicuous in such a site. But such is not the case, because the grebe invariably covers her nest, unless she is too badly frightened.

Because of boyhood memories, I wanted to know something of the habits of these shy little divers. I had found their nests from time to time, when slopping about the marshes, but I had never seen an old bird upon her floating home, nor, for that matter, anywhere in the near vicinity. So last year, when making motion films for the Chicago Academy of Sciences, I built a blind near a conveniently placed nest, and left it for a day. The nest was about seventy feet out from shore, in a stand of growing cat-tails, and as Bob Niedrach and I waded to the blind the following morning, we watched carefully for the adult, but did not get a glimpse of her. The nest appeared as I had left it, with half-rotted vegetation concealing the eight eggs.

After putting the motion camera in place and carefully eliminating bits of grass which interfered with the view, we drew the blind together and watched for a

THE NEST OF THE PIED-BILLED GREBE

The nest was about seventy feet out from shore in a stand of growing cat-tails, and the blind was erected conveniently near to accommodate the photographers

OUTWITTING THE INVADER

The grebe climbed quickly upon the nest and pulled the covers around the youngster, concealing it from view, and then slid into the water

Photograph by Edwin V. Komarek

AN ENERGETIC FAMILY

Only a single egg remained, but several striped little sprites were found hiding in the water under pond grass. When returned to the nest, they kicked lustily and tumbled overboard

grebe to make its appearance. We half feared the nest was abandoned, and yet the débris which covered the nesting mound seemed damp, as though just pulled into position.

A few red-winged blackbirds hurled epithets at our canvas shelter, and querulous voices challenged us from nearby clumps of reeds. We heard a slight ripple of water just in front of us, and saw a slender, brown marsh bird, a Virginia rail, edging between the tules, while a pair of coots swam back and forth in open water to our left.

We stood motionless in knee-deep water until nearly paralyzed. An hour slipped by without a sign of the owner of the mound before us, and we had about given up hope when there was a rasping, throaty call from among a bunch of cat-tails, and then there was a swirl of water and flying spray as the grebe dived—deliberately, it seemed, making a disturbance in the hope of decoying us into view. A few moments later we heard a swirl and splashing behind the blind, but we did not see the bird.

Then all was quiet for another half hour. We were content, for we knew that the grebe was probably eyeing our blind, watching for the slightest movement. Then Bob touched my arm cautiously and motioned to the right. I looked carefully for fully a minute before I saw the light-colored, banded beak, and the rounded, brownish head thrust from a mass of dead growth. Only the head and a portion of the neck were visible, the rest of the body being submerged beneath the marsh growth. No wonder that few naturalists have seen the pied-billed grebe near its nest! We watched silently, and after a few minutes sac-a-plomb sank from view without a ripple. We were so interested in the performance that we were startled to see her come to the surface near the nesting mound; she swam about nervously, and then, as though sure that all was well, she climbed awkwardly upon the nest, paused momentarily to eye our shelter, and, with half open beak, began to push away the nest covering. As she worked, she circled about the nest with head toward the center, and after making two rounds, she seemed to feel

that the eggs were cleaned to her satisfaction. She then obligingly faced the camera, raised herself, and spread her breast feathers so the eggs would come in contact with the bare skin,—and settled down.

Although our blind was within eight feet of the nest, the grebe did not seem to mind the whirring of the motion machine. We made our film record so others could see how the diver returns to her nest and uncovers her eggs, and when all the footage desired had been obtained, Bob splashed in the water. The grebe quickly raised upon her feet, and with a few deft dabs pulled the covering over the nest, and dived from view.

I made many trips in the days that followed, and although there were several nests near by, and I approached cautiously each time, I never saw a grebe except from the blind. I was unable to determine the period of incubation, but Mr. Bent states that it occurs in between twenty-three and twenty-four days.

The last day was a typical one of springtime in central Illinois. The redwings were in full song, a marsh hawk hovered over the stands of cat-tails, and a thunder pumper—the American bittern —called near by. Changes had occurred in our nesting mound, for, as I approached, I saw a slight movement in the decayed covering, and a small, striped head was thrust into view. The camera was quickly put in place and I was scarcely hidden before the water witch rose quietly alongside the nest, with head and neck thrust from a mat of floating grass. She was nervous, however, and disappeared beneath the water only to come to the surface almost immediately. She climbed quickly upon the nest, pulled the covers around the youngster, concealing it from view; after eyeing the results of her work, she glanced at the blind and slid into the water. So far as photographs were concerned, it was her farewell. She circled the blind and scolded, often splashing with her wings in her efforts to lead me from the blind, but she refused to climb upon the nesting mound.

The next day the marsh home was nearly deserted. Only a single egg remained. We searched the near-by reeds and found several striped little sprites hiding in the water under pond grass, but when they were returned to the nest, and were liberated, they kicked lustily and tumbled overboard. We did not see the adult, but I could visualize her as she was watching us from her place of concealment, ready at a moment's warning to disappear "like a sack of lead."

She Circled the Blind and Scolded, Refusing to Climb Upon the Nest

So Far as Photographs were concerned, it was the Bird's Farewell

A Native Home in the Mountain Village of Barirua

MOUNTAIN PEOPLE OF THE SOUTH SEAS

The Home Life of the Natives in the Hill Villages of Bougainville

By BEATRICE BLACKWOOD
Demonstrator in Ethnology, University of Oxford

During the twelve months from September, 1929, to October, 1930, Miss Blackwood was engaged in ethnological work in the islands of Buka and Bougainville, in the Northern Solomons, under the auspices of the Institute of Human Relations of Yale University, Oxford having granted her leave of absence from her Demonstratorship for this purpose.

In November, 1929, the Administrator of these islands, His Honour General Wisdom, visited, on his annual tour of inspection, the island of Petats, off the west coast of Buka, on which Miss Blackwood was then residing. At his invitation, she became his guest on his yacht, the "Franklin," for a voyage down the east coast of Bougainville to Kieta, the only white settlement of any size on the island. There she remained for several days, while the yacht made the round of some distant islands. During this time she was able to see some of the native villages which line the coast, and was especially fortunate in having an opportunity to visit a group of villages in the mountainous country a short distance inland. It is with these mountain people that the present paper is concerned. Mr. R. H. Tutty, of the Seventh Day Adventist Mission, arranged the trip into the mountains for Miss Blackwood.—The Editors.

SEIJAMA, the mission teacher, and his wife Nerisi, natives of the British Solomons, were returning to the mountain villages after a visit to Kieta. They agreed to take me with them, Seijama promising to bring me back to Kieta in time to rejoin the "Franklin" on her return trip from her inspection tour of the islands.

We started the next morning about six o'clock. Seijama, in loin cloth and belt, carried my kit bag containing a few absolute necessities, also a small native basket with some bottles of cough mixture and other oddments dear to the heart of a native. Nerisi carried on her back a native sling basket with sleeping mats and other family belongings. In her arms she had an absurd brown puppy with short hair and a wiry tail, of which she seemed very fond. After the fashion of the mission natives, she wore a cotton dress reaching to her knees. I carried a haversack containing my camera, a supply of

films, the inevitable notebook, and a bundle of sticks of trade tobacco, the passport to a native's goodwill.

Our way led us past the Kieta wireless station—the latest product of modern civilization functioning on the edge of country still unknown and unexplored. It is situated on the top of a hill from which there is a magnificent view. We were fortunate enough to get a really clear morning, somewhat rare in the moist tropical climate of Bougainville. On one side the view embraces Kieta Harbor, and the island which partly closes its entrance, called locally "Pok-pok," which means "crocodile," from its quite striking resemblance to that creature. The other side of the hill overlooks a sweeping curve of beach, Kieta being situated on a promontory joined by a narrow isthmus to the mainland. Behind lay stretch after stretch of forest-covered foothills, and away to the northwest, the larger mountains of central Bougainville, crowned by the volcano, Balbi, more than 10,000 feet in height, with smoke issuing from its crater. To the northeast we caught a glimpse of the coast reef, with great Pacific rollers continually breaking over it, their dull roar audible even at our distance of several miles. The line of surf is broken by two small islets, low against the horizon.

Descending the far side of the hill, we came to the shore. Our path then lay along the beach for a mile or so, following the curve of the bay, and crossing the mouth of one small stream. After a while we turned left along a narrow bush track, and soon came out on the Government road which runs down the coast. This road, a cleared track some ten feet wide, was made while the islands were under the control of the Germans, who had planted coconut trees on each side of it for the benefit of hungry and thirsty travelers. The natives are supposed to keep it cleared, but they carry their obligations lightly, and it is overgrown with grass in many places except for a single-file track. We soon left it, and plunged into the bush. The path was narrow, and quite steep in places, and had

MAUA NATIVES

The woman is using a leaf fan to protect her burden from the rain. These leaf fans are made by sewing together two layers of leaves

the surface been wet, it would have been hard going.

The path continued to climb rapidly, with many twists and turns, till we came out on a ridge and caught a distant glimpse of the sea.

After walking for about three hours we came upon the first signs of habitation. The group of villages for which we were bound is known by the general name of Maua. There are three hamlets, separated from one another by perhaps half a mile or so of bush, though the steepness of the valleys which lie between them makes the distance seem farther than it probably is.

The first village we came to is called Barirua. It is so well hidden in the bush that although it lies on the top of a hill it could not be seen till we were close upon it. Round the village is a palisade of bamboos over which we climbed by means of a stile. We found the place almost deserted; the only person visible at first was a woman sitting nursing a baby on a mat made of plaited coconut-palm leaves. We found that the rest of the population was away attending a funeral ceremony at another village some distance off. A chief had died and they had gone to "cook him," which is Pidgin English for "cremate him," and has no reference to cannibalism! I took a photograph of the woman and her baby; she did not seem at all concerned, but some children who appeared from around the corner ran away, and Seijama said they were crying out that there was a devil-devil in the camera.

We went through the village and on to the top of the ridge, where we got a glimpse of the other two villages on the skyline, but almost hidden by the surrounding forest. After clambering down

A WOMAN AND BABY AT BARIRUA

The first village visited by Miss Blackwood was deserted for the afternoon, save for this mother and her baby, who obligingly posed for their portraits. Note the mat of plaited coconut palm leaves on which the woman is sitting

WOMEN'S FAN DANCE

The large leaf fans are used for many purposes, one of which is the dance wherein the fan is moved very gracefully, while the body sways from side to side

into a valley and up again, we finally reached our destination, Budru the chief village, which is the middle one of the group. It is also the largest, consisting of a dozen or more houses. I was told that there were about seventy people in this village, and about forty in the other two combined. A number of the people from this village had gone to see a sick relative farther inland.

The houses are arranged very roughly in two rows with a space between, the doors facing this "street" for the most part, but some are at odd angles, with no particular orientation, for the steepness of the site made it necessary to take advantage of such ground as could most easily be levelled. At one end of the village there is a high balustrade of poles in front of a raised platform. This is where they lay out the large quantities of food which is distributed at various ceremonies, to be taken away by the participants for consumption at home. Near each house is a small, gabled structure on a pole about three feet high, like a pigeon-house. Some houses have more than one. These are the dwelling-places of spirits. Offerings of taro and coconuts are placed in them, and the spirits are asked to take care of the house and to see that there is plenty of food for the family. I had been warned that these spirit-houses were very sacred, and that the natives might object to my photographing them, but by getting a child to pose in front of one of them I managed to include it in the background without giving offence.

On the steep side of the hill just above the village there is a garden which strikes the eye because of the number of poles up which yam vines are climbing. Yams and taro form the staple diet of these natives, though they grow a certain amount of corn, and make use of several kinds of leaves, including a variety of watercress. There is no lack of bananas, and they can always fill up with coconuts, which provide both food and drink. For meat they have 'possum, which are plentiful in the bush. Pigs are a luxury, and are not killed except on special occasions.

All the people came to look at me. It appeared to be the first time a white

woman had visited the village, though the natives have seen white women on their trips to the coast. They thought I was a man till Seijama enlightened them. They were very friendly, and made no objection to my stopping in the village. They seemed quite pleased to be photographed, after Seijama had explained that it would not do them any harm, and I had let them look in the view-finder.

We sat down on the verandah of Seijama's house, which commands a view of most of the village. Some small boys were immediately despatched to climb a coconut palm and bring down some green nuts for us. There is no better drink after a long, hot tramp than the contents of a green coconut.

The houses are built on piles, often on the edge of quite a steep slope, where the hill-top falls away behind them, so that the back piles have to be considerably longer than the front ones. They are raised about four feet from the ground, and access is by a very rickety ladder of poles, leading to the verandah. The floor is made of small split canes, laid on cross logs, not very closely. The walls are made of the leaf of the sago-palm, threaded through cane supports. The roofs are of the same material, made into a kind of thatch. The leaves, which are long and narrow, are folded over a long piece of cane and fixed by sewing with fiber. They are put on to the framework of the roof like long tiles, overlapping one another a good deal. The slope of the roof must be very steep or it will rot. The top ridge is capped with leaves.

Across the gable of the house of any-one of importance there is frequently to be seen a string of pigs' jaws, showing that the owner of the house has made many feasts. Bundles of dried leaves are also hanging about in various places; these are generally for use in magic of one sort or another. On the verandah there is usually a heavy wooden pestle for pounding taro, and some large baskets, shaped like inverted broad-brimmed hats, for storing it.

The inside of the house consists of one room only, as a rule. Along one side is the fireplace, divided off from the rest of the floor by a long,thin log, and strewn with soil and ashes. On it there may be several native cooking pots of black ware, resting on stones between which burning logs and embers are glowing. These pots are made by the shore people, from whom the hill villages obtain them by barter. Over the fireplace there is usually a rack containing more cooking pots, and sometimes a packet of native tobacco drying. Somewhere on the floor there will be a roll of sleeping mats made of leaves neatly sewn together with fibre.

Stuck into the layers of sago-palm leaves that made the wall, there will be shells for scraping taro and other vegetables, halves of dried coconut shells which serve as dishes, and an implement for scraping the meat out of coconuts, consisting of a sharp-edged shell set on the edge of a long piece of wood, the end of which is flat and serves as a seat for the operator.

Standing in one corner there are always a number of lengths of green bamboo with leaf stoppers; these contain water. Food is also cooked in them, particularly a sort of salad made of leaves obtained from the bush, which is delicious. In one house there was a very large basket hanging from the roof, open end downwards; from its center were suspended a number of forked branches serving as hooks, on which hung bags and baskets of cane or of native string (fiber, twisted on the thigh), containing roots of yams ready for planting. There are also large flat baskets for holding the enormous quantities of food distributed at feasts. These are made by the old men. In the house just described, which was typical of many that I visited, the only articles of Euro-

pean manufacture to be seen were a long bush knife stuck into the wall, and some bottles, containing coconut oil, with which the natives like to anoint their skins.

Most of the villagers, both male and female, wore loin cloths of European cloth, like those worn by the coast people. The old men were content with a piece of string twisted once or twice round their waists, sometimes with a bit of rag depending from it in front, sometimes without. The smaller children, as usual, wore nothing at all.

CHILDREN OF THE MOUNTAIN VILLAGES
Note cicatrices on the chest; also the nose ornaments and earrings

Many people of both sexes have cicatrices on chest, back, and arms. They told me that these had no special significance, but were put on because they looked well. They are made when the child is about six, judging from the size of some on whom the operation had recently been carried out. (No native ever has any idea of ages.) The cuts are made with a sharp shell, lime being then rubbed in to prevent them from healing smoothly. The result is a series of raised keloids. The wounds often become septic and heal badly, with the result that the chests of some of the people were very badly disfigured.

Many of the children wore an ornament made of clam shell, through the nasal septum, and ear-rings consisting of small white shells ground flat. A few had necklaces of small trade beads. The older people wore no ornaments except an arm-band of plaited fiber, colored yellow and black, which they buy from the natives of Buin in the extreme south of the island. In default of pockets, these arm-bands enable them to keep their pipes and other treasures handy.

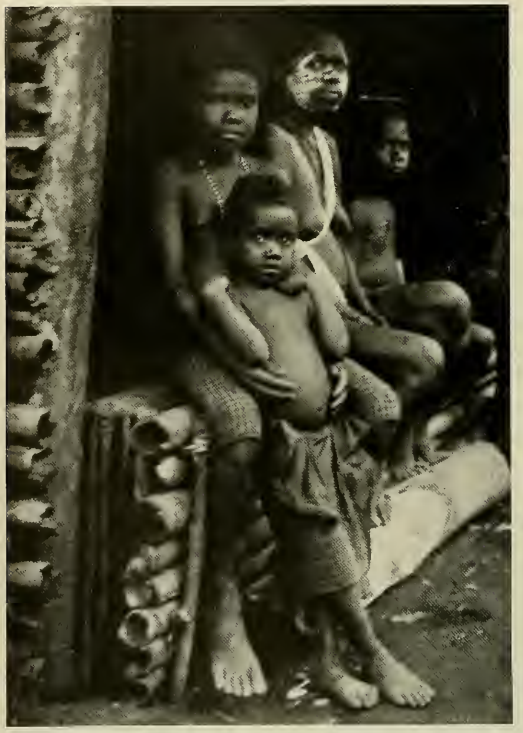
In physical type these natives are typical inhabitants of Bougainville. They are very dark in skin-color, though there are some who show a redder tinge. Their hair is black, and very frizzly; they keep it trimmed fairly short. Their noses are very broad, their lips thick, and they have a considerable degree of prognathism, though this varies a good deal individually. They are of medium height. Occasionally I noticed individuals who seemed almost to approach a pygmy type. They are spare in build and show no tendency to become fat.

Several of the men carried bows and arrows, which I thought they had brought to sell to me, but I found that it was their custom to go about thus armed, and none was offered for sale all the time I was there, though I purchased other specimens of their handiwork, paying for them in sticks of trade tobacco.

With the help of Seijama, I began to try to find out something about their

social structure. Seijama talks excellent Pidgin English, and has a working knowledge of the Maua dialect. Very few of the natives could speak any Pidgin, and that imperfectly, and as their dialect is totally different from the one with which I had some acquaintance, I was entirely dependent on the services of Seijama as interpreter.

There are five clans (*mu*). Their names are Mara-owi (Eagle), Lingumbuto (Spring of Water, *ng* as in *singer*, not as in *finger*), Mō (Coconuts), Toro (Eel) and Kandji (Ground). There are no subdivisions, but the Eagle clan is regarded as the most important. A man may not marry a woman of his own clan, but can marry into any of the others. The children follow the clan of their mother. As a rule, when a man marries he comes to live in his wife's village, but this seems not to be invariable. Some of the men have two wives; I did not hear of anyone who had more. I took down short genealogies from two men, in an attempt to obtain the terms of relationship, but they seemed unable to concentrate their attention for more than a few minutes at a time, and they had not, or affected not to have, the extensive knowledge of their forebears possessed by many natives.



WHITE PAINT FOR MOURNING
In this group is a widow, who has smeared white paint on her face and body as a sign of mourning

Certain families are recognized as being of high rank, the rest being commoners. There is an hereditary chieftainship, a man's heir is his sister's son, his own children belonging to another clan, and taking a position corresponding to the rank of their mother.

The third village in the group, by name Tokei, is situated on the top of another hill, access to it involving a precarious descent into a valley and a slippery climb. The hill-top is rather larger than that occupied by Budru, so the houses are built round an open space like a village square—you could not call it a "village green" because the soil is quite bare. In the middle of this space there is a yam vine climbing

up a bamboo, fenced round with short lengths of bamboo placed very close together. I was informed that the body of a dead man had been burnt on this spot, and the vine had been planted to mark the place as sacred.

The dead are always cremated, in contrast to the customs prevailing farther north. All a man's possessions are burnt with him, and his house is destroyed. After the ceremony the old men go up on to a hill and watch for a light which comes from the funeral pyre and moves over the country until it reaches the hut of the sorcerer who made the poison which caused the death of the person. I was not able to get further details about this, but the fact that a light actually appeared was corroborated by two white people in Kieta, who said that they had seen it. I saw the widow of a chief who had died not long since. Her face and body were thickly smeared with white paint in sign of mourning.

MAKING A SLIT-GONG

The instrument is used by the natives as a means of signaling by long and short beats, and also in their dances. It is made of a large hardwood log, hollowed out inside, the outlet narrowing to a slit along the top

No one ever dies a natural death. All death is caused by someone "making poison." The natives will not throw away anything belonging to them, especially remnants of food, in case it should be used for making poison against them. Everything must be either burned or buried or hidden in the bush. They were horrified when Seijama pitched his household rubbish down the slope behind his house. He says he does not believe in their silly ideas. But if his defiance leads to a general abandoning of the very sanitary custom of carefully disposing of rubbish, it will be another illustration of the adage "A little knowledge is a dangerous thing."

During my visit to the farthest village, there was a heavy tropical downpour, such as frequently occurs without warning in this climate, especially in the afternoon. I was invited to take shelter on the verandah of one of the houses. The ground beneath us was soon converted into a pond, though it drained away very quickly when the rain ceased. Seijama

having remained at home on affairs of his own, I experienced the difficulties of conversation without a common language as medium, and found it hard to check a curious tendency to break into the dialect I knew, which was completely unintelligible to my present hosts, but amused them considerably.

I watched one of the women making a leaf fan, she was sewing together two layers of leaves by the aid of a bit of fibrous thread and a very rusty needle, in spite of which her stitches were remarkably small and neat. The thread is dyed reddish-brown by being soaked in the saliva which is produced when betel-nut is chewed with lime and pepper-leaf. A man sitting nearby was kept busy producing the necessary dye, and projecting it into half a coconut shell, in which lay a handful of fiber. Bright scarlet at first, it soon darkened, and when it had reached the desired shade, a child squeezed out the superfluous moisture and hung the thread up to dry.

The large leaf fans are very characteristic of these people, and are not seen farther north. They are used for a variety of purposes, to fan the embers of a smoldering fire, to keep off flies, to shield the head of a burden carried on the back from rain or sun, and finally, in a women's dance, a short version of which was staged for my benefit, after the rain had ceased. The dancers moved their fans very gracefully, much as our own dancers might use a scarf, with their bodies swaying from side to side and their feet lifted high.

The evening meal, prepared by Nerisi, consisted of taro in great chunks, yams, delicious corn on the cob, fresh beans—these from her own garden, not native to the place—and little yellow bananas, a present to me from one of the villagers. By the time we had eaten it darkness was falling with the rapidity characteristic of these latitudes, but as the moon was full, the landscape was soon flooded with tropical moonlight, trees and houses standing out on the hilltops with fantastic effect. I watched it for awhile, but soon turned in according to native custom. Seijama's house boasts a raised sleeping platform and some woven grass mats, so with the blanket I brought with me—necessary in the mountains even in the tropics—I spent a comfortable night. Nerisi and I shared the sleeping platform while Seijama occupied the verandah.

Next day I returned to the farther village, where the rain had interrupted my explorations the day before. It was very hot, and the village was sleepy. Children, dogs, and pigs ran around rather listlessly. In front of one house a man sat chipping at a piece of wood to make a handle for an adze, whistling rather tunelessly the while. I sat on a verandah and watched a woman preparing tobacco. These natives have their own tobacco plants, which they cultivate very carefully, though they much prefer sticks of trade tobacco when they can get them. It is the women's work to prepare the tobacco. They tie a few fresh leaves in a bunch on to a long strip of fiber, then make a loop farther along the string and tie on a second bunch, and so on until there are about a dozen bunches on the string. This is then hung up in the sun, care being taken to bring it in when rain threatens. It is afterward made into rolls of about the size and shape of a large ear of corn in the husk, tied up with fiber, and put away in the house till wanted.

I was also lucky enough to see one stage in the manufacture of a slit-gong. This instrument is very general among the natives of Bougainville, who use it in their dances, and also for sending messages, by means of a kind of Morse code of long and short beats. It is made of a large log, perhaps six or seven feet long and two or three feet high, which is hollowed out inside, the outlet narrowing to a slit along the top. The one I saw was being hollowed out by means of an iron

pig spear and a knife tied to a stick. The slit at the top was delimited by branches fixed on either side of it. The outside had already been shaped by means of an iron blade hafted like an adze. Hard wood must be used to produce the right sound when the gong is beaten on the outside. The amount of effort involved in making one of these instruments with stone tools must have been enormous. All these natives can now obtain metal knives and axe-heads from planters and traders, but there are still a number of stone implements to be seen in the villages. They are now used only for sharpening knives or for cracking nuts, but the people know that they are the tools of a previous generation, and freely admit that they would not care to work with them.

Transport facilities being few and far between, it was necessary for me to be in Kieta in time to take advantage of the opportunity of returning on the "Franklin" to the region, about a hundred miles to the north, where I was engaged in making an intensive study of the natives. I was therefore unable to spend more than a couple of days among these people, and returned to Kieta in time to reëmbark on the "Franklin."

THE CHILD IS STANDING IN FRONT OF A "SPIRIT HOUSE"

IN THIS ARE PLACED OFFERINGS OF FOOD FOR THE SPIRITS

A MAUA CHILD

The Bear Mountain Trailside Museum

ANIMALS ON THE NATURE TRAIL

The Personalities and Activities of Some of the Animal Pets That Become Guests of the Trailside Museum During the Summer

By WILLIAM H. CARR
Assistant Curator, Department of Education, American Museum

The Bear Mountain Trailside Museum and Nature Trails in the Hudson Highlands at Bear Mountain, New York, are operated for six months each year by the department of education of the American Museum of Natural History. The Trailside Museum is open from May until October, each year.—The Editors.

THE most familiar question asked on the Nature Trails at Bear Mountain is,

"Where do you keep the live animals?"

And the usual answer,

"We don't keep them—they stay with us!"

With very few exceptions, this is the truth, for we have always believed that one real animal pet was worth more than a dozen cage-fighting captives.

Last season, Coco, the raccoon, Cleo and Mark, the two very tame and exceedingly active crows, and Sachet, the equally contented skunk, were guests of the Trailside Museum, but not prisoners. Of course cages were necessary for housing, but happiness and well being on the inmates' part were more of a consideration than restraining steel bars and wire mesh.

We talked along these lines to a trail visitor on a Sunday afternoon, and, most decidedly, she did not agree with us.

"Although I have a canary at home," she said, "I am sure *your* birds and animals would be far more content in the freedom of the woods and fields. You may say they are well cared for there in the cages, but I'm positive that if they were given a choice in the matter, they would vote for a life in the wilds."

She was very emphatic and her voice rose in righteous indignation as she continued,

"I think it's a positive shame! There should be no place in the scheme of nature for the existence of a zoo!"

Jerry, the tame blue jay, was present at this one-sided debate. He looked at the woman out of his keen, saucy, bright eyes. Jerry was a particular favorite of ours and was something of a wit. His head was cocked inquisitively yet he said not a word. After a detailed inspection of his visitor, he turned toward us as though to suggest:

"Well, I guess she's right in some respects, and wrong in others. If you're wise though, you'll agree with her! She's reached the point where further argument is useless!"

The outraged visitor expressed her views at some length and departed. Possibly she was bound homeward to

feed the canary! Regardless of where she went, however, we still keep a few birds and animals, year in and year out, where thousands of visitors may view them.

Jerry, doubtless at first would rather have flown from his nest straight into the world where he first saw the light of day. Nevertheless, he soon had grown to like the new situation, to accept our care and many attentions and to enjoy, immensely, appreciative crowds thronging to do him homage. Furthermore, he was an ambassador from the realm of feathers. His cheerful personality made numerous friends for birds in general, and blue jays especially! His presence was a joy, a delight, and an education. He gave favors impersonally and never worried about what the morrow might have in store. An army of indignant women could never have persuaded us to release him!

As for Sachet, the young wood kitten—the truly captivating skunk—he was an animal show all unto himself, in the cage or out. People were drawn to his enclosure as by a veritable animal magnet. His very name served to excite varying feelings of fascination and repulsion that ultimately resolved into a harmonious appreciation of the skunk as an animal and not as a myth. Combined in his round, furry body were elements of beauty, attributes of fear and doubt, from the public's viewpoint, and also the undeniable quality of winsomeness, all strangely intermingled.

We defy anyone to handle, or even to observe a contented infant skunk, for any length of time, without being impressed with the thought that some of his preconceived ideas were wrong. (We made it possible for some of our visitors to handle Sachet as well as to look at him!) Among the mammals no one is more maligned than the wood pussy. Therefore, like the blue jay, Sachet constantly performed a

LOOKING PRETTY

Coco was always delighted to show off all her tricks whenever an opportunity offered, so when the camera man came around to photograph her, she assumed her most fetching pose

RESTING

Caroline, the little gray fox, was a nervous, high-strung youngster, and would gambol and play only when she thought she was unobserved. Now she lives in the Bear Mountain Zoo with her mate, and is quite unconcerned about her visitors unless they happen to have some tempting morsel to offer her

service to his down-trodden relations.

Obviously there are skunks *and* skunks! Sachet had arisen from the rank and file of skunkdom to the exalted position of royalty. His subjects were the human onlookers and we were his faithful court attendants. He was a gentleman and a good fellow. Although the powerful weapons of defense were never removed, Sachet never used them. Being a kind and considerate monarch, he kept his artillery hidden until there was need for its display. In the rôle of a superlative marksman, he felt no need for target practice!

"Is he really tame?" asked a man who had paused before the skunk cage. "Is it true you can handle him and carry him about without fear of consequence?"

"Yes, we can do many things with Sachet," we replied. "He is a pet in every sense of the word. We have carried him on trains, automobiles, steamships, canoes, and practically every form of conveyance except an airplane. Many times he has spent the night with us in hotel rooms. While we were asleep, Sachet ran about the floor, sniffed beneath windows and explored every object in the room, for our nighttime was his daytime."

We might have added that the skunk's signature was always missing from the hotel register!

We have harbored skunks for many years. The greatest number in our keeping at one time was thirty-seven. This was thirty-five too many. We took steps accordingly and released the excess collection in the woods, some distance from home. All we had to do to obtain skunks was to announce the fact that we wanted a few and immediately skunks came pouring in from all points of the compass. Apparently, they were unwanted elsewhere and their discoverers were only too glad to locate someone who *did* care for them.

Sometimes it became a bit more difficult

to secure animals for our zoo. Witness the case of Caroline, the gray fox.

One day, early in June, we were climbing Grandfather's Mountain in North Carolina. On the way we encountered a mountaineer boy, bare-footed, ragged, and smiling. He had good reason to smile, for he had just captured a very handsome little gray fox—had located the den and carried the conquest through unaided—and he was proud of it! The baby fox's nose was tucked into a crook of the boy's arm, and only the gray back and drooping tail were visible. We paused for awhile to talk and to examine the baby carefully. Soon it became apparent that the fox was for sale even though its captor was a bit reluctant to part with it. After a time, he said,

"Sure, I'll sell her to you. She'll cost five dollars."

At once we were interested and made arrangements with the sturdy youngster to keep the animal for several days until we should return homeward.

"I'll keep her for you!" offered the boy.

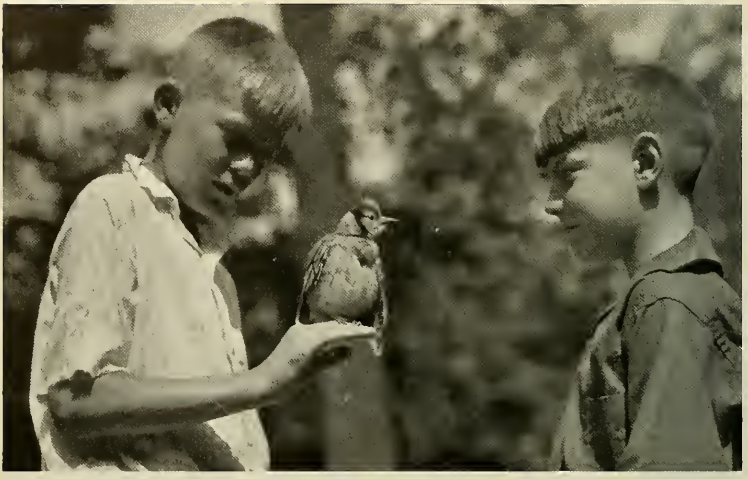
Right there was where we made a mistake. Perhaps the gleam in the boy's eyes should have warned us, but it did not.

Three days later we returned to learn, after considerable evasion, that the fox had been sold to another man for six dollars. But we were bound to have that fox for our Trailside Zoo, so we sought the other purchaser, only to find that he had exchanged the elusive creature with still another man for ten dollars. Finally we ran down the fox and parted with fifteen dollars before she was ours! She had changed hands five times. The moral of this tale is, that one fox in the hand is worth exactly three on Grandfather's Mountain!

Naturally we called our newly acquired

BARN OWLS

These three little barn owls, found in the belfry of St. Peter's Church at Haverstraw, became temporary residents of the Trailside Museum until they were ready to fly. When released, the three sailed out together, circled the near-by woods, and disappeared in the direction of Haverstraw



MAKING NEW FRIENDS
Jerry, the blue jay, was one of the friendliest of all the pets at the Trailside Museum. He always returned inspection with interest

zoo specimen, "Caroline," after her native state. Unlike her cage neighbors, she could not truthfully have been called "tame." Her's was the typical high-strung, nervous, suspicious disposition of her kind. Eventually she trusted us enough to take food from our hands, but the least sudden movement or unexpected sound would send her trembling to the farthest corner of the pen. At last we transferred her to a much larger out-of-door cage, where she had the companionship of a brother fox.

One of the most graceful things to be seen in nature is a fox playing. Often, late in the evening, Caroline would play and play to her heart's content. In order to see her, we would steal to the edge of a near-by building and peer cautiously around the corner, for Caroline, unlike our other animals, was very shy and would not perform for an audience.

In the privacy of gathering darkness, she would leap about, pursue her wonderful bushy tail, and gambol like the woodland spirit that she was. She would jump high in the air, land stiff-legged and leap again, turning in her course as though propelled by steel springs. Every motion was a picture of grace—an exposition of perfect muscular control. It was a rare privilege to observe her, to be permitted so intimate a glimpse of the pure animal revelry and complete abandon that characterized her exhibition.

Coco, the friendly, knowing raccoon, in direct contrast to Caroline, was delighted in the presence of multitudes of onlookers and was never so happy as when performing before a laughing crowd of children or grown-ups. She was the clown of our small managerie. Her especial act was to lie upon her back, overturn her water basin, and balance it on all four feet, looking at the crowd, meanwhile, with a comical air as though to insist, "There now, this is my best trick! Of course it amuses you!"

Oh yes! we have proved to our own satisfaction, times without number, the

value of keeping a few animals in our "zoo!" Our visitors, many of whom had no previous out-of-door background, were overjoyed to have real experiences with our pets. And while they were interested they learned, and when they learned, they became greater friends of wild-life in general. It was not in vain that Coco performed.

Also, she taught us a great deal, as did all the other creatures. When occasion permitted, we would enter her cage and play with her. She would rush about, take our fingers in her mouth, turn over and scramble around, enjoying the experience possibly more than we did. Sometimes, late at night, we would go in to her cage and sit upon the floor while she climbed into our lap to have her head scratched.

We built a small see-saw for her and often, long after dark, we could hear the balanced board striking the floor again and again, as she stood in the middle and shifted her weight from one side to the other. Cleanliness of cage, freshness of water, and quantities of food are essential for captive animals, but *only* essentials. Objects for exercise or for play should also be provided. Coco and her see-saw offered an excellent illustration of this need and its fulfilment.

It was always a treat to watch Coco eat her meals. The time-honored rite for the raccoon clan is to wash their food in water before eating. Coco followed this custom religiously. Even lumps of sugar received the same dousing as did pieces of meat and bits of bread. True to form, the sugar invariably showed a distressing tendency to dissolve and vanish in the confines of the water pan, and then Coco, who dearly liked sugar, would search for it in vain. She was clearly puzzled at this

CLEO'S FAVORITE PASTIME

The crow spent hours playing here, and had a wonderful time getting in and out of the water pan. Many times, when the bird was thoroughly water-soaked, it would fly to the shoulder of a human friend and shake water from its feathers with supreme indifference to the results

WITH HORNS IN THE VELVET
This elk is a permanent resident in the Bear Mountain Zoo, which is operated by the Bear Mountain-Palisades Interstate Park Commissioners the year round

sad state of affairs and explored the basin very thoroughly but all to no avail. The problem of the disappearing sugar worried her many times. As a rule she could eat it successfully only when no water was available or when she sampled a lump before submitting it to the washing process.

Cleo and Mark, the two black, anxious, and highly intelligent crows were our best bird "exhibit!" Our relationships with them were more satisfactory than with any of the others because they knew no cage. The freedom of the grounds was theirs, to come and go when they pleased, and thus to enjoy something of the independence that is the crow's birthright. A water pan was provided near the Trailside Craftshop. Food could be secured at the same place, and in between feeding times, the crows were always observed near by.

They both liked human companionship and, if nothing else offered to occupy their time, they would walk into the Craftshop, perch upon a chair back and watch whatever work was going forward on the carpenter's bench. Often the birds would try their best to converse with the carpenter, making throaty sounds and mumbling away in a grotesque fashion, accompanying their "speech" with expressive gesticulations of the head and wings as though to emphasize various facts.

They both knew perfectly well where we lived and, early in the morning, would strut over to the cabin door and, with voices raised in loud duet, would demand their breakfast in no uncertain terms. The process of feeding the black twins never failed to please crowds of visitors, and often we permitted our guests to take active part in the crows' dining ceremony for it made but slight difference to the birds whence food came, so long as it *did* come!

We have watched the expressions, first

of amazement, then of pleasure, and finally of confidence, that came over the faces of visitors who suddenly encountered either Cleo or Mark upon the trails. Entire families, mother, father and the children, would spend the greater part of an afternoon playing with the birds to their huge entertainment. No one could tell us, after having witnessed affairs of this sort, that the crows, like the blue jay, were not making friends for all of their numerous tribe.

Mark was the more friendly of the two and would show as much enthusiasm for people as they would display toward him. If the play became too rough or if someone teased him, he would simply turn away in disgust and stalk off to his own affairs. If necessary, he could use that long, strong beak of his to good advantage to escape from undesired attention. Indeed, both birds were self reliant and knew when to take themselves away from bad company.

Their favorite resting place was on top of an old stone wall under the shade of a large maple tree. This was their sanctum sanctorum and we usually could find them there during the warm summer afternoons. After a time, however, they investigated the cabin more thoroughly and discovered that the porch railings made a superlativly fine resting spot. So they transferred their quarters there to the annoyance of the "keeper of the cabin." The kitchen window was very close and this fact stimulated the crows greatly. The scent of cooking food, and the sight of it, too, reacted upon their already enormous appetites and they peered through the window screen and took notice of everything that went on. They made vociferous remarks about it, too! They were a splendid, loyal team. Despite the occasional annoyance they caused, their absence would have been mourned by us all.

"PLEASE LET ME HAVE THE CORE?"
Sachet was especially fond of apples, and would stand on his hind legs, despite the fact that he was already stuffed to repletion, to dine on this tit-bit

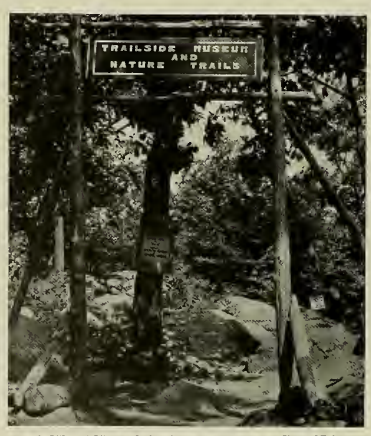
Constant association with gentle, entirely likable animals, that are absolutely dependent upon their human companions for their very existence, is a stimulating and wholesome experience for any boy. It brings forward altruistic instincts of kindness and usefulness.

We, at Bear Mountain, have always been fortunate in having boys take a large share of the responsibility for the welfare of our animal population. Nearly every one of the young men has developed a very honest dependability in his work of feeding, cleaning, and general care of the animals. Many have been the surreptitious tit-bits smuggled from the table at dinner time to find their way to Coco, to Caroline, or to Sachet. The boys have shown a fine, active interest in the creatures, too. One youth, during leisure periods, would spend literally hours sitting beside Caroline's cage, trying to gain the confidence of the nervous, wary little fox—talking to her and showing signs of friendliness and of affection. After a time he was able to enter the cage without having the fox fly into a panic of fear. It was he who coaxed Caroline to feed from his hand.

Yes, the care of animals brings to light the best qualities in human nature—strengthening the arts of observation and patience—and creates in the individual a lasting admiration and respect for beings lower in the scale of life and living than himself. If a boy or a girl can be consistently trusted in the matter of faithful attendance upon animals, he or she may usually be counted upon for many other things as well.

At the conclusion of a long, busy summer, when it becomes our duty to close the doors of the Trailside Museum for the last time until another spring comes to renew our activities, we release many of the animals that are able to fend for themselves, and make arrangements for keeping others. The cages are emptied one by one, until at last no creatures remain. How empty and deserted the trails seem without them!

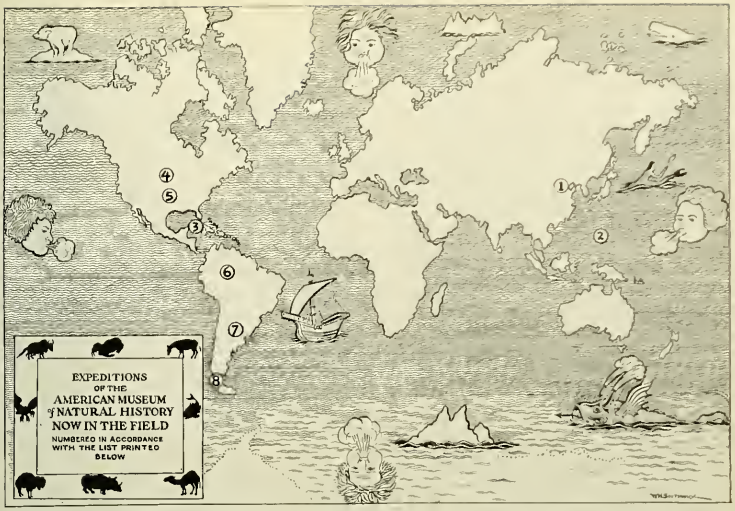
The Bear Mountain Nature Trails without birds and animals? Certainly not! When we return to pay brief visits in winter, how eloquent are the empty cages! They wait silently for old and new tenants and for the crowds. So long as we live and work there, they shall never wait in vain.



Thousands of visitors at Bear Mountain pass through this gate-way each season to enjoy the Trail

ENTRANCE TO THE NATURE TRAILS

Many labels are placed along the Trail to call the visitor's attention to various interesting objects



1. Central Asiatic Expeditions; 2. Whitney, South Sea, Island of Kwasie, for birds; 3. Boekelman Shell Heap Project; 4. Frick-Falkenbach, Wyoming, for fossils; 5. Frick-Rak, Santa Fé, New Mexico, for fossils; 6. Olalla Brothers, Brazil, for birds and mammals; 7. Naumburg-Kaempfer, Southern Brazil for birds; 8. Scarritt, Patagonia, for fossil mammals

AMERICAN MUSEUM EXPEDITIONS AND NOTES

EDITED BY A. KATHERINE BERGER

It is the purpose of this department to keep readers of NATURAL HISTORY *informed as to the latest news of the Museum expeditions in the field at the time the magazine goes to press. In many instances, however, the sources of information are so distant that it is not possible to include up-to-date data*

THE CHAPIN CONGO EXPEDITION.—After a year's absence, Dr. J. P. Chapin returned to the American Museum on May 28. It will be recalled that he visited the Belgian Congo to collect material for a group illustrating the bird life of the equatorial forest along the Congo River, a gift to the Museum by the late Mrs. Dwight Arven Jones. He was accompanied by Mr. Franklin Edson, 3d, who returned last December.

The site chosen for the group was at Lukolela, some 500 miles up the Congo River, about 1° south of the equator. Here he was the guest of Lukolela Plantations, directed by Monsieur V. de Bellefroid and Dr. M. Abrassart, and was also assisted during the latter part of his stay by the Unatra, the company which operates the greater number of the river steamers.

The group will show the virgin forest near the bank of the river with a view out toward the wooded islands as a background. A small collection was made of the birds of the region, but the greater part of the work consisted in the gathering of material with which to reproduce the vegetation: trees, foliage, lianas, and everything that goes to make the wealth of a virgin tropical forest. The work of sketching, photographing, and packing took many months. The directors of the plantation did everything possible to help, so that the days passed most agreeably. There was relatively little time to devote to the remainder of the forest fauna; but active colonies of weaver birds nested in the palms of the station, and a pair of large hornbills had their nest in a forest tree almost within sight of the house, so that the male was watched for a month as he brought food many times a day to his mate and their offspring. Tree-frogs of curious habits bred in the near-by swamps, and the workmen engaged in the planting of cocoa trees brought

hundreds of specimens of small creatures encountered during their work.

A large proportion of the forest trees are characterized by buttressed roots, woody flanges growing out from the base of the trunk. With the help of Monsieur Bourry, the representative of the Unatra, one of these shapely trees was cut down and transported to the company's sawmill. There its trunk was sectioned and packed for safe shipment to the Museum, without injury to the bark.

This portion of the Congo River is the home of a swallow-like bird, *Pseudochelidon*, of great rarity in museums, which was known to nest in the sand bars at low water. None was seen during the period of low water in July and August, but in the following February great numbers returned to many of the bars. This gave an opportunity to study their habits and to secure photographs of the birds, which are supposedly nearly related to the wood-swallows of Malaysia.

In Belgium, both on the way to the Congo and when returning, Doctor Chapin was welcomed most cordially by Dr. H. Schouteden, director of the Congo Museum, who has always assisted so generously in the American Museum's investigations of African fauna. The Belgian Administration of the Congo, as usual, gave every facility needed for the work. The continued progress of this great African colony is admirable, and is reflected in the magnificent collections of its Museum at Tervueren.

NEW LIGHT ON THE SEQUENCE OF MEXICAN CULTURES.—Dr. George C. Vaillant returned to the Museum on June 1, after a successful season in the Valley of Mexico. A site, El Arbolillo, was worked with a view to corroborating the results of the previous excavations at the Early Culture sites of Zacatenco and Ticoman. The sequence established at those sites was confirmed, and additional data on the Early and Middle Zacatenco Periods were obtained, including much information on mortuary customs. A fair collection of skeletal material of great value for the study of the races of Mexico was brought back to the Museum, as well as many specimens of stone and pottery objects. A layer of Early Teotihuacan material was encountered which will serve as a basis for chronological studies at the pyramid site of San Juan Teotihuacan next winter.

NOTES

ASTRONOMY

THE AMATEUR ASTRONOMERS ASSOCIATION held its annual meeting (the last meeting of the current year) on Wednesday, May 20. The following officers were elected for the year 1931–32: Dr. Clyde Fisher, President; Mr. George A. Galliver, 1st Vice-president; Dr. Oswald Schlockow, 2nd Vice-president; Mr. Charles W. Elmer, 3rd Vice-president; Dr. Clement S. Brainin, 4th Vice-president; Mr. Oliver P. Medsger, 5th Vice-president; Mr. Charles J. Liebman, Treasurer; Mr. John A. Kingsbury, Secretary. The other members of the Council will be Mr. Stanbury Hagar, Mr. William Henry, Mr. D. B. Pickering, Dr. R. E. Lee, and Mr. O. H. Caldwell.

CONSERVATION

THE NEARLY EXTINCT BISON OF EUROPE.—At the spring meeting of the Board of Trustees of the New York Zoological Society, President Madison Grant spoke of the desperate situation of the rare and almost extinct European bison. He announced that the Zoological Society had decided to send the director of the Zoological Park, Dr. W. Reid Blair, to Europe during the summer to visit the various private collections of bison in England, Germany and Poland, and to consult with the officers of the International Society for the Preservation of the European Bison in order to ascertain just how the Zoological Society might be of service to the European Society in its commendable efforts to preserve this interesting species.

While the European bison never attained anything like the numbers of its American cousin, they were, however, abundant in western Europe up to the Fifteenth Century. Since that time they have gradually diminished in numbers throughout their former range. In recent years there have been but two principal preserves of the European bison, one in the Caucasus of western Russia, and the other in the Bialowies forest of Lithuania. The Caucasus herd, containing about 700 animals, was said to have been completely exterminated during the World War, the animals having been killed off for food during hostilities, with no thought of the fate of the species.

The European bison, or wisent, miscalled the aurochs, is the nearest living relative of our American bison. It is a forest-dwelling animal feeding largely on ferns, leaves, twigs and bark of trees, and in this respect differs from our American bison which feeds almost wholly on grass.

Up to the present time very little progress has been made in increasing the numbers of pure-blooded bison, priocipally because of the scattered groups which has afforded no opportunity for selected breeding.

The Duke of Bedford, at Woburn Abbey, England, is the owner of the largest herd of European bison. Others are now located in Germany and Poland.

The last report of the International Society for the Preservation of the European Bison shows that today there are but fifty-nine pure-blooded bison in Europe.

DESTRUCTION OF WILD ANIMAL LIFE.—Dr. Jean M. Linsdale, in *The Condor*, XXXIII, pp. 92–106, May, 1931, has contributed a most important and significant article entitled, "Faets Concerning the Use of Thallium in California to Poison Rodents—Its Destructiveness to Game Birds, Song Birds and Other Valuable Wild Life."

In a calm and dispassionate account Doctor Linsdale reviews the history of the element thallium and its known properties as a poison, sets forth the data on its use in California, and county by county records the statistics which indicate the destructiveness of thallium. These statistics reveal an appalling situation and emphasize the single-mindedness of some advocates of mammal control, who are willing to kill off all the wild life of a given region if only they can exterminate a single obnoxious species (in this case the ground-squirrel).

In this same number of *The Condor*, pp. 131–132, Dr. J. Grinnell comments on the Linsdale article, and his pertinent conclusions should be brought to the attention of every conservationist. Doctor Ginnell writes:

Wholesale Poisoning of Wild Animal Life.—It is with a peculiar feeling of despair that we read the statement of findings summarized by Doctor Linsdale in his article published in the present issue of *The Condor*. His findings show that over one-third the area of California is being subjected to repeated applications of a poison, to kill ground squirrels, so insidious and far-reaching in its effects as to threaten the existence within that whole area of important native birds such as mourning doves and valley quail, as well as, secondarily but even more certainly, of carnivorous birds and mammals generally. And this has been going on, under State and Federal authorization or recommendation, despite our frequent solicitious inquiries of those agencies as to the harm suspected, until a stage has been reached when the malignant situation must be made known to the public through private initiative, in the hope that the practices will be discountenanced.

There is a certain administrative type of mind to which the human "use" of all natural resources and the correlated elimination of anything which looks to be detrimental, or even not immediately and clearly of value, loom as the only "practical" aims. Doctor Linsdale refrains from giving much in the way of conclusions in his paper, leaving it for each of his readers to make interpretations suitable to his own understanding. However, we feel so apprehensive on the subject that we yield to the temptation to comment on our own part on some of the more obvious implications.

The total area poisoned in the year ending June 30, 1929, was over 5,000,000 acres (10th Annual Rept., Calif. Dept. Agri., December, 1929 [issued in 1931], p. 792); 558,000 pounds of grain poisoned with thallium were scattered. In one year, 1928, over *two million* pounds of *poisoned* grain were used. The behavior of thallium-poisoned animals is such that few dead animals come to the attention of the human observer, perhaps much less than one per cent. But even so, 116 witnesses report over 5000 dead animals identified and counted on less than one per cent of the total area poisoned. We can figure from this that in the last four years not less than 50 *million* animals *other than* ground squirrels have been killed in California through these operations! As to the money cost of such poison campaigns, $812,178 were spent in California in the year 1930 for rodent control alone.

Now all this destruction of our higher vertebrate animals is done in the interests of but a part of the human population. Indeed, close analysis of the many angles in the problem leads to the query whether this expenditure has not been a total waste economically, —not only that but has involved a positive loss besides!

The pity of it is that these campaigns of destruction are carried on "in cooperation with" the Biological Survey, a governmental organization which we were brought up to believe, upon the best of grounds, was consecrated to the practice and encouragement of real conservation, and nothing else. While much of the work of this Bureau remains truly conservational in character and is thus to be highly commended, there has crept in of late years this insidious tendency toward a "practical" type of "conservation," which means saving profits for those groups of persons whose financial interests can be benefited by "control" that is, extermination) of wild animal life.

It is a curious perversion, surely, when "conservation" is appealed to to justify *destruction*.

In our mind, at the present moment, the wholesale poisoning of wild animal life (birds, carnivorous mammals, rodents) on uncultivated terrain, ought to cease; not only that, but it should be prohibited by law. The first step to be sought is the stoppage of the use of thallium; and what is needed here is to reach those governmental authorities who are willing to heed facts and to act in the interests of people at large, not in the interests only of small potent minorities. Read Doctor Linsdale's report; then if your conscience directs, exert your personal influence toward stopping this destruction of our wild animal life.

CONSERVATION MEDAL AWARDED.—At the spring meeting of the N. Y. Zoological Society, Prof. Henry Fairfield Osborn presented to Mr. Madison Grant, on behalf of the Board of Managers, a six-inch bronze medal in recognition of Mr. Grant's constructive work as a conservationist, as chairman of the Bronx River Parkway, for the fine work he has done in the Redwoods of California, and as president of the N. Y. Zoological Society.

The medal was designed by Mr. John R. Sinnock, of Philadelphia, and cast by the Medallic Art Co. On one side of the medal is a portrait in relief of Mr. Grant, and on the other an appropriate design signifying his various activities.

EDUCATION

SUMMER UNIVERSITY COURSES BY AMERICAN MUSEUM CURATORS.—The University of Chicago has invited Dr. G. Kingsley Noble to give a course in comparative anatomy of vertebrates and also a graduate course in experimental biology during the summer semester. Dr. Clyde Fisher is conducting two courses this summer at Cornell University, namely one on general natural history, the other on visual education.

EXPERIMENTAL BIOLOGY

INVESTIGATION OF SPRING WATER POLLUTION.—William G. Hassler of the department of herpetology and experimental biology of the American Museum has been working for several

months with the Cattaraugus County department of health with a view to determining whether salamanders are responsible in any way for the pollution of spring water.

FOSSIL VERTEBRATES

FOSSIL PROBOSCIDEANS IN THE UNIVERSITY OF NEBRASKA.—One of the largest collections of fossil elephants in existence is located at the University of Nebraska, where it is housed in the State Museum. The Nebraska collection represents the results of forty years of collecting in the fossil fields of the great plains, by parties from the University under the direction of Prof. Erwin H. Barbour. This extended period of collecting has been made possible through the munificence of Mr. Charles H. Morrill, a benefactor of that institution.

A recent letter from Doctor Barbour, director of the State Museum, informs us that he has made a recount of the material on exhibition. To quote from the letter: "There are four hundred and thirty teeth on exhibition with an indefinite number stored. There are one hundred and sixty tusks, counting everything, and there are fifty mandibles of which twenty are four tuskers."

The American Museum has been in close coöperation with the Nebraska Museum for many years. In accordance with this policy of mutual benefit between the two institutions, the Nebraska proboscidean collection is being used extensively in the studies of fossil elephants now being pursued at the American Museum. Last summer the Nebraska collection was thoroughly examined and measured. Since that time many new specimens have been added to the collection, specimens that will be of great aid in the further prosecution of studies into the evolutionary history of the elephants.—E. H. C.

A DINOSAUR FOOTPRINT.—There has just been placed on exhibition in the foyer of the American Museum a slab of rock containing one of the largest footprints of a dinosaur ever discovered. This came from the roof of a coal mine at Sego, Utah, and was obtained through the courtesy and coöperation of Mr. R. M. Magraw, manager of the Chesterfield Coal Company.

The imprint, which shows the three toes distinctly, measures thirty-nine inches in length and nearly three feet across the tips of the outer toes. The animal's stride as measured on a line of tracks on the roof of the mine was nearly thirteen feet, and this probably represents the step as the animal walked about in a leisurely fashion. This dinosaur was undoubtedly one of those with bipedal locomotion, but whether of the carnivorous or herbivorous type cannot be definitely determined.

LOWER PLEISTOCENE AGE OF PEKING MAN—Of great interest is the geologic age of *Sinanthropus pekingensis* from the cave of Chou Kou Tien, thirty-five miles southwest of Peking. Teilhard de Chardin gives us (*L'anthropologie*, 1931), the first clear critical light on this important subject, dating the Peking Man as undoubtedly early Pleistocene—quite as ancient as the Gibraltar Man and much more ancient than the Neanderthal Man. Chou Kou Tien was a true cave, although filled by a succession of deposits and consequently displaying different stratigraphic levels; it is certainly older than the widespread Upper Pleistocene yellow loess of China characterized by the woolly rhinoceros (*R. tichorhinus*), the urus (*Bos primigenius*), the stag (*C. elephus*), the spotted hyena (*H. crocuta*), etc., with occasional Palaeolithic quartzite implements of Mousterian and Aurignacian type.

The Chou Kou Tien fossil deposits positively belong to the early Pleistocene containing the giant rhinoceros (*Rhinoceros cf. sinensis*), the primitive hyena (*H. sinensis*), the saber-toothed hyena (*H. machairodus*), the fossil dog (*Canis sinensis*) and the fossil horse (*E. sanmeniensis*), species which closely correspond with similar forms in the Nihowan deposits, but Chou Kou Tien lacks certain of the distinctively Upper Pliocene fossils found in Nihowan, such as *Hipparion sinense*, Chalicotherid (*Circotherium*), etc. Clearly distinguished from the Upper Pleistocene 'yellow loess,' the formation is a series of sands, clays, and 'reddish' loess which begins at the end of the Pliocene and extends into the Lower Pleistocene.—H. F. O.

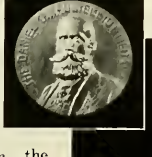
MAMMALS

RECENT ACCESSIONS.—The American Museum has just received an adult, a juvenile, and an embryo chimpanzee from Lukolela, on the south bank of the Congo River. These specimens, collected by Dr. James P. Chapin, are of a race new to the collection, *Pan satyrus paniscus*. Though the colonial residents have for years known of the presence of chimpanzees south of the Congo River, it was not until 1929 that the scientific world became aware of this. Dr. E. Schwarz of Berlin then described the left bank race on the basis of a specimen from south of Befalé, which is to the northeast of Lukolela. Now it is established that the chimpanzee occurs throughout the forest south to the Sankuru River.

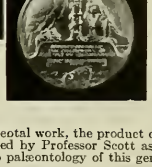
The race *paniscus* is characterized by its small size, black round face, and small ears. It is also

said to make different vocal sounds than the chimpanzees of the right bank.—R. T. H.

MR. RICHARD ARCHBOLD of the department of mammalogy of the American Museum is this summer studying mammals of New Guinea and Celebes in the collections of the Muséum d'Histoire Naturelle of Paris and the Museum für Naturkunde of Berlin, with a view to identifying comparable material which the American Museum now has.



AT THE UPPER LEFT AND LOWER RIGHT ARE PICTURED THE OBVERSE AND REVERSE OF THE ELLIOT MEDAL



HENRY FAIRFIELD OSBORN
THE RECIPIENT OF THE DANIEL GIRAUD ELLIOT MEDAL FOR 1929

HONORS

AWARD OF THE DANIEL GIRAUD ELLIOT MEDAL.—At the Annual Dinner of the National Academy of Sciences held in Washington, April 28, 1931, the Daniel Giraud Elliot gold medal was presented for the year 1929 to Prof. Henry Fairfield Osborn.

The Daniel Giraud Elliot Fund of the National Academy was established in 1917 by the gift of Miss Margaret Henderson Elliot to carry out the provision in the will of her father for the medal award:

> One such medal and diploma shall be given in each year and they, with any unexpended balance of income for the year, shall be awarded by the said National Academy of Sciences to the author of such paper, essay or other work upon some branch of zoology or paleontology published during the year as in the opinion of the persons, or a majority of the persons, hereinafter appointed to be the judges in that regard, shall be the most meritorious and worthy of honor.

Twelve awards of the medal have been made, the first in 1917 to Dr. Frank M. Chapman, curator of the department of birds in the American Museum, for the work entitled "Distribution of Bird Life in Colombia." The subsequent awards are as follows:

1918 William Beebe—"A Monograph of the Pheasants," Volume I.
1919 Robert Ridgway—"Birds of North and Middle America," Part VIII.
1920 Othenio Abel—"Methoden der Palaobiologischen Forschung."
1921 Bashford Dean—"A Bibliography of Fishes," Volume I.
1922 William Morton Wheeler—"Ants of the American Museum Congo Expedition."
1923 Ferdinand Canu—"North American Later Tertiary and Quaternary Bryozoa."
1924 Henri Breuil—"Les Combarelles des Eyzies" (Joint authorship).
1925 Edmund Beecher Wilson—"The Cell in Development and Heredity."
1927 Erik A. Son Stensiö—"The Downtonian and Devonian Vertebrates of Spitzberger."
1928 Ernest Thompson Seton—"Lives of Game Animals."

The medal for 1929 is conferred upon Professor Osborn for his great work, "The Titanotheres of Ancient Wyoming, Dakota and Nebraska," Monograph 55 of the United States Geological Survey. The preparation and publication of this monograph involved the intensest kind of labor on the part of Professor Osborn, his assistants, and the Geological Survey for nearly thirty years. The appearance of the volumes in December, 1929, marked an important milestone in the history of science. Dr. Frank R. Lillie, chairman of the Committee on the Elliot Medal, wrote in his report to the secretary of the National Academy:

> This monumental work, the product of labors of a lifetime, is regarded by Professor Scott as "the outstanding contribution to paleontology of this generation."

DR. G. KINGSLEY NOBLE was recently elected an associate editor of the *Journal of Morphology and Physiology*. The journal was founded in 1887, and was the first national publication of its kind in the United States. Its appearance marked the beginning of American morphological literature. The editor of the Journal is Prof. C. E. McClung of the University of Pennsylvania. The associate editors are elected by the American Society of Zoölogists to serve for a period of years.

HISTORY OF THE EARTH

HOW OLD ARE THE CAPE YORK METEORITES?—This is a question which the astronomers and geologists would be pleased to have answered. While notable advances have been made in

recent years as to the age of various radioactive minerals and some of the meteorites, the age of the huge meteoritic irons from Greenland remains to be determined.

In 1818 when Captain John Ross in the ship "Discovery" explored Baffin's Bay, the Eskimos of Prince Regent's Bay presented to Captain Ross knives of iron with bone handles. The iron was obtained from these meteorites.

In 1894, when Lieut. R. E. Peary visited the region, three large meteoritic masses named "The Tent" or Ahnighito, "The Woman" and "The Dog" were shown to him. They weighed respectively about 36½ tons, 3 tons, and 960 pounds. "The Woman" and "The Dog" were found about thirty-five miles east of Cape York on a narrow isthmus which connects Ironstone Mountain with the ice-covered mainland. Glacial débris was strewn over the glaciated surface of gneissic rock. "The Ahnighito" was found on Savigsiviki Island in Melville Bay six miles south of the Ironstone Peninsula.

Peary removed "The Woman" and "The Dog" in 1895 after much difficulty and exciting work, an incident of which was the breaking of the cake of ice on which "The Woman" was being floated to the ship. For lack of sufficient equipment, Peary had to abandon his 1896 attempt to remove "The Tent." He finally secured it in 1897.

The specimens were eventually delivered to the Brooklyn Navy Yard where they lay for a few years. They were unwieldy objects, and for a time it was proposed that they be sold for scrap iron although they contained about 8 per cent of nickel. Through the generosity of Mrs. Morris K. Jesup the specimens were purchased and presented to the American Museum in 1904. "The Ahnighito" specimen, which resembles a tent in outline, is the largest meteorite in any museum.

In 1913, another specimen, the Savik meteorite, weighing 3½ tons, was found on the tip of the Savik Peninsula. This location is about four miles east of Ironstone Peninsula where "The Woman" and "The Dog" were obtained. In 1925, this specimen was transported from Greenland to Denmark where in 1926, it was placed in the Natural History Museum in Copenhagen.

In recent years Dr. Fritz Paneth of Königsberg University, Germany, has developed an elaborate and very successful technique for studying the age of iron meteorites from highly exact measures of their radium, thorium, and helium contents. He is now developing a technique for treating stony meteorites. He finds that the irons when heated to high temperatures do not lose their helium content. The oldest specimen which he has examined yields a reported age of 2,600,000,000 years. He finds, however, that the Savik specimen contains no helium, hence its age cannot be determined by this method.

Following the receipt of letters from Doctor Paneth, Prof. L. M. Dennis of Cornell University, Dr. George F. Kunz of Tiffany & Company, and Dr. Harlow Shapley of Harvard College Observatory, the officials of the American Museum have approved of the sawing of a 100 gram piece from each of the three Cape York meteorites in New York, and the transmission of these samples to Doctor Paneth for study. In sawing these irons it was found that the Ahnighito was much harder than the other two, a fact the Eskimos had noted more than a century ago. When polished and etched, each sample showed medium octahedrite Widmanstätten figures. The specimens are now on their way to Doctor Paneth. It is hoped that they contain helium and that their age may thus be determined. Should this prove to be true, then Doctor Paneth will be confronted with another problem, the explanation of why the Savik specimen, which has Widmanstätten figures of similar pattern, does not contain helium.—Chester A. Reeds.

MEETINGS OF SOCIETIES

Predatory Mammal Control.—The American Museum was well represented at the meeting of the American Society of Mammalogists, held at the Academy of Natural Sciences in Philadelphia from May 12 to 15. Professor Gregory discussed the origin of the mammalian palate and jaw. Reports of their recent expeditions were recounted by Messrs. Archbold, Goodwin, and Raven. Natural history studies were presented by Messrs. Goodwin, Tate and Hatt, and unnatural history as it is found in native accounts of animal behavior was described by Mr. Carter.

The most discussed item on the program was a report of the Society's special committee on problems of predatory animal control, presented by its chairman, Mr. H. E. Anthony, curator of mammals of the American Museum. This report, which was the summary of the committee's investigations covering a year's study, strongly censured the present widespread poisoning campaign carried out by the United States Biological Survey against predatory mammals. In support of the opinion of naturalists throughout the country, the committee found that the Survey has been poisoning large areas of the West in such a manner as seriously to menace the entire flesh-eating fauna of the region. This destruction,

though aimed primarily at the coyotes, has proved highly unselective, as many other species of mammals and birds highly beneficial to man pick up the baits and die. It has also been shown that this killing off of the coyotes is done largely for the assumed benefit of a small group of stock raisers, without any adequate knowledge of the actual food habits of the species killed nor their economic status. The dollar value of the mammals destroyed by poison may equal or even exceed the sums saved to special interests.

The committee recommended and the Society voted:

That the Society strongly urges the Biological Survey that the use of poison as a control measure against predatory mammals be drastically curtailed, with the view to complete suspension of poisoning as soon as it is reasonably possible.

That the Society deplores the propaganda of the Survey which is designed unduly to blacken the character of certain species of predatory mammals, giving only part of the facts and withholding the rest, and which propaganda is educating the public to advocate destruction of wild life.

That the Society asserts the claim of the great nature-loving public to a voice in the administration of our wild life resources, and challenges the right of a federal organization, such as the Biological Survey, to consider only the interests of a very small minority, the livestock interests.

—R. T. H.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE this year launched the plan of holding annually a summer meeting of really national character. The first of these meetings was held in Pasadena, California, from June 15 to 20 inclusive. The 1932 meeting will be held in New Haven, the 1933 meeting in Chicago, and the 1934 meeting in San Francisco.

Dr. Frank E. Lutz and Mr. Barnum Brown, of the American Museum, attended the Pasadena meeting.

INTERNATIONAL GEOLOGICAL CONGRESS.—The Committee on Organization of the Sixteenth International Geological Congress has voted to postpone the meeting of the Congress for a year, to the latter part of June, 1933. It was felt that the generally adverse economic conditions throughout the world made this postponement desirable.

A circular is now being prepared giving more detailed information. This will be sent to all those who received the first circular and to others interested who request it from the Secretary, Sixteenth International Geological Congress, U. S. Geological Survey, Washington, D. C.

CENTENARY OF THE BRITISH ASSOCIATION.—The British Association for the Advancement of Science will celebrate its centenary during the week September 23 to September 30 of this year. The meeting is to be held in London, for the first time in the history of the Association, under the Presidency of Lt.-General the Right Honorable Jan Christiaan Smuts of South Africa.

Some interesting notes regarding the British Association may be extracted from its preliminary program.

> The initial practical step toward the foundation of the Association was taken by Sir David Brewster, F.R.S., who proposed to John Phillips, the geologist, then secretary of the Yorkshire Philosophical Society, that a meeting should be held in York, as a convenient geographical centre, to establish "a British Association of men of science." The coöperation of the society and of the municipal authorities and influential citizens of York was secured, and the first meeting took place in York on September 26, 1831. . . .
>
> The objects of the Association were then laid down, and have remained: "To give a stronger impulse and a more systematic direction to scientific inquiry; to promote the intercourse of those who cultivate science in different parts of the British Empire with one another and with foreign philosophers; to obtain more general attention for the objects of science and the removal of any disadvantages of a public kind which impede its progress."

Other events of considerable scientific interest are scheduled at approximately the same time as the Association meetings. On September 21 and 22 the centenary of Faraday's discovery of electro-magnetic induction will be celebrated in London by various societies; there is the Clerk Maxwell celebration, and the jubilee of the Natural History Museum immediately follows the Association's week.

The Association itself "is doing what it can to give the occasion an imperial and, indeed, a world-wide significance by inviting representatives from all the places where it has met in the past, both at home and in the dominions, and also a notable list of foreign guests."

The American Museum of Natural History will be officially represented by its president, Professor Henry Fairfield Osborn, an honorary corresponding member of the Association since 1894. Dr. William King Gregory will accompany Professor Osborn as the representative of Columbia University.

SCIENCE OF MAN

WITH great regret the Trustees of the American Museum have accepted the resignation of DR. RONALD L. OLSON as assistant curator of South American archæology, in order that he may accept the important post of associate professor of anthropology in the University of California. Doctor Olson will continue his valuable service to the American Museum as research assistant in Peruvian archæology during such time as he can spare from his duties in the University.

THE AZTEC RUIN NATIONAL MONUMENT was recently enlarged through the gift of an additional small plot of land adjoining the property previously deeded by the American Museum to the United States Government. The Museum has now turned over all its property at Aztec to the Government. As is well known to readers of NATURAL HISTORY, the creation of this National Monument to conserve the famous Pueblo ruins, known as Aztec Ruins lying near the town of Aztec in New Mexico, was initiated by the American Museum and made possible through the generosity of Mr. Archer M. Huntington in providing the necessary funds. From 1916 to 1922, Mr. Earl H. Morris conducted excavations at the Aztec Ruin. It became obvious during the course of this work that the conservation of this and adjacent ruins would be impossible if left in private hands. The Museum therefore, in 1920, with funds donated by Mr. Huntington, purchased the plot of ground on which the Aztec Ruin stands; this was presented to the United States Government and in 1923 was proclaimed a National Monument by President Warren G. Harding. Later, the Museum also purchased adjoining property on which were six additional structures. This was presented in 1928 and promptly added to the Monument area. Thus, with the recent final gift, the Museum has presented to the United States Government nineteen acres of land on which stand seven important Pueblo ruins, one of which has been excavated in part.

The creation of the National Monument has served not only to conserve and care for these remains of the prehistoric inhabitants of the site, but the exhibition of the objects used and made by them, uncovered by the Museum's excavations, has made it possible to reconstruct very vividly for the visitor to the Monument the life of the ancient people.

NEW PUBLICATIONS

Cope: Master Naturalist. By Henry Fairfield Osborn, with the coöperation of Helen Ann Warren. Princeton University Press. 1931.

NOWADAYS it is the fashion for scientists to publish curves and graphs, illustrating, for example, the increase of population in any given country or the growth of the average citizen from infancy to old age. While not a single graph adorns this rather bulky volume, it is none the less an authentic and absorbingly human document, recording the mental development and stirring history of one of the greatest naturalists that America has yet produced.

The hero of this work largely tells his own story by letters that he wrote at first to his father, mother, and sisters, later to his wife, his daughter, and one of his scientific friends, who is also the author of the biography. This material is so well arranged and classified that the reader easily follows the many-sided life story almost from infancy onward.

In 1847, when hewas seven years old, the young naturalist was taken by his kindly Quaker father on a seven-day sea voyage from Philadelphia to Boston. Among other charmingly direct and vivid entries is the following:

"2nd day. Today some whale killers came near. They are large black fish and they blow water out of their heads. Some of them have white spots on their sides. One came alongside of the vessel. The captain ran and got a harpoon to catch one, but it was too late, they had all swam away."

Below this is a spirited drawing of a grampus, half-turned over above the waves, with one flipper pointing upward. We follow young Cope through his experiences at an excellent Quaker boarding-school: "I thank thee," he writes to his father, "very much for the figs, almonds & other good things which thee very kindly gave me. . . . Please give me some Envelopes. Farewell. Please give me some wafers."

There are several explanations of low marks in conduct and apologies for mistakes in his last letters. Also:

"Thee talks about 'miserable goodies'; by goodies I dont mean candy, cakes, pies &c (though I confess they dont appear to do *any* harm), but crackers, figs, walnuts, shelbarks, & the like. If I, who have just eaten 3 big pieces of pie & drunk a porringer of milk, cant bear these, I must be rather a strange boy. On pie night at supper I never stop under 2 pieces of pie & a Westtown piece is about 6 inches long by 4 wide at the top by ¾ inch thick & yet with all that I am as well as could be. . . . That Quarter dollar is not gone by any means, I only began to ask soon as I thought some more might be hard to get. . . . "

This at twelve. But at fourteen, after two seasons' work on a farm, we read this:

"I brought with me the little book of Ruschenberger's on Entomology that thee gave me. There are two other volumes of the series viz. Ornithology & Herpetology & Icthyology which I should like to have very much so that I might know something more about the birds & snakes & fishes that abound here;—that is, if thee thinks right, or if it is convenient or proper. I should think from the looks of the Entomology that they

were quite cheap, but perhaps I am mistaken. At any rate I dont want to ask too much. . . ."

In one of the biographer's brief but illuminating interludes we learn that Alfred Cope, the father of the young naturalist, "did his best to educate him as a practical farmer. Edward dutifully responded to this plan between the years 1856 and 1860, when his father finally yielded to his strong intellectual predisposition for a scientific career and permitted his first studies under Joseph Leidy, the leading anatomist and palæontologist of the time. With great affection, foresight, and liberality, Alfred Cope provided his son with the best literature, the best of contemporary culture, and finally a most influential journey abroad, during which Edward not only seized every opportunity to meet the distinguished anatomists and naturalists of the day but visited all the museums and institutions, which were so far in advance of America at that time, and enriched his mind with the advanced civilization and art of Europe. No formal college or university education could compare with this."

Fortunately for his biographer, during this long transition and highly influential period he was away from the home that he loved and had the gift of writing in great detail and in a most charming and witty style of his observations and experiences. Of this period we may stop long enough to pluck this gem from Cope's letters to his father:

". . . As a member of the zoological society I have become acquainted with many members as Sclater, Wallace, the East Indian and Brazilian traveller Bates, just out in a book on the Amazon, and Salvin just returned from Guatemala. It is however a different thing from an equivalent party of Germans at a *kneipe;* here there is quiet endeavour after the inviolable and unutterable majesty of *the* gentleman, there all is brotherhood and nature. . . . "

Meanwhile Cope was fairly launched on his great career as a naturalist. By the time he was twenty-two years of age he had already published no less than thirty-one papers on the classification of the snakes, lizards, and batrachians. Dr. G. Kingsley Noble, curator of the department of herpetology of the American Museum of Natural History, summarizes Cope's contributions to this subject as follows:

"Herpetology was Cope's first scientific love and remained a field of active research throughout his productive life. His monumental *Batrachia of North America* (1889), and his *The Crocodilians, Lizards and Snakes of North America* (1900) are the standard texts of American herpetology, to which every serious student of American reptiles and amphibians must turn. Cope described many species of reptiles and amphibians new to science, but it was chiefly his major classifications which brought the greatest advance to herpetology. In these phylogenetic studies he displayed a profound knowledge of the anatomy of reptiles and amphibians, and the conclusions which he reached were often revolutionary."

As to his writings on living and extinct fishes, the curator of the department of fishes in the same Museum writes thus:

". . . His labors in ichthyology alone, as recorded in one hundred and twenty-five titles, would suffice to establish the reputation of an ordinarily industrious ichthyologist, and yet we find that collectively they were but a tithe of his writings, as his vast bibliography lists one thousand, three hundred and ninety-five titles! Ichthyology was neither his first nor his chief field, and while, as we have seen, his contributions to the major classification of the fishes were remarkable both for their boldness and originality and for their wide influence, especially in American ichthyology, they were neither so numerous nor so fundamental as his contributions to herpetology and to mammalian palæontology. We realize accordingly that Cope was a veritable titan of the natural sciences."

As to Cope's contributions to mammalogy, the excellent bibliographies prepared under Professor Osborn's direction supply us with the fact that Cope was the author of no less than three hundred and eleven papers and notes on living and fossil mammals between the years 1862 and 1897, besides which were papers on fossil faunas, many of which dealt largely with mammals. Thus he made known to the world an immense number of extinct species of mammals, many of which were of great importance in the story of life in North America. This quantitative aspect of the subject, however, is perhaps purposely not stressed by the author of the biography, who dwells rather on the generalizations regarding the evolution of the mammals that Cope endeavored to establish. Of these the greatest and most enduring were undoubtedly first, the "law of trituberculy," that all later types of molar teeth in mammals have originated in modifications of the tritubercular molars of the mammals of the basal Eocene, and second, the generalization that the hoofed orders of mammals have arisen from the clawed types of Creodonts (primitive flesh-eaters) and Insectivora (primitive insectivorous mammals). These, Professor Osborn regards as "the great generalizations which establish Cope's historical

position in Mammalian Palæontology. These are the mountain peaks, the points where exploration and discovery were followed by happy inspiration, in a chain of contributions which includes his exposition of the faunal succession of the mammals from the base to the summit of the Tertiary, as well as two or three discoveries of great interest in the Cretaceous."

Of great human interest is the story of Cope's struggles to obtain enough money for his fossil-hunting expeditions through extensive field work in search of mineral wealth, and of his financial straits through unfortunate investment in mining properties.

Rather sad reading is the story of the great rivalry and scientific warfare of Professors Marsh and Cope, which proved almost ruinous to Cope's position and damaging to the reputation of Marsh. And sombre is the story of Cope's last illness and untimely demise. At the Quaker funeral in 1897 the spirit finally moved his friend, the author of this biography, to read some excerpts from the book of Job, in which the wonders of nature and their challenge to man's feeble intellect are set forth in language of epic grandeur. "Such were the problems," commented Professor Osborn, "to which our friend devoted his life."

Here then is a biography that is worthy of a master naturalist in a century of great scientists. The patient preparation of this book over a long period of years has been a labor of love on the part of Cope's friend and successor, who defended Cope during his life and developed his great generalizations after his death.—W. K. G.

ANTARCTIC WHALING

Whaling in the Antarctic. By A. G. Bennett. Blackwood, Edinburgh & London, 1931.
"**Southern Whaling.**" By Sidney F. Harmer. Proc. Linn. Soc. London, Session 142, pp. 85–163, London, 1931.

TWO men who are particularly qualified to speak of a subject with such great implications for all lovers of nature have recently published works relating to southern whaling. Although their productions are of quite different scope, one being technical and statistical, the other descriptive and popular, the authors have, nevertheless, a community of sympathy and purpose. They have, in fact, been in close contact with each other, and have mutually submitted their respective findings during the course of many years.

As representative of the British Colonial Office in the Dependencies of the Falkland Islands, Mr. A. G. Bennett, long a correspondent of the American Museum, has had thirteen years' experience in southern whaling. Upon such a basis he has written an extraordinarily vivid and accurate account of the gigantic exploitation that has developed along the edge of the Antarctic ice fields since the beginning of the present century. To date some 200,000 whales have been captured in the waters of the Far South, and a further 20,000 lost after being struck with the bomb harpoon.

Mr. Bennett traces the history of modern whaling-gear since the successful experiments of Svend Foyn, whose original apparatus has undergone modification rather than change. The outfit used today is highly complicated, whether intended for the shore factory or for the pelagic factory; in the latter case everything must be contained within large vessels built or adapted for this work. Three or four hunting steamers provide the prey, and the slaughter goes merrily ahead, the only redeeming feature being that nowadays an honest effort is made to utilize the entire carcass of every whale, down to the last scrap.

Very vivid and informing are the author's notes on the zoology of whales, their migrations, food, and breeding habits. His descriptions of the hard life in Antarctic seas, of the everyday living at shore stations or on pelagic steamers, of the breath-taking details of whale hunting, and of all the small but important exigencies that tend to keep the life interesting for men of the right temperament, are extremely well told.

The author's ideas of the bygone pelagic sperm whaling have obviously been acquired second-hand, for his brief resumé is faulty in several particulars. Moreover, he is not quite correct in stating that no book has dealt with the modern industry, because several excellent accounts in book form have appeared during the last two decades. Nevertheless, Mr. Bennett's work rests upon a broader and deeper authority than any of the others. It gives a correspondingly valuable picture of present conditions and of the prospects. Three of the final chapters, devoted to other creatures of the Antarctic, furnish a useful and highly original compendium on the seals and sea-birds.

Sir Sidney F. Harmer, formerly director of the British Museum (Natural History), returns regularly to the biological and conservational problems involved in modern whaling. In his presidential address before the Linnean Society of London, he now presents an analysis of recent data from the Far South, and comes to the conclusion that events may fairly be described as alarming in that they foreshadow a depletion of the stock of whales within a short period of years.

Sir Sidney, like Mr. Bennett, stresses the enormous commercial projects which have culminated in such floating factories as the "Kosmos," a vessel of over 22,000 tons, with a length of 550 and a beam of 77 feet. Into the bowels of such ships the whales captured by the chasers can be hauled entire, subsequently to be cut up and rendered in high pressure steam boilers. The "Kosmos" has a capacity of 135,000 barrels, or 22,500 tons of oil. Her catch during the season of 1929–30 represented about 1400 whales, the operations of two average days exceeding the entire season's production of the first type of whaling factory that worked in the Antarctic.

Norwegian whaling preponderates increasingly over that of the rest of the world, and now comprises more than two-thirds of the total. Antarctic whaling accounts for nearly 87 per cent of the products, and the destruction of whales has been extended so rapidly, since floating factories began to supersede shore stations, that the whalemen themselves are at length becoming concerned. Hitherto such anxiety has been confined mainly to those who regard the future of the great whales as a question of biological and ethical importance.

By a detailed study of statistics available from all sources, and the reduction of many of them to graphic form, Sir Sidney has presented a wealth of information concerning the life history and migrations of whales. His data reveal, for instance, the periodic movements of most of the important species. The times of these respective migrations do not coincide, but rather follow one another in orderly sequence. These differences are shown to be largely due to ecological distinctions caused by the annual cycle of the melting of south polar ice and the subsequent increase of special food supplies, or even to causes more directly dependent upon temperature. As an example of the latter, it is stated that the newly born young of blue whales and fin whales have extremely thin blubber, which may account for the fact that these ice-loving species retire to warmer seas for the birth of their offspring. In contrast with this condition, the young of the bowhead, the narwhal, and the white whale, all of which breed in cold water of North Polar oceans, are born with exceptionally thick blubber. It is probable that adult whales in good condition are not directly affected by water temperature, whether warm or cold, and that they select their respective ranges rather because of the nature of the food to which they are best adapted. At any rate, a table of distribution shows that a few of the warmth-loving sperm whales each year enter the icy waters of both West Antarctica and Ross Sea. In the former locality 29 sperm whales were killed during the season of 1928–29 as against 9,179 blue whales, 3,502 fin whales, 411 sei whales and 16 humpbacks.

The data show, furthermore, a constantly decreasing number of blue whales of more than 90 feet in length and, indeed, of large-sized whales of any species. The blue whale must reach a length of 75 or more feet before becoming sexually mature, and the steady decrease in the average size of whales constitutes one of the most serious forebodings not only of the end of the industry, but also of a perilous reduction in the breeding stock of the mightiest of all creatures.—R. C. M.

AMONG the many and varied questions which we are asked concerning the study of insects are those relating to books and magazines for people who are just entering this interesting and important field.

Of magazines there is, unfortunately, none. The entomological periodicals published by "amateur" societies are really professional in character, because the distinction between an advanced amateur entomologist and a professional one is largely a matter of source of income. Many an amateur is more proficient than the average professional and the beginner has no magazine devoted to the rudiments of his hobby.

The situation as to books is not quite so bad, and the purpose of this note is to call attention to several rather recent ones, without, however, attempting to exhaust the field.

Scribners have just issued a revised edition of Mrs. Robertson-Miller's *Butterfly and Moth Book*. This, first published about twenty years ago, records the failures as well as the successes of a "butterfly lady" in rearing her pets from egg to adult. In this connection we should mention another somewhat similar book that has for years been a standard with amateurs who are interested in the life-histories of moths. It is *Caterpillars and Their Moths* by Ida M. Eliot and Caroline G. Soule, published by the Century Company.

One of the recent additions to the Putnam Field Book series is Miss Ann H. Morgan's *Field Book of Ponds and Streams: An Introduction to the Life of Fresh Water*. It touches on all the aquatic groups from plants and protozoa to frogs but, of course, this range includes insects and some of the most interesting insects are aquatic.

About six years ago an Englishman, Dr. A. D. Imms, published a wonderfully good *General Textbook of Entomology including the Anatomy, Physiology, Development and Classification of Insects*. Parts of this book are as technical as its title suggests, but there is much in it for the beginner, and it gives a world-wide survey of the

subject. Although the first edition is still young, a revised edition giving several pages of "Addenda" was published in 1930, and this year Blakiston's Son and Co. have published *Recent Advances in Entomology* by the same author. This contains a great deal of very interesting material, together with copious references to the scattered literature. It is a "reading book" for mature minds that have had at least some training in science.

Finally, for the present, are two histories of entomology. One is *Thomas Say, Early American Naturalist* by Harry B. Weiss and Grace M. Ziegler, published by Chas. C. Thomas; the other is *A History of Applied Entomology (somewhat Anecdotal)* by Dr. L. O. Howard, published by the Smithsonian Institution.

On glacing over this short list of relatively recent books one feels guilty because of the omissions. "Of the making of books there is no end," and, when attempting to gather together the scattered literature on some subject, one is tempted to feel the same way about periodicals. However, there really should be some magazine devoted to the interests of real beginners.

—F. E. Lutz.

THE second volume of the Final Reports of the Central Asiatic Expedition "The Permian of Mongolia" by Dr. A. W. Grabau was issued early in the year, and complimentary copies have been forwarded to the Geological Survey of China and to Dr. W. H. Wong, director of the Survey. Various authors are working on other volumes of this series, and Doctor Andrews, who is now in Peking, writes that he is preparing, for the Narrative Volume, the story of the 1930 exploration, which proves to have been one of the most profitable of the Expedition's five trips into the Gobi.

ERRATUM

AN error in transmission of the original cable message from Mr. James L. Clark of the O'Donnell–Clark African Expedition caused NATURAL HISTORY MAGAZINE to state in the May–June number that the Expedition had secured five bull and five cow elands for the American Museum group. The message should have read, "a fine thirty-five inch bull and fine cow secured." The Expedition altogether secured only two specimens of this species.

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total membership 12,089.

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From these adventuring scientists and from observers and scientists connected with other institutions, NATURAL HISTORY MAGAZINE obtains the articles that it publishes. Thus it is able to present to the members of the American Museum the most fascinating, the most important, and the most dramatic of the facts that are being added to the sum total of human knowledge.

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For the enlargement of its collections, for the support of its exploration and scientific research, and for the maintenance of its many publications, the American Museum is dependent wholly upon members' fees and the generosity of its friends. More than 12,000 members are now enrolled and are thus supporting the work of the Museum. There are ten different classes of members, which are as follows:

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In addition to these lectures, illustrated stories for the children of members are presented on alternate Saturday mornings in the autumn and in the spring.

MEMBERS' CLUB ROOM AND GUIDE SERVICE

A handsome room on the third floor of the Museum, equipped with every convenience for rest, reading, and correspondence, is set apart during Museum hours for the exclusive use of members when visiting the Museum. Members are also privileged to avail themselves of the services of an instructor for guidance.

SCIENCE
EDUCATION

RESEARCH
EXPLORATION

SIXTIETH ANNIVERSARY ENDOWMENT FUND. Already, $2,500,000 has been contributed to this $10,000,000 fund, opened in January, 1929, to commemorate the Sixtieth Anniversary of the Founding of the American Museum of Natural History and to further the growth of its world-wide activities in Exploration, Research, Preparation, Exhibition, Publication, and Education. Committees are now engaged in seeking the $7,500,000 which remains to be contributed. It is greatly to be desired that this fund, so vital to the scientific and educational progress of the Museum, shall reach completion at an early date.

EXPEDITIONS from the American Museum are constantly in the field, gathering information in many odd corners of the world. During 1930, thirty-four expeditions visited scores of different parts of North, South, and Central America, of Europe, Asia, Africa, and Polynesia. New expeditions are constantly going into the field as others are returning with their work completed, or in order to digest material gathered preparatory to beginning new studies.

SCIENTIFIC PUBLICATIONS of the Museum, based on its explorations and the study of its collections, include the *Memoirs*, devoted to monographs requiring large or fine illustrations and exhaustive treatment; the *Bulletin*, issued in octavo form since 1881, dealing with the scientific activities of the departments except for the department of anthropology; the *Anthropological Papers*, which record the work of the department of anthropology; and *Novitates*, which are devoted to the publication of preliminary scientific announcements, descriptions of new forms, and similar matter.

POPULAR PUBLICATIONS, as well as scientific ones, come from the American Museum Press, which is housed within the Museum itself. In addition to NATURAL HISTORY MAGAZINE, the journal of the American Museum, the popular publications include many hand books, which deal with subjects illustrated by the collections, and guide leaflets which describe individual exhibits or series of exhibits that are of especial interest or importance. These are all available at purely nominal cost to anyone who cares for them.

THE LIBRARY of the American Museum is available for those interested in scientific research or study on natural history subjects. It contains 115,000 volumes, and for the accommodation of those who wish to use this storehouse of knowledge, a well-equipped and well-manned reading room is provided. The LIBRARY may be called upon for detailed lists of both popular and scientific publications with their prices.

COLLEGE AND UNIVERSITY SERVICE. The President of the Museum and the Curator of Public Education are constantly extending and intensifying the courses of college and university instruction. Among some of the institutions with which the Museum is cooperating are Columbia University, New York University, College of the City of New York, Hunter College, University of Vermont, Lafayette College, Yale University, and Rutgers College.

PUBLIC AND NORMAL SCHOOL SERVICE. The increased facilities offered by this department of the Museum make it possible to augument greatly the Museum's work, not only in New York City public schools, but also throughout the United States. More than 22,500,000 contacts were made with boys and girls in the schools of Greater New York alone, and educational institutions in more than thirty states took advantage of the Museum's free film service during 1930. Inquiries from all over the United States, and even from many foreign countries are constantly coming to the school service department. Thousands of lantern slides are prepared at cost for distant educational institutions, and the American Museum, because of this and other phases of its work, can more and more be considered not a local but a national—even an international—institution.

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Entered as second-class matter April 3, 1919, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

BLAZING THE TRAIL

RARELY has NATURAL HISTORY MAGAZINE been so fortunate as it is in preparing the illustrations for the September–October number, in which a score or more of original paintings of East Indians will be reproduced. A result of eighteen months of intensive work on the part of Mr. Hubert Stowitts in painting the disappearing native types of India, these works of art, which recently were on display at the American Museum, form an important and a beautiful record of the life of the East.

ANOTHER, and a very different, account of the East, has been prepared for the next number by Dr. I. Wyman Drummond in collaboration with Mr. Herbert P. Whitlock. In no place in the world is the art of the lapidary more remarkably developed than in China and Japan. Carved jade, carved crystal, and many other carved semi-precious stones, besides, of course, carved ivory and carved amber, form some of the most beautiful of the artistic work of the East, and it is of these, and of the patient artists who carve them, that Doctor Drummond and Mr. Whitlock have written. The illustrations are from the extraordinary collection that Doctor Drummond, during a long period of years, has brought together.

READERS of NATURAL HISTORY MAGAZINE will recall several articles that have been written by Mr. R. T. Hatt, of the American Museum's department of mammalogy. The last of these was called "Collector's Days and Nights in Yucatan," and an earlier article that attracted more than a little delighted comment was "The Odyssey of a Ground Squirrel." Now Mr. Hatt has written an article on how various animals prepare for winter. It may be that we are slightly premature in planning to publish such an article in the September–October number, but certainly our more northern readers will have felt a little of the crispness of coming winter before October has passed, and their interest in the subject may thereby be enhanced.

IN view of the plans that are being made for the Pacaraima-Venezuela Expedition, as announced in the last number of NATURAL HISTORY, it is fitting that we should be able to publish an article on another expedition that has already taken one of the leaders of the coming expedition into Venezuela. Mr. G. H. H. Tate, who is to be Assistant Leader and Mammalogist of the coming expedition, has written an article on his expedition to Mt. Turumiquire, in Venezuela. This will appear in the following number.

THE COVER OF THIS ISSUE

'A HOWLER Monkey of Panama," the subject of the cover for this issue of NATURAL HISTORY, was painted by Francis L. Jaques, of the American Museum staff of artists.

By virtue not alone of his voice, but by his character as well, the howling monkey is the dominant personality of a tropical American forest. His appalling vociferations bespeak so fierce a nature that were he terrestrial one would not venture to enter his haunts unarmed. Doubtless his bite does not match his reverberating, roaring bark, but so rarely does he leave his home in the highest trees and so soon does he die in captivity, that few naturalists have been permitted to look an adult bowling monkey in the face. The artist, therefore, who would paint his portrait must draw freely on his imagination. Form and pose he can get accurately, but the black, saturnine countenance of this largest of American monkeys is still unfamiliar to us.

AFTER an eleven months sojourn on the Congo River, Dr. James P. Chapin has recently returned to the American Museum, and the September–October number will present the first of two articles on his work there. Almost single-handed, owing to an injury suffered by his associate, Franklin Edson, 3d, Doctor Chapin gathered an enormous collection of material for a new bird group ultimately to be set up in the Museum.

IT is not invariably possible to do all that we plan, and because we made an announcement before an article that was scheduled had actually materialized, it is now necessary for us to apologize for its non-appearance. Captain J. F. Hellweg, superintendent of the United States Naval Observatory, was prevented, by a rush of official work, from completing the article on the Observatory that was announced as coming in this number. We are glad to state that it will make its appearance in the next issue.

THE very fine work the Mexican government is doing to conserve the wonders of its historic past will be described by Dr. George C. Vaillant in the September–October issue. He will also describe the New Middle American architectural models recently acquired by the American Museum.

TEN years after his passing, John Burroughs still lives in the hearts of his friends and admirers. In the next issue, Dr. Clyde Fisher will recount some of his delightful associations with Burroughs, the beloved naturalist of "Slabsides."

AFTER many months sojourn among the natives of Melanesia, Dr. Margaret Mead brought back with her a history of these people, their manner of living, their customs, and occupations. These will be depicted in a miniature group at the American Museum, and in the next issue, Miss Dorothy Edwards of the editorial staff of NATURAL HISTORY will tell the story of this Museum model.

NATURAL HISTORY

Vol. XXXI, No. 5 1931 Sept.-Oct.

A HINDU GYPSY OF THE NATH TRIBE

JOURNAL OF THE AMERICAN MUSEUM OF NATURAL HISTORY

NEW YORK, N. Y.

Fifty Cents a Copy

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NUMBER 5

NATURAL HISTORY

SEPT.-OCT.
1931

The Journal of The American Museum of Natural History

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Published bimonthly by The American Museum of Natural History, New York, N. Y. Subscription price $3 a year.

Subscriptions should be addressed to James H. Perkins, Treasurer, American Museum of Natural History, 77th St. and Central Park West, New York, N. Y.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

A RAMPUR HOLY MAN

He is very much respected by the people of the whole country-side, who flock to tell their troubles to him and profit by his advice and wisdom

See "Vanishing India," Page 459

VOLUME XXXI

NATURAL HISTORY

NUMBER FIVE

SEPTEMBER–OCTOBER, 1931

VANISHING INDIA

The True India Which Has Escaped Occidental Influence Is Depicted by Hubert Stowitts in a Series of Ethnographic Paintings Executed in Fresco Secco, from Life

NOW and then an individual appears who has the wit to see. The fact is widely accepted, but is seldom stated, and we are prone to think of seers as men of the distant past, almost lost in the mists of time. Yet the paintings that make up this series of illustrations of the India that is passing are the work of such a man.

For a generation or more, hardly a visitor has returned from British India who has not at least commented on the fact that "Europeanization" is going on apace in that ancient land. Yet until now no one has thought to make a pictorial record of that which seems, today, to be so rapidly fading into the past. Why this should be so it is difficult to say, except, of course, that often the most obvious is the least seen.

It is interesting that Hubert Stowitts should have seen the importance of the task where others have failed to do so. It is another of those demonstrations of individuality, perhaps,—the individuality of thought and purpose and action that makes the world so much more interesting than it would otherwise be.

Born in Nebraska, which seems to be almost as distant from India as any corner of the globe—a student of economics at the University of California, which suggests few connections with the uneconomic East—for a time Pavlowa's premier dancing partner, appearing in the great and very modern cities of South America, which again suggests no interest in the almost voiceless millions of the heated Indian plains and jungles, Mr. Stowitts still somehow saw the need for what he has so ably done.

Beginning his work in Java, he has felt impelled to carry it on in other portions of the East. The pictures reproduced here have been chosen from among the scores he put on canvas during eighteen months in India in 1929 and 1930. And as this article appears, the artist is once more on his way to those lands that lie "east of Suez," this time to continue his chosen work on the almost idyllic island of Bali.

For ten days during April of this year, Education Hall, at the American Museum, was hung with well over a hundred of these paintings, and it is from this considerable collection that the accompanying reproductions were chosen. It is unfortunate that these gorgeous representations of the East cannot be reproduced in their original colors, and that the limitations of space have precluded the use of

(Continued on Page 473)

TURBAN WEAVER

The weaving industry is slowly dying out as its place has been taken by the enormous industrial mills. When cloth is wound for the turbans, a special width is used, according to the fashion in which the turban is to be tied

COTTON SPINNER

This is the wheel which Gandhi has taken as the symbol of nationalism in India, and through which he wishes to restore India to its former condition as the wearer of homespun exclusively

COTTON CLEANER

The cotton industry in India is older than the time of Herodotus. When early Europeans were still wearing animal skins, the Indians had long been weaving fine cotton cloth. To remove the seed from the boll, the boll is put through a wringer

COTTON FLUFFER

By means of an archer's bow, from the string of which hangs a sort of harp, a double vibration is caused through which the cotton is picked up and thrown through the air to fluff out

COBBLER'S FAMILY

Three generations making the embroidered shoes of Jaipur Rajputana. These shoes are famous all over the Orient for beautiful workmanship in embroidered silks and gold thread. Note how the shoe is held with the feet while the sewing is done with the hands

BRASS AND LAC WORKERS

In northern India one sees in the market places beautifully decorated pots which look like enamel. It is, however, really sealing wax pressed into the designs which have been engraved in the brass. The inside of the vessel is heated just at the point where the color is to be applied on the outside

SHUKAWATA
WOOD CARVER

The finest wood carvers in India are at a distant village far in the interior of the great Indian desert, where there is not even one tree, and all the wood must be imported. This is because the patrons of the wood carvers are rich bankers and money lenders who have stationed themselves in the interior of the desert where they are immune from attacks of robbers

LAC TURNER

Table legs and round boxes and trays are decorated by revolving them rapidly and pressing against the part to be decorated a stick of colored lac or sealing wax. The heat of the friction melts the wax and attaches it to the wood in layers

HIS HIGHNESS THE MAHARANA OF UDAIPUR

His Highness is of the oldest family known on earth, with an ancestry traced back to 140 generations beyond Agamemnon. Maharana is a title higher than Maharajah. The Maharana of Udaipur is descended from Rama, whose life and adventures are the theme of the great Indian epic, the Ramayana

SWEEPERS
(UNTOUCHABLES)

This caste, or rather these outcasts, are the Dravidians of lower orders which were found in India when the first Aryans came, and which the lawgiver Manu forbade his Aryan followers to marry. They have recently had a number of prophets, who have gradually raised their standard of living and their opportunities for education, and in the south one finds them taking responsible places in the government

PARSI PRIEST, FRANJI NARINAN OF BARODA

The Parsees came to India from Persia when the persecuted followers of Zoroaster were driven out of that country by the Mohammedans. They settled in Bombay and have become the richest merchant class there. At a wedding the Parsi priest holds a flower

NAGA
MILITARY ASCETIC

The Nagas were a sect founded 300 or more years ago by a brother of the Maharajahs of Jodhpur who came to Amber and lived in a grotto beside the palace. The cadets of the noble families were sent to him to study, and he established his great military priesthood in which the boys were taught the arts of war. The twenty teachers still alive are the consummate type of the finest characteristics of Rajputana chivalry

PRAYER

At the abandoned Ali Mosque at Rampur. Old religions, old customs, old tools, old techniques, all the picturesque heritage of the past which is fast disappearing from India, are the themes of the paintings from life made in India's remote regions by Mr. Stowitts, as a permanent contribution to science

POTTERY PAINTER

The beautiful Delhi blue, famous the world over, before it goes into the oven is painted in designs on the pottery. Its color is black. It is the firing which brings out the blue and green colors

RAMPUR STATE ELEPHANT

In all its gorgeous trappings, with real jewels and plates decorated with emeralds, rubies, and diamonds, and carrying a howdah of gold and silver, this royal animal is rarely seen except on state occasions, as it has been given up as a mode of conveyance and has been replaced by the motor car

WOMAN GRINDING FLOUR

In India flour is not bought in the bazaar but is ground each day at home before the unleavened bread is made. To a Westerner's eyes the bread looks like pancakes and it is cooked in the same fashion

BALUCHISTAN MOSLEM
FAKIR

Almost all the people in Baluchistan are of the same type and wear the same type of clothing. Their hair is long and uncut, but very well groomed, and their clothing usually is white and immaculate

MUNA DAS NO. II
BANDARI, NAWAI

Each one of Mr. Stowitts' one hundred and fifty paintings shows a different aspect of the life of the India that is vanishing. There are portraits of types ranging from the noble Rajput princes to the lowest pariah sweepers of the streets; from the Hindu Brahman to the muezzin Mussulman; from the Pathan and the Sikh in the northwest to the aboriginal from the forests of Travancore

MOHAMED KHAN IN CHAIN MAIL

At the great feasts 500 chain mail horsemen manoeuvre in a glittering array. They are usually all Mohammedans, even though they are at a Hindu court, leading one to believe that chain mail was brought into India from Persia

CAPTAIN ABDUL KADIR KHAN

A. D. C. Rampur of the Rohilla Pathans, the great warriors who swept over northern Asia and India in the Seventeenth Century. Mr. Stowitts was fortunate in obtaining the interest and coöperation of the native princes of India and their entourage, who posed for him, after which he found it possible to persuade the native Indian craftsmen to allow him to paint their portraits also

KANIYAN ASTROLOGER MUSICIANS

When Marco Polo visited the Malabar coast, he said that it was preëminently a land of astrologers and it is still so today. The most insignificant event of life is decided by astrologers

PRECIOUS STONE CUTTER

By means of the emery wheel, precious stones are cut either cabochon or in facets. The stone is attached to the end of a stick with sealing wax, and the stick is held steady by resting the arm on the knee while the emery wheel is turned

METZAKALI
STREET DRAMA

This is a popular street form of the famous Kathakali, the Malabar national drama, although there are only two companies left, those of the Maharajah of Cochin and of the Maharajah of Travancore

LAC ETCHING

By the process of friction, one layer of colored lac after another is put on a round box, or table leg, then the etcher scratches a design through the lacquer to the depth of the color which he wishes to bring out. It is practically a lost art

KANIKAR ABORIGINALS

The Kanikars were the original inhabitants of India, long before even the Dravidians or Aryan invasions. There are only a few families remaining. Her Highness, the Maharani of Travancore sent the Conservator of Forests into the fastnesses of the hills to bring back this family to be painted

THE RAMPUR BARDS

These bards stand on the steps of the palace when the Maharajah goes out or returns, and chant in verse the exploits of the Maharajah's ancestors. The leaves decorating the turbans are from a sacred tree which brings good luck

the others of the group, for on these canvases Mr. Stowitts has recorded British India.

It is, however, British India without the British that has been portrayed, and among the paintings are many that might serve as well to illustrate immemorial India.

Among this valuable collection one finds portraits of noble Rajput princes and paintings of outcast sweepers of the streets. Brahman, Mussulman, Pathan and Sikh are pictured, along with aboriginals from the forests of Travancore. Furthermore, Mr. Stowitts has portrayed potters and founders, ivory and wood carvers, cotton carders and weavers, dancers and warriors, and others still. Nor have his problems been only those of the painter, for it was only after six months of work that he was able to begin his first painting. It was only by beginning with maharajahs and princes educated in Europe that he was able to overcome the innate objection of the native Indian to having his likeness set down—fearing, as his kind has feared for centuries, that in making such a likeness the artist was, by some strange black magic, obtaining an undesirable or even a dangerous control over the very spirit of the portrayed person.

It is Mr. Stowitts' expressed desire that his paintings be viewed for their ethnographic rather than their artistic value, and it is as an ethnographic record that they are being made, but in the words of Mr. Alfred Foucher, of the Institute of France, "he cannot prevent us from having eyes that see, and what we see is that these paintings are not only documents—as one says in the modern jargon—but also that he has done that which those who offered themselves or resigned themselves to pose for him feared he would do. He has brought away with him a good part of their very souls."

—H. D.

THESE ARE ALWAYS OF THE SECT OF GYPSIES AND ALMOST ALWAYS HINDUS

THEY USUALLY WEAR TURBANS AND CLOTHING OF AN ORANGE COLOR

A Snake Charmer

Old Man River in Africa, with a steamer of American build

UP THE CONGO TO LUKOLELA

A Forested River Bank Chosen as the Site of a New Group in the American Museum to Show the Woodland Birds of Western Equatorial Africa

By JAMES P. CHAPIN

Associate Curator of Birds of the Eastern Hemisphere, American Museum

THE name of the place, I am often told, has a musical sound. So have many words in Bangala, the handy trade-language of the central Congo. If one of my black helpers wished to know whether men were to be summoned, he might ask "Nabinga bangu?"—without the slightest thought of a Hawaiian guitar. The origin of the word Lukolela is still a mystery to me. It seems not to refer to any old chief or tribe,—but is merely a name for the locality, the derivation of which has been forgotten.

Lukolela is not exactly a town—and I am glad of that. It is a small state post, with two plantations, a few trading stores, a mission, two sawmills, and a station of the steamer company. These are strung out for eight miles along the left bank of the Congo River, some five hundred miles from the coast.

The founding of the post dates back to September 22, 1883, when Stanley installed E. J. Glave, a young Englishman, with a garrison of twenty-five black soldiers. Their first task was to make a small clearing in the heavy forest covering the spot purchased three months previously from the native chiefs Iuka and Mungawa.

The white population now amounts to fifteen men and eight women. There are several native villages, and with the people working for Europeans, the black inhabitants may be estimated at 2000. For the Congo it is an old settlement. In school days I might have been asked questions about it, since Frye's Geography of 1895 showed it as one of fifteen named localities in the Congo State.

Lukolela was important for its forest, as Stanley had pointed out. At this strategic point the river emerges from the southern margin of the equatorial forest. Léopoldville, two hundred miles down the river, needed wood for its shipyards, and Lukolela is still supplying Léopoldville and Kinshasa with lumber. At the beginning of this century the Congo State had a little

sawmill buzzing and screeching in a clearing on the river bank.

Lukolela—like most equatorial forests—has a great variety of trees, intricately intermingled. Some have soft wood, easily worked, but prone to attack by insects and rot. Others split too easily. Still others furnish useful timber, often reddish or brown in color, and highly resistant to termites, beetles, or fungi. Many trees are not worth felling, and some individuals of the valuable kinds grow so large that their handling becomes unprofitable. The area near a sawmill need not be wholly devastated. Many large trees remain untouched, while the undergrowth receives increased sunshine and ramifies into nearly impassable thickets, totally different from the open under-wood that existed previously.

Although I had passed but two afternoons at Lukolela, it occupied a conspicuous niche in my memories. There, during my first trip up the Congo, the old barge "1–bis" (a number, not a bird-name) had tied up toward noon on July 18 in 1909; and Herbert Lang and I went roaming in the forest. What birds more characteristic of the Congo forests than the "boulicoco" and large hornbills? Who could forget the spot where he first followed them through the woods?

The bands of red *Colobus* monkeys, crashing from tree to tree, were still there in 1914, and they or their descendants are still to be seen from the river bank. At dusk, on the way back to the boat, I stared with wonder at my first pennant-winged nightjar, flapping over the post, long streamers trailing from its wings. The boulicocos (great blue plantain-eaters) were still giving the rolling coos and clucks that have earned most of their native names. They have not been silenced.

Memories improve with age. Heat and mosquitos fade into forgetfulness. The high river bank at Lukolela I always remembered. Likewise the little sawmill, and the majestic forest that for five years had stood unharmed close beside it.

An alcove in the American Museum stood waiting for a group of the birds of the West African forest. The corresponding fauna of the New World was already fittingly displayed in the Barro Colorado

ABOVE LUKOLELA POST

Here sketches and photographs were made for the background of the group, which is to show a view toward the river

A LOG BEING DRAWN TO THE SAWMILL
Cut from a huge "molundu" tree, it contained about seven tons of hard brown wood, similar in quality to teak

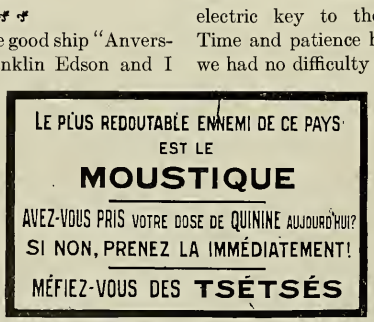
group, and Mrs. Dwight Arven Jones had offered to finance the collection of the African group. Dr. Frank M. Chapman asked me where we could best obtain the material. He favored the Congo River, at some spot with a high bank. Lukolela was the logical answer.

From the rail of the good ship "Anversville" my friend Franklin Edson and I were reading:

"The most redoubtable enemy of this country is the mosquito."

This in letters six feet high, on the floating drydock at Boma. Had we gone on to the farthest frontier of the great Belgian colony we would still have met this good counsel posted on the doors and walls of government buildings, with additions:

"Have you taken your quinine today? If not, take it at once. Beware of tsetse flies."



Edson and I began taking our quinine.

My companion was lured to Africa by his fondness for mammals, and this was to be his first evening ashore. We took our "focusing" flashlights and strolled about the outskirts of Boma. When I had lived in Boma I lacked the handy electric key to the secrets of night. Time and patience had to suffice. Now we had no difficulty in finding the geckos flattened against trees and walls. Just opposite the little house where I once dwelt, round spots of glowing yellow proved to be the eyes of a pair of goatsuckers squatting in an open field. We could watch them at three yards, and recognize the species by its mottled brown pattern.

Similar points of reflected light were moving about among the upper branches of a large silk-cotton tree—the eyes of fruit-bats feeding on the flower buds.

Our first evening was a decided success, and we boarded the ship again, ready for Matadi on the morrow.

From Boma up to Matadi, the head of navigation for ocean steamers, the Congo is a deep river, with grassy hills on both sides, and graceful fan-palms near the banks. The current is swift, as well it should be, for a million cubic feet of water are slipping seaward every second. Just above Matadi are the rapids of Kasi, and just below it Hell's Caldron, a widening of the river forming a gigantic whirlpool. The steamer circles around its northern side before tying up at its destination. Matadi is translated literally as "the rocks."

The town is built on a steep hillside, and our hotel was near the top. Even if Matadi were not one of the hottest places in the Congo, the climb would make it seem so. We were glad to take the train for Kinshasa in the cool, gray dawn; here it is never cool after sun-up. The first part of the railway line skirts precipices and stares down ravines. Then it winds for a long day through hilly country, mainly savanna-clad, but with woods in many of the valleys.

Naturally I kept one eye on the birds. This was the dry season, the widow-birds all in brown, like the grass. Weaver-birds' nests in hundreds on palms and silk-cotton trees were all deserted. Brown kites with forked tails circled listlessly over the slovenly native villages. Two hoopoes were more beautiful; and after sundown two blackish hawks, of the notable genus *Machærhamphus* were circling near a station where we stopped. They prey on small bats, and are never seen in broad daylight.

The railway trip of 240 miles around the cataracts used to take two days. Though the line is being straightened and the rolling stock improved, the second-class cars on this train were those in use as first-class coaches in 1909. Small, but comfortable enough, they are kept in good repair.

What a bustle as we drew into Kinshasa late in the evening; it was typical of the changes in Africa. We took a taxi to a large hotel ablaze with electric lights.

MATADI, THE SEAPORT OF THE CONGO

View from the hotel, looking down toward Hell's Caldron. Glave, the founder of Lukolela, died of fever in 1895 at a mission on the distant promontory shown in the left of this picture

A CANOE ON THE RIVER NEAR LUKOLELA
The wooded islet in the background was not indicated on the pilots' chart, although it lay close to the course now used by steamers

Yet the name of the town is said to mean "the place for antelopes." When first I saw it, Kinshasa was a sleepy trading post under a group of large baobab trees, on the shore of Stanley Pool. A half-dozen small brick buildings housed an insignificant government post with a couple of Europeans, and the offices of a well-known company called the S. A. B. A quarter of a mile to the westward the genial Mr. Howell conducted a small mission. That was all of Kinshasa.

Five years later Kinshasa had become the terminus of railway and river steamers, the principal business center of the Congo. It had hundreds of white inhabitants, a wireless station, a bank, shops in abundance, a great palm-oil depot, the three-story hotel where Edson and I were now living—and a European barber!

The changes between 1909 and 1914 were more astonishing than any that have occurred since, yet growth has continued till the white population is now more than 2000. Officially, Kinshasa has fused with Léopoldville, although they were five miles apart, and between them is the new capital of the Belgian Congo.

Here we paid our visits and found old friends. Monsieur Van den Abeele was getting us our hunting licenses. I felt a little anxiety, and could not suppress a question:

"Did the old Ford run well?"

It was reassuring to learn that it had continued its good behavior. In 1926, on the far eastern edge of the colony, De Witt Sage and I had sold him a battered truck. It is still rolling around in the Ituri, where Sage has seen it recently.

Governor General Tilkens had visited the American Museum with King Albert in 1919; and I found that I could scarcely board a river steamer without meeting old friends.

As I looked off the upper balcony of the hotel at the sparkling waters of the Pool, in the foreground stood some of the same old baobabs, draped with hanging "monkey bread." It pained me to see one being chopped down to widen an avenue. One of the surviving Borassus palms on a near-by street furnished apartments for small palm-swifts, modestly colored but full of grace as they darted to and fro,

heedless of black men in store clothes.

The altitude of Kinshasa is 1200 feet. In the stillness of night the roar of the cataracts, six miles away, is clearly audible, as the waters of Stanley Pool start on their mad rush to the sea.

The mail steamer was full, so we were booked on a cargo boat, the "Capitaine Hanssens," named for one of the great Belgian pioneers. It was a broad-beamed stern-wheeler, like most of the Congo steamers. They burn wood, the fuel being stacked up at many stations, villages, and special "postes à bois" all along the river.

Passengers of our tastes find many opportunities to stretch their legs on shore. The water of this portion of the river is low in February and March, and drops again during July and August. There are accordingly two periods of high water each year. It was now July, but the current is always strong. Five hours' steaming was required to reach the head of Stanley Pool, with its white cliffs, recalling those of Dover on the English Channel.

The Congo may have fewer aquatic birds than the Nile or the Niger, but when sandbars emerge from the ebbing waters, fair numbers of birds are visible on them. The birds show no desire to approach a noisy steamer, and the captain keeps his course as far as possible from the bars. On this day I noted among old bird-friends gray pelicans, snake-birds, wattled lapwings, skimmers, kites and fishing eagles. Old enemies, too, were recognized in the shape of crocodiles lying here and there on the sands.

Near Maluku we entered the narrow strip of river known as the Channel, bordered by high hills. Here begins a sort of woodland, not as luxuriant as the true equatorial forest, forming dark green patches of varying size and shape. On the French side they are largely confluent. Elsewhere the yellow-brown grasslands are thickly dotted with small crooked trees and bushes.

The water in the Pool and the Channel is dark brown, but the reflection from the sky adds an olive tinge to its surface. The bow-wave reminds one of coffee with-

UNDER THE OIL-PALMS AT BOLOBO

The populace watching the steamer at the landing. A lively trade is carried on in smoked fish and other edibles with the black crew and passengers

out milk. Pushing on against the increased current, the steamer finally tied up at Mambutu, a wood-post on the Belgian bank. The northern side is French territory.

mostly dead, often pieces of trees felled to make room for cultivation. Most of it comes from within a few hundred yards of the river, and the larger trees are spared. Along the greater part of the

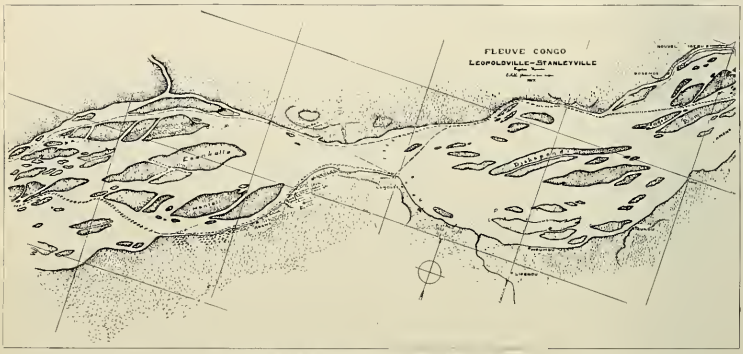


CHART OF THE CONGO RIVER NEAR LUKOLELA
LUKOLELA IS SITUATED AT THE STRIKING CONSTRICTION OF THE STREAM. MERIDIANS ARE 5¾ MILES APART

It was a half-hour before sunset, time for a walk through manioc fields to the edge of the tangled woods. Vociferous "boulicocos" protested the intrusion. As we returned to the steamer after dark, goatsuckers' eyes responded to the beams of our flashlights. Not only is it possible to approach them behind the protecting glare of the lamp, but with patience one may sometimes succeed in capturing a bird in the hand.

After dinner we beheld a novel exhibition of fishing. The two black fishermen had neither hooks nor nets, but walked through the shallow water, each bearing a huge torch made of a bundle of reeds. The other hand wielded a machete. Gazing fixedly in the water, they struck at the fish with the heavy knives.

The following afternoon we stopped at the wood-post of Fumu Djale, and made another excursion. Each steamer burns so much wood per day that one wonders how the supply holds out. In reality the damage is slight. The wood gathered is

wooded banks, swampy in many places, evil results are practically nil. The clearing of land for cultivation, or to drive tsetse flies back from habitations, is inevitable. Careless native farming beyond a doubt has made the greatest inroads on the primeval Congo forests.

During the third day we called at Kwamouth, the mouth of the Kwa, or Kasai River, largest of the southern affluents of the Congo. Its appearance now showed how little rain was falling south of the equator, for a pebbly bar rose in midstream, beneath the telegraph wires spanning its breadth. In April a dark brown flood rolls high over the bar, carrying innumerable clumps of floating marsh-growth.

The night's stop was at Tshumbiri, where we were entertained at the mission by Mr. Metzger, an old-timer. He discussed sleeping sickness with some authority, having been cured of it himself. He thought that 25 per cent of the native inhabitants might still be infected.

Of 6000 people living near the mission when it was founded, scarcely 600 remained. Many a time have mission stations been abandoned because of the dreaded disease. Monsembe and Beni are two cases I know, and I have seen government posts removed from fly-ridden lowlands for the same reason.

Fortunately in the Congo it is only here and there that infection is so widespread. Even in the worst places only one fly in many hundreds is a carrier, so the transient white man is not running a very grave risk. The Congo medical service wages unceasing war on trypanosomes, and the Rockefeller Institute has contributed tryparsamide, the best curative of West African sleeping sickness.

Above Tshumbiri the river widens again, and from here up to Basoko, a distance of 680 miles, it is plentifully bestrewn with islands of all sizes, the vast majority wooded.

On the fourth day from Kinshasa we made a brief stop at Bolobo, with another important mission, and before nightfall reached the old wood-post of Mistandunga. Fruit-bats became the specialty of the evening. The species we had seen at Boma has a weak call; one might think it came from some small tree-frog. But at Funu Djale we began to hear one of the loud-mouthed kinds—my old friend *Epomops*. Who could guess, on first hearing its nasal "kyŭrnk!" repeated without pause for a half-hour or more, and so loud as to carry a quarter of a mile, that the author was a bat? When I first heard it from the deck of a Congo steamer, I vowed it was some nocturnal bird.

At Mistandunga, then, I determined to introduce Edson to *Epomops*. What a task it proved! Back from the river, in woods that had evidently suffered from native activities so that the undergrowth presented a thick tangle, one was calling persistently. With two of our fellow passengers, who must have thought us more than mildly insane before we finished, we began to stalk our bat. Each time we thought the bough where it hung had been accurately located, and turned the light on it, the beast would stop calling and take wing unseen. A

THE LANDING AT THE PLANTATION

Near here in 1883 lived an old chief named Mpuké who coveted Glave's skull to decorate the roof of his house. His attack on the post was repulsed, and Mpuké later became most friendly

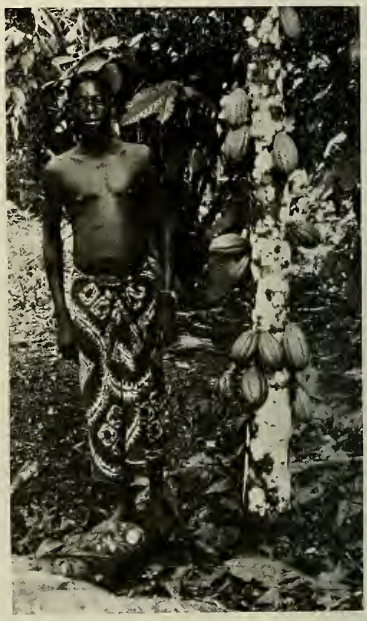
A YOUNG "HAMMER-HEAD" BAT
Being a male, he called vigorously though still of tender age

minute or two later it would be heard from another direction. For an hour and a half we pursued it, this way and that, pushing, tripping, and crawling through the underbrush. Finally it made the fatal error of clinging a little too long to its support, so that its eyes could be seen glowing yellow in the night.

Amongst this group of fruit-bats the males make most if not all the noise, for their larynx is exceptionally well developed. The large "hammer-head bat," *Hypsignathus*, is also to be heard in most parts of the forested Upper Congo, reiterating a still more powerful "pwock!" Never was there a more efficient organism for transmuting fruit juices into sound. The male of *Hypsignathus* has a voice-box that extends from the throat down into the thorax, seeming to crowd the heart into a far corner, and almost touching the diaphragm.

The river was fast beginning to look like a lake. One could seldom tell whether he was looking at the far shore, or just another long island. One more night, the fifth, we had to spend tied up along the French shore, at the tiny forest village of Makulu Ndambu, named "half a leg" for a headman who had been maimed. We arrived long after dark, and saw little of interest save a camp of native hippo-hunters and the red glow from the eye of a crocodile, illuminated of course with the flashlight. No eye glows in the dark of itself—not even a lion's, as I can attest.

We were on the French side because the channel is deeper there. The next morning when I awoke we were already steaming toward the narrows, where Loukolela Français gazes at Lukolela Belge across two miles of gliding water. The changes in weather and waves seem to cause them to approach and recede. A wind blowing upstream, even in fair weather, makes crossing in a dugout perilous.



"MAKINGS" FOR BONBONS
The seeds contained in these melon-like cocoa pods, after fermentation and careful drying, provide food and drink for the civilized world

The village on the French side has a mission and a trader, but no resident official. Just opposite are Lukolela Plantations, where we were to accept the cordial hospitality of Monsieur de Bellefroid. My dear friend Doctor Schouteden had written ahead to him from the Congo Museum in Belgium, and at Kinshasa a telegram of welcome told us we were awaited. The Belgian government post is three and a half miles upstream from the Plantations.

The "Capitaine Hanssens" edged toward the left bank, allowing for the swift current, and whistled to announce its arrival. Whether ascending or descending the river, the steamers make fast with bow upstream. To avoid grounding, the anchor is dropped; and a husky team of river natives jumps off from bow and stern, swimming ashore with wire cables to be tied round trees or posts. The cables are tightened, and gangplanks run ashore.

A FISHING EAGLE
On his lofty bough he quietly let the boat pass beneath him

A TERMITE PAGODA
Abundant in the forest, these hard clay abodes of "white ant" colonies stand about two feet high. Many will support a sitting man

At the Plantation landing stood Doctor Abrassart, one of the directors, who greeted us warmly and made us put on our sun-hats again. This is an outstanding feature of Congo etiquette; and while I do not believe in sunstroke, I have to buy a helmet. Soon Monsieur de Bellefroid joined us, and Madame Abrassart led us in to a luncheon table that would make one forget this was Africa. To me it was indeed a new Lukolela.

Back in 1909, the colony had a small agricultural station here. The rubber trees still stand, but they serve now only to shade the cocoa trees. In 1910, Monsieur de Bellefroid was placed in charge of the government's experiment as to agricultural possibilities. After the war, when the colony turned over many of its plantations to private enterprise, Monsieur de Bellefroid returned with Doctor Abrassart as his partner, and they founded a splendid plantation, the like of which I

VIEW ACROSS THE RIVER
Between the islands, in the dim distance, are the silk-cotton trees rising over the village of Kassa on the French shore

had never seen in the Congo. Within ten years, more than 500 hectares had been planted with cocoa and a little coffee. The area is equivalent to a square nearly a mile and a half on each side. In reality, the cocoa groves ranged southward for a distance of four miles, since irregular bands of swampy forest, useless for any purpose, extend back from the river. In 1929, two hundred and fifty-two tons of dried cocoa were shipped from Lukolela, and in 1930 more than one hundred additional hectares were planted with cocoa. There are only six white men on the plantation. Needless to add that they work with a will.

The cocoa tree is a delicate plant, it cannot stand evaporation, and so wherever possible it is planted in the shade of forest trees. A certain thinning out of the forest is required, and Monsieur de Bellefroid was well aware that I had come to see the virgin forest. He offered us the hospitality of the "Plaine," a small patch of natural grassland at the far edge of the plantation. All about it stretched the primeval forest, as yet untouched by the workmen who prepared the areas to be planted.

There stood a little station, only three years old, adorned with huge fan-palms that bore witness to the age of the opening in the forest. It was not made by natives. There was no fringe of second growth such as their farming would have entailed.

So after lunch we were driven to the Plaine, and installed in a neat little brick house. As we sped through several miles of thriving cocoa groves, typifying the change that is coming over Africa, I recalled many weary miles trudged afoot, and the hardships of the poor savages who used to bear our boxes. The speed of the car provided a cooling breeze, and the blacks were singing as they rode on trucks with our luggage.

The automobiles used on the plantation had no road to permit their straying even to the adjacent government post. From our little home in the Plaine, we could watch monkeys feeding in the treetops, or listen to the hornbills, plantain-eaters, and pigeons calling in the forest.

Now it was time for work. A spot must be selected for our group, and I studied the bank of the river for several miles above and below the Plantation. Except

where the shore was so low as to be flooded occasionally, human occupation had generally altered its vegetation. Below the Baptist Mission there was a succession of old-established villages, almost hidden under oil-palms. Going upstream, one passed through other villages, the wide clearing planted with coffee by the "Synkin" (Syndicate of Kinshasa), other clearings, Portuguese stores, one more palm-shaded village, and finally the old state post. Back from the river there was forest aplenty, but we wanted a view of water for our background.

The post of Lukolela now belonged to the steamer company, except for the rambling grass-thatched residence of Monsieur Pieters, Agent Territorial. Even the post office, directed by the charming Madame Pieters, was in a wooden building belonging to the steamer company, known as the "Unatra."

I was anxious to revisit the forest just above the post. How had it fared since my departure? The little sawmill had ceased to chug and buzz. Most of its machinery was dismantled, and a newer mill had been established at Mompoto, two miles upstream, across a bay. Had my forest been depleted?

The forest was best approached by a narrow path, following a single strand of wire strung on iron poles. Until a few months before the war the wire had carried telegrams from the outer world into the Upper Congo. Messages from the American Museum to Lang and Chapin had thrilled its copper spine. Now it was only a telephone, carrying the voice of a black man who repeated radiograms caught from the air by the station at Coquilhatville.

Five minutes walk along the same path brought me to the happy hunting ground of yore. Almost too good to be true. On the high ground it would have been hard to say where a tree had been removed, and I roamed through the open undergrowth again, listening to the "boulicocos" and other familiar forest voices. Then I sat down between the buttresses of a great tree to write some brief letters home.

Lukolela has a very large wood-post; and just along shore, where wood gatherers came by canoe to collect fuel for the steamers, the forest had been somewhat thinned out. In a way this was fortunate,

A LARGE "MOLUNDU" TREE
Of the same family as the mulberry, it bears green fruits that find favor with swarms of large bats

THE "TABORA" ABOUT TO CALL FOR A SHIPMENT OF COCOA

The palms in the foreground are among the riches of the Congo. They bear fruit furnishing an oil long used in soap-making

for it provided the glimpses of open water which were desired.

Thus the spot on which I had counted in New York was still available. The land rose to about fifty feet above the river, and the vegetation was exactly the same as in the forest close to our house at the Plaine. Sketches and photographs were made on the river bank, but much of the other work could be done near the Plantation.

We arrived at Lukolela during the two dry months of the year. From September on, one day in every three or four was wet. This made the forest all the more beautiful, and at worst only delayed us a little. Work proceeded.

In the evenings Edson and I went strolling again along the forest roads, "shining" the eyes of bush-babies, little lemurs that run like squirrels on the forest boughs, listening to fruit-bats and tree hyraxes, finding large flying squirrels, and wondering when our lights might fall on the eyes of a prowling leopard. Sometimes we made a special search for frogs, and those of Lukolela exhibit some unusual preferences in places for laying eggs.

It was all too happy to last. My congenial friend fell ill. The heat told on his strength, and it was decided that he should return to a better climate. Early in November the "Tabora," one of the mail steamers, swung in to the Plantations, and we waved Edson a fond good-bye.

Besides the work on the accessories for the group, there were a few birds to be collected for it. All too many other things were waiting to be studied in this forest at Lukolela. If only there were more time.

A small number of natives had been trained as helpers. When more men were needed for heavy work, they could be borrowed from the Plantation. My last task was to secure the trunk of a buttressed tree, and in this Mr. Bourry, manager of the Unatra station, gave me his invaluable help.

With the exception of a short trip to the

Bank at Coquilhatville, I had not left the vicinity of Lukolela. There is an advantage in watching the course of the seasons at one place. Even on the equator, flowers come and go. So do certain of the birds: swifts and swallows from Europe, cattle herons from the Sudan. The river rises and falls. It was now late in March, the water had been low since early February. A half dozen huge crocodiles basked habitually on a crescentic sandbar just opposite the government post. Flocks of small gray pratincoles alighted on other bars, as did marsh terns, lapwings, skimmers, and many more aquatic birds.

Numbers of blackish birds like swallows, but with red beaks, were tunneling their nests in the sand. This was the "rare" *Pseudochelidon*, not known to breed elsewhere than on the Congo River.

Swallows were leaving for Europe, and it was long past the time when I should have begun my own homeward migration. So I prepared to leave by the "Kigoma," the largest of the passenger steamers, which was on her way down from Stanleyville. She pulled in after nightfall on April 6, and a sweating gang of half-naked roustabouts struggled to put my huge boxes aboard. Farewells to the good friends of Lukolela occupied the rest of the evening.

One dear friend whom I had lost at home was Mrs. Dwight Arven Jones, who had made the expedition possible. She had written to me since my arrival at Lukolela. My deepest regret was that she could not have been spared until we could show her the results of her generous support.

As day broke, the "Kigoma" cast off and went gliding down her flowing road. One passenger at least stood looking back as the red disk of the sun detached itself from the low wooded horizon beyond Lukolela. No, it was not homesickness, but a feeling closely allied. Parting is a sweet sorrow.

Daybreak at departure

The Main Building of the United States Naval Observatory

THE UNITED STATES NAVAL OBSERVATORY

The History of One of the World's Leading Observatories—The Ever Widening Scope of Its Service to the Commercial and Scientific Life of the Nation

By CAPT. FREDERICK HELLWEG
Superintendent, U. S. Naval Observatory, Washington, D. C.

AN amateur astronomer—William Lambert—presented a memorial to Congress in 1809 recommending the establishment of a *first* meridian in the United States at the permanent seat of the government. Lambert had determined the longitude of Washington and submitted his calculations with his memorial to Congress.

The mental inertia of Congress caused it to procrastinate in settling this important question. After it had been repeatedly referred to various committees and commissions, James Monroe, the Secretary of State in 1812 took the first positive action in recommending the establishment of an observatory. In 1815 Congress finally acted, but the President took no action.

John Quincy Adams in his first message to Congress in 1825 urged the establishment of a national university and the erection of an astronomical observatory either separate or as part of the university. For erection of buildings $14,500 was requested and $4000 for cost of operation.

Ten years later, in 1835, the Secretary of the Navy called attention to the great importance to the government of a Naval Observatory, its effect on the defense of the country, its bearing on the Navy, and on our commercial and scientific pursuits. Attention was called to the necessity for employing an officer of science to keep maps and charts, to regulate chronometers, and to preserve all mathematical and nautical instruments required for the Naval Service. No action was taken.

In 1838, John Quincy Adams entreated the President—Van Buren—to use the income from the Smithsonian bequest in establishing an astronomical observatory,

and to pay the salary of one astronomer and one assistant, for nightly observations, the periodical publications, and for annual courses of lectures upon natural, moral, and political sciences. In 1842 John Quincy Adams again urged the establishment of a national observatory.

In the memoirs of Adams it is stated that the powerful opposition to the establishment of an astronomical observatory during this long period was due in a large measure to the political enmity toward himself. But in spite of all this determined opposition, the establishment was effected in an entirely different way, a way not contemplated by either the advocates or the opponents of such an institution.

Until 1830, each vessel of the Navy when fitting out, obtained its instruments and charts by requisition on the Board of Naval Commissioners, the purchases being made by a Navy agent from foreign governments or from private dealers. No tests were made of either instruments or charts prior to their purchase. When a ship went out of commission her instruments and charts were piled in a store house where they were neglected until another ship went in commission and needed them. Then they frequently were found unfit for use. So, in 1829, a definite recommendation was made by the Secretary of the Navy covering the inspection, testing, and preservation, when not in use, of instruments and charts.

CAPT. FREDERICK HELLWEG, U. S. N.

Captain Hellweg, present superintendent of the United States Naval Observatory, planned the details of the modernization of the Observatory, which will take about three years to complete

In 1830, Lieut. L. M. Goldsborough made a definite recommendation that a suitable place be designated for the stowage of all chronometers, instruments of precision, theodolites, circles, telescopes, charts, etc., and that a competent officer be made personally responsible for all instruments submitted to his charge.

Based on Lieutenant Goldsborough's recommendations, the Secretary of the Navy in 1830 ordered a depot of charts and instruments to be established in Washington, D. C., and placed Lieutenant Goldsborough in charge. Among the functions of this depot was the ascertaining of errors and rates of chronometers. This was accomplished by means of sextant and circle observations. These instruments were mounted in a circular building near a house rented on what is now G Street between 17th and 18th.

At the time of the establishment of the depot, charts and books were purchased abroad and frequently were in a foreign language. The Navy Commissioners ordered Goldsborough upon the latter's recommendation to make modifications in charts, reduce them all to the meridian of Greenwich, and translate all notations into English.

Goldsborough was relieved, in 1833, by Lieut. Charles Wilkes who, in 1834, evidently tired of the procrastination of everyone and built the first observatory building at his own personal expense. It was only sixteen feet square. He mounted a transit made by Troughton in

LIEUT. CHARLES WILKES, U. S. N.
Lieutenant Wilkes, the famous explorer who conceived and led the Wilkes Expedition, was superintendent of the Depot of Charts and Instruments from 1833 to 1837

England for the Coast Survey in 1815.

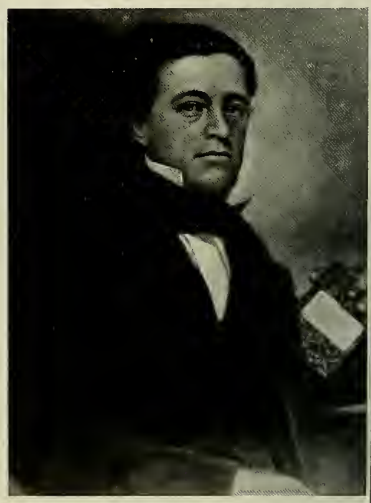
Lieutenant Wilkes was relieved in 1837 by Lieut. J. M. Gilliss and the latter was relieved in 1842 by Lieut. M. F. Maury.

From such a meagre beginning the present observatory grew. In 1842 the Secretary was finally authorized to contract for the building of a suitable house as a depot of charts and instruments. Lieutenant Gilliss prepared the plans after going abroad and consulting distinguished astronomers.

In 1844 Lieutenant Maury who had relieved Gilliss, was ordered to take charge of the new quarters, the first real observatory, and to move all instruments, charts, etc., into the new building. Lieutenant Maury therefore became the first superintendent of the Naval Observatory.

Wilkes was at heart an astronomer; Maury was more inclined to develop the hydrographic and meteorological work. While considerable work had been done by Wilkes and by other officers in the field of hydrography, it was Maury who really laid down the foundations of the extensive system for hydrographic work of the Navy Department. He organized the system for collection of information from the logs of all ships both naval and merchant. He collected information all over the world of ocean currents, wind and air pressures, temperatures, water temperatures and other marine and meteorological phenomena from which he made charts. The system still continues and on it is based the present efficient and excellent work of our Hydrographic Office whose publications are now so eagerly sought by mariners all over the world.

But it was not until one year later, 1845, that observations of the sun, moon, planets, and brighter stars were begun



LIEUT. JAMES M. GILLISS, U. S. N.
Lieutenant Gilliss was superintendent of the Depot of Charts and Instruments from 1837 to 1842

systematically, and have been observed since. The results of the first year's observations were published in 1846 and the publication was characterized as "The first volume of astronomical observations ever issued from an institution properly entitled to the name of an observatory on this side of the Atlantic."

In 1846 the Secretary of the Navy, in referring to the observations taken, said that the Observatory might now produce its own nautical ephemeris, a small appropriation being sufficient to accomplish the object, the expenditure for which would be returned by supplying our merchant vessels with nautical almanacs at cost.

The Naval Observatory gained considerable prominence among world astronomers in 1847 through the discovery by one of the staff that the planet Neptune which had been discovered September 23, 1846, was identical with a star seen twice by Lalande in May, 1795, and which had since been listed as star No. 26266 in Lalande's catalogue. The researches which resulted from the Observatory's discovery afforded the means of accurately determining the orbit of Neptune.

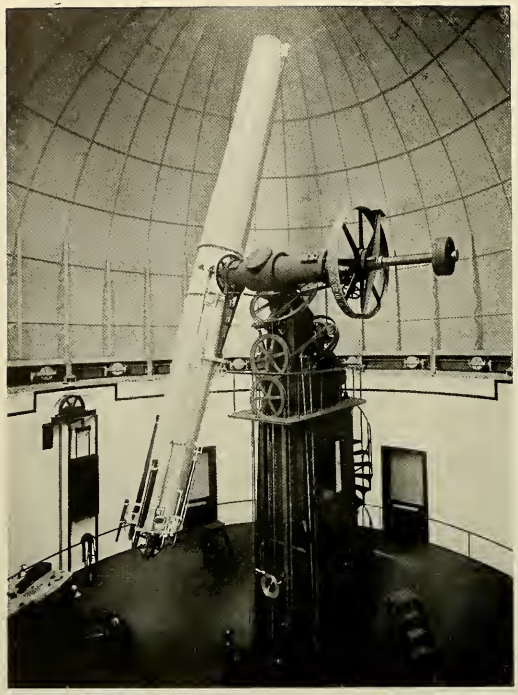
LIEUT. MATTHEW FONTAINE MAURY, U. S. N.
He was superintendent of the Depot of Charts and Instruments from 1842 to 1844, when he was ordered to take charge of the Naval Observatory, where he remained until 1861

LIEUT. L. M. GOLDSBOROUGH, U. S. N.
Lieutenant Goldsborough was the first superintendent of the Depot of Charts and Instruments from 1830 to 1833

In 1849 the first practical chronograph —Doctor Locke's magnetic clock— in which electricity was first employed in the recording of observations, was installed at the Observatory. It is now in our our museum.

Between 1854 and 1860 three minor planets were discovered by the Observatory.

As the instruments of the Observatory were of too low power to enable the astronomers to meet the demands of the time, a new meridian circle was mounted



TWENTY-SIX INCH EQUATORIAL

With micrometer attachment. This is the largest instrument at the Naval Observatory. Its object glass has a diameter of twenty-six inches, and it was completed in 1873. At that time it was the wonder of the scientific world

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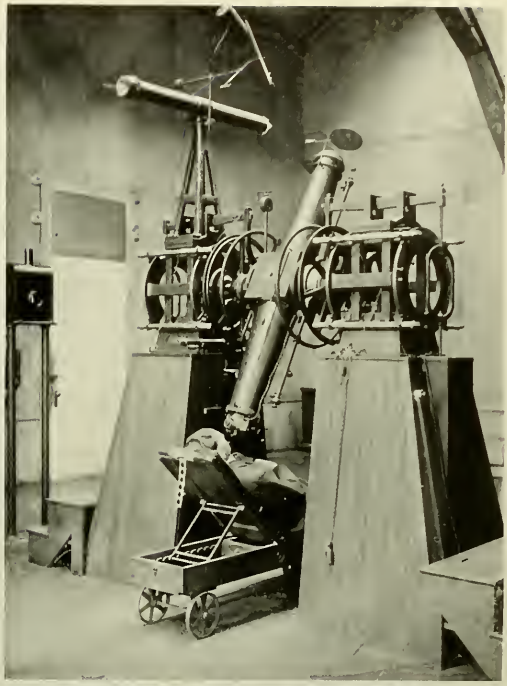
LIBRARY OF THE NAVAL OBSERVATORY

This library has the reputation of being one of the most complete of its kind in the world. It is used by many as a reference library because of its numerous old records and its rare publications, some of which date as far back as the Fifteenth Century

SIX-INCH TRANSIT CIRCLE,
U. S. NAVAL OBSERVATORY

Here the astronomer is making observations of the transit of the stars from which our time is calculated. The difference between the observed time of transit and the predicted time of transit over the meridian is the error of the clocks



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THE CONSTANT
TEMPERATURE ROOM

The time service is one of the most important functions of the Naval Observatory. In this room chronometers and other time pieces used in the Navy are thoroughly tested and rated at different constant temperatures to insure their accuracy before issue to the Service

NO. 2 TRANSMITTING CLOCK, A DUPLICATE OF NO. 1
Astronomer Paul Sollenberger, in charge of the time service, is tuning in to receive the tick over the air which will be broadcasted by the No. 2 clock

in 1865, which enabled the Observatory to measure the right ascensions and the polar distances at the same moment and with equal exactness. The new instrument's program of observations was begun January 1, 1866. In 1870 Congress authorized the construction of the largest size refracting telescope of American manufacture to cost not more than $50,000. A subsequent act provided for housing the telescope.

Alvan Clark of Cambridgeport, Massachusetts, constructed a refracting telescope with a twenty-six inch clear aperture mounted equatorially on the German plan with all the usual counterpoises and other easy motion devices, with driving clock, etc., etc. The telescope was mounted in 1873. We are still using that instrument.

The excellence of the work of the Observatory began to be recognized by the world's astronomers and the United States was invited to send representatives to all international conferences.

In 1842 Lieutenant Wilkes was the first to use the telegraph for ascertaining differences of longitude. His first attempt was that between Baltimore and Washington. In 1868 and 1869 with the aid of the Western Union Telegraph Company, the Naval Observatory undertook the determination of longitudes by means of telegraph of stations in Havana and several continental stations in the United States. In 1912 the Superintendent of the Naval Observatory by letter to the International Conference held in Paris, suggested the determination of the difference of longitude between the Naval Observatory at Washington and the Observatory at Paris by means of radio time signals. This was done in 1913 and 1914, the naval radio at Arlington and the Eiffel Tower radio at Paris being used for the communication.

These observations were the first direct determinations of the difference of longitude and the velocity of transmission of radio waves between the United States and Europe, and was the first time that radio was used for transatlantic longitude determination.

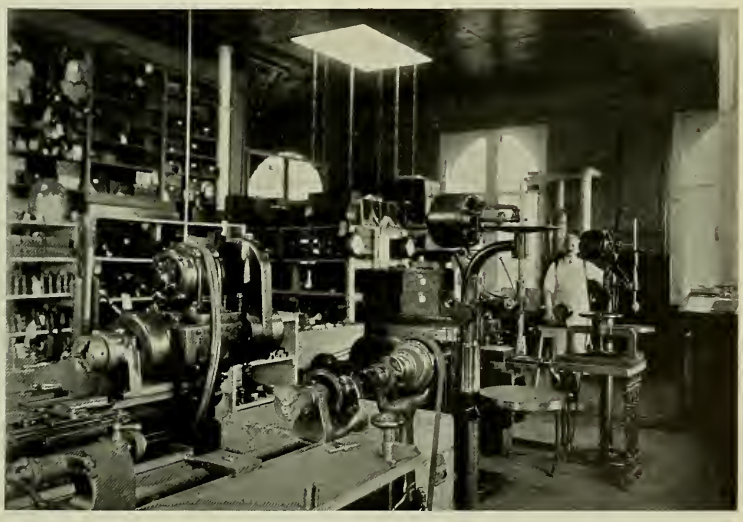
The Observatory has participated in the observations of all eclipses, and when funds were available has sent representatives to all International Conferences.

This brief history of the Observatory gives an idea of the steady development of its work since it received its first humble start. Let us now look at its present-day activities.

The Naval Observatory is a *national institution.* By the time it was transferred to its present location it had become recognized as one of the highest ranking observatories in the world, due to the character of its work in astronomical research. The Observatory has been assigned to the Navy but it is the only national institution of its kind in the United States.

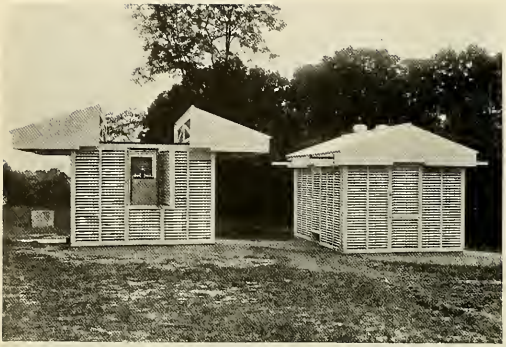
The present site on Massachusetts Avenue was, by act of Congress, made circular in form around the clock vault with a 1000-foot radius. This was done to prevent the vibrations of passing heavy motors from adversely affecting the standard clocks and astronomical instruments of precision.

The Observatory has a dual personality. It serves the Navy in many ways. It also serves the general public throughout the country in equally important ways. It is the only government institution of its kind to render this service. Its primary mission is the determination of absolute position by astronomical observations and the maintenance of a continuous series of observations of the sun, moon, planets, and the standard stars of the American Ephemeris in order to be able



THE REPAIR SHOP

A finely equipped workshop is maintained for repairing all the instruments used in the safe navigation of all vessels of the United States Navy



OBSERVATION HOUSE AT THE NAVAL OBSERVATORY

This photograph shows how the roof splits and separates so as to insure absence of conflicting air currents that would disturb the accuracy of observations

to prepare all the necessary tables for the Ephemeris, as well as to maintain a series of such stars as may be necessary to serve possible future needs.

Another part of its mission is the procurement and supplying of an adequate number of instruments for the navigational needs of the Navy.

Our work therefore naturally divides itself into two distinct groups. First:—The astronomical work including all the observations with the various instruments, and the resultant work of preparing and publishing the nautical almanac and the American Ephemeris. Second:—The procurement, inspection, and upkeep of all instruments used in connection with the navigation of naval vessels. This includes compasses both magnetic and gyro, all equipment under the cognizance of the Bureau of Navigation such as binoculars, spyglasses, sextants, and the like.

Under this department comes one of the most important functions of the Naval Observatory:—the Time Service. In the center of the reservation is our clock vault in which we keep our standard clocks. They are sealed airtight and are maintained at a constant temperature. They are electrically wound and they are never reset, but accurate records of their rates are maintained. These clocks keep sidereal or star time. A specially designed small transit instrument is used for the time determination. As the earth's rotation causes certain fixed stars to cross the celestial meridian, the transit instrument is set on them. An automatic mechanism causes the eyepiece to travel so that the stars appear to the observer to be stationary. By means of a differential mechanism, the astronomer keeps the star exactly on a spider line. The automatic mechanism transmits a series of electric impulses which indicate the time of the star's meridian passage. These are recorded chronographically on a chronograph, together with the second ticks from one of the standard clocks in the vault. By measurement of the record it is possible to determine the time of the star's transit according to the clock, and therefore the error of the clock.

We have three old standard Riefler clocks and one modern Shortt clock in use at the present time. By keeping the clocks at constant pressure and constant temperature their rates are more uniform and the accuracy of the result is greatly increased. For the purpose of transmitting our time signals, secondary or transmitting clocks are used. These clocks can be set. They are compared with the standard sidereal clocks by means of a chronograph and are set electrically to the smallest fraction of a second. The astronomer broadcasting the time signals

measures the difference between the transmitting clocks and the sidereal clocks as shown by simultaneous records of each clock's performance on a chronograph drum. By measuring the difference with a scale and applying the proper correction, the error of the mean time clock can be determined with great accuracy. By means of an electrical control the mean time or transmitting clock can then be retarded or advanced until it is exactly on time. This is done every time immediately prior to the broadcasting of the time signal.

When this has been accomplished, the mean time clock is accurate to about the one-hundredth of a second. At five minutes before the zero hour, the switch is thrown and the tick of the transmitting clock is magnified and automatically broadcast from Arlington and from Annapolis, where our high power broadcasting stations are situated.

In order to check the accuracy of our own broadcasts, our own receiving set catches the record of the ticks which are in turn projected on the drum of the same chronograph with the transmitting clock tick and the sidereal clock tick. In this way we have a visual record of our sidereal time, our mean time broadcast, and the broadcast from both Annapolis and from Arlington. Immediately after the broadcast of each time signal, the astronomer on watch measures the error, if there is any, and correction sheets are prepared showing to one-hundredth of a second the error for each broadcast for each day. These correction sheets are mailed weekly to all activities in this country, including all private enterprises, observatories and, in fact, any one who requires extremely accurate results for manufacturing or scientific purposes. These bulletins are mailed free of charge to those requiring them, and by them it is possible for the various activities to check back and determine with mathematical accuracy their own errors on any particular day at any particular broadcast.

These time signals were originally broadcast for the use of navigators at sea, but now they are used for hundreds of purposes and the number of uses is daily increasing. You will probably be surprised to learn that all the accurate determinations of gravity all over the Western Hemisphere are dependent upon the broadcast of our time signal for the accuracy of their work. Mineralogists use the time signals in locating deposits of oil in the bowels of the earth. Radio development now demands exceptional accuracy for frequency determination, and there are many commercial uses which are daily developing, each requiring added accuracy in the broadcasting of the time signals.

THE PHOTOHELIOGRAPH AT THE NAVAL OBSERVATORY
Photographs of the sun are made daily, showing the sun spots about which so much as been written recently

At present, our time signals are broadcast three times daily: at 3 A.M., noon, and 10 P.M., but plans are under way now for increasing the number of broadcasts per day in the very near future. It is expected that the number of broadcasts will be doubled daily.

The method of broadcast has been developed to a high degree of efficiency. At five minutes befor the zero hour and when the transmitting clock has been accurately adjusted to 75th meridian time, the astronomer throws the switch which automatically starts the entire mechanism described above. Each tick of the pendulum is magnified and transmitted by radio practically all over the world. In order that any one receiving the time signal can identify the position in the time broadcast, the 29th second of each minute is silent. This omission acts like a finger pointing to the next second so that after you hear 28 ticks, the 29th will be silent and you will know that the next tick is the 30th second of some minute.

The 56th, 57th, 58th and 59th seconds' ticks of the 55th, 56th, 57th and 58th minutes are silent, acting as a finger pointing to the next audible tick, so that you know that, after a silence of four seconds, the tick following this silence is the 60th second, or the beginning of a minute. During the 59th minute there are no ticks from the 50th to the 59th second, so that when you note the long silence of 9 seconds, you know that the next tick will be the zero hour—either 3 A.M., noon, or 10 P.M., 75th meridian time.

As those receiving the time signal may not be able to begin the reception exactly on the 55th minute, a system of identification signals has been arranged so that if you tune in at any time during the broadcast you may be able to tell how many minutes there are still to go before the zero hour. This is done by omitting the 51st, 52d, 53d and 54th seconds' ticks on successive minutes. The number of ticks that then remain between the identification ommission and the 55th second tick indicates the number of minutes to go. For instance, if the 51st second tick is omitted you will then hear the 52d, 53d, 54th and 55th seconds' ticks, indicating that there are four more minutes to go before the zero hour. If the 52d tick is omitted, you will count three ticks before the four-second silence, indicating that there are three more minutes to go. If the 53d second's tick is omitted, you will then hear only two ticks before the four-second silence, indicating that you are listening to the 57th minute and that there are but two minutes to go. If the 54th second's tick is omitted, you will only hear one tick before the four-second silence, indicating that you are listening to the 58th minute and that there is only one minute to go. On the 59th minute, you will hear the tick at the 50th second and then there will be an absolute silence until the 60th second, the zero hour. The 60th second tick is twice as long as all other ticks in order to accentuate the zero hour.

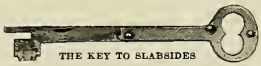
When the importance of the time service to the commercial and scientific life of the nation is considered, no expense is too great to insure the maximum accuracy. The three Riefler clocks at the Observatory are approximately thirty years old. Naturally many improvements in precision timepieces have been made since their purchase. Last year, one of the new Shortt clocks was purchased. It is a great improvement over the older clocks, but the ever-increasing demands for greater accuracy and for increased service require constant searching for newer and better methods of maintaining accurate time. This in turn requires the newest and most accurate equipment, and the newer equipment requires additional construction for housing the instruments.

In another month we will break ground for our new clock vault which will really

be approximately like an enormous thermos bottle. It will consist of a large hollow tile vault, completely surrounded by another reinforced concrete vault, from which it will be separated by a two and-one-half foot air space. The inner vault will have electrical temperature control and will be maintained at 83 degrees. Within the inner vault there will be six piers on which our sidereal clocks will be mounted. All pier faces will be set at varying angles so that all pendulums will swing in different planes. Constant pressure will be maintained and every effort will be made to insure absolutely uniform conditions throughout the year, thereby insuring absolutely uniform performance of the clocks. The inner vault will be brilliantly illuminated by external illumination, similar to the magazine lighting on board ship. Visual inspection of the vault and all clocks will be possible by a periscope let down from the office above, through the outer and the inner vaults, so that astronomers and visitors can inspect the operation of the clocks from the office above, without endangering the performance by going below. Congress, in its last session, has appropriated funds for this construction and for the building of a new astrographic laboratory.

All large observatories of the world are equipped with photographic apparatus for recording permanently the positions of stars at any given time. The Naval Observatory, for the past thirty years, has been unable to keep abreast of the times due to lack of funds, but the recent action of Congress will correct the long period of inaction, and within the next two or three years the Naval Observatory will have resumed its position as one of the leaders so far as its equipment is concerned. The Observatory has never relinquished its position as a leader so far as the quality of its astronomical work is concerned. Recently, a report from one of the foreign observatories which had collected, tabulated, and compared the work of the principal observatories in the world and had assigned efficiency weights to the results obtained, rated the work of the Naval Observatory as ten. No other observatory received a perfect mark for all of its work. One of the German observatories received ten for one of the coördinates, but not for the other. This excellent work represented the result of over two years of labor. The Secretary of the Navy took occasion to commend the astronomers of the Naval Observatory for having attained this premier position, which was recognized by one of the foremost astronomers of the world.

John Burroughs' Rustic Cabin, Slabsides



WITH JOHN BURROUGHS AT SLABSIDES

Recollections of the Famous Poet-Naturalist and His Mountain Retreat near Riverby

By CLYDE FISHER

Curator of Visual Instruction, American Museum

PHOTOGRAPHS BY THE AUTHOR

March 29, 1931, marked the tenth anniversary of the passing of John Burroughs, whose life and works are so well known to many readers of Natural History *Magazine. The John Burroughs Memorial Association has honored this anniversary by the publication of The Slabsides Book of John Burroughs, which is just off the presses of the Houghton Mifflin Company. The following is a chapter as written for this book, by one whose friendship for John Burroughs extended over a period of many years.*—The Editors

IN the waning days of the Nineteenth Century there happened to fall into my hands a little volume of essays entitled *Signs and Seasons* written by John Burroughs, the first of this author's books that I had ever seen. I am not sure that I can tell why it impressed me. The unobtrusive style surely had something to do with it, but there was much more than that. The simplicity, the genuineness, and the sympathy of the man shone out through the lines, and I came to feel a strong affection for the writer as a man before I had finished reading the book. This affection grew as I read his earlier books and deepened as I read his later ones—those which followed *Signs and Seasons*.

John Burroughs believed that literature is observation plus the man, and this is indicated by his reply to a friend who had urged him to write his autobiography: "My books are my autobiography."

It seems to me that John Burroughs

has succeeded in putting himself in his books as few men of letters have done.

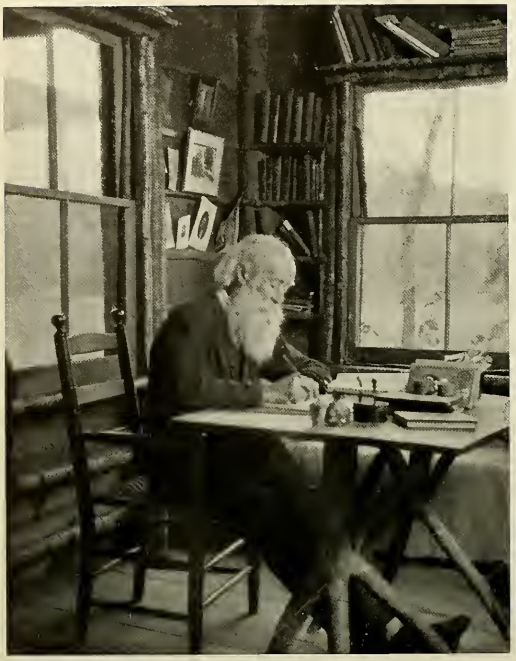
Of John Burroughs' style, one of his critics has said, "His manner of writing is so unaffected that we feel we could write in such a manner ourselves. Only we cannot."

Although his essays read so easily, much hard work, much revision, was necessary to make this possible. However, our literary naturalist always protested against his books being called "The Works of John Burroughs," since so much of play had gone into the making of them. Here we note the joy he had in his writing, a fact most significant.

"Man can have but one interest in nature, namely, to see himself reflected or interpreted there, and we quickly neglect both poet and philosopher who fail to satisfy, in some measure, this feeling." So wrote the Sage of Slabsides in the first of his books that I ever read. It is an important, a really fundamental truth, which every teacher and every writer should bear in mind.

I am now convinced that it would have made no difference which of the early books of Burroughs came first to my attention, although when my advice is asked, I usually recommend prospective readers to begin with his first outdoor book, *Wake-robin*, written in Washington, D. C., and while Abraham Lincoln was president of these United States. Burroughs' description of the song of the hermit thrush (in itself a classic) is in this volume. To him this song was "the finest sound in nature." Altogether, it is doubtful whether Burroughs has written a more charming collection of essays than *Wake-robin*. In this book, chiefly about birds, he chose for its suggestive title the name of a wild flower that blooms in the woods when the birds are returning in the spring. His study of the birds and flowers went hand in hand, and

RAMBLING THROUGH THE NOVEMBER WOODS
John Burroughs and Clyde Fisher examing an herb-robert flower near Slabsides



JOHN BURROUGHS IN SLABSIDES

Taken November 7, 1920, this photograph proved to be the last one made of Mr. Burroughs at Slabsides. At this table he wrote *Whitman: A Study*, and many of his nature essays

we find them in close proximity on his page, as they are in nature.

In *Wake-robin*, Burroughs says, "Take the first step in ornithology, . . . and you are ticketed for the whole voyage." I like to paraphrase this as follows: "Take the first step in John Burroughs' books, and you are ticketed for the whole long shelfful."

My first letter from John Burroughs came in 1902 in response to a question of mine concerning the reason and instinct of animals. In that reply he stated: "My opinion is that animals have powers that are analogous to, or the same as, the first rudimentary steps of human reason—that is, they draw inferences from facts and compare one thing with another." This letter was written a year before the nature-faking controversy broke out and swept the country, but it is an interesting coincidence that the subject is the same, especially since it was an article by John Burroughs ("Real and Sham Natural History") in the *Atlantic Monthly* which started the controversy.

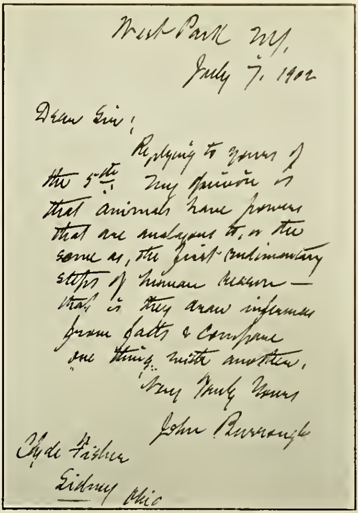
When in 1903 I first came to New York City from Ohio, the thing I wanted most to do was to hunt out John Burroughs in his home haunts. Impulsively I took the Hudson River Day Line boat for Poughkeepsie, crossed the river to the village of Highland on the west bank, then went by rail six miles north to the little hamlet, West Park, where he lived. How eagerly I walked the quarter of a mile from the railway station to his home! Actually within a few minutes of meeting face to face the author of *Signs and Seasons*, and all the other books I had by then come to love!

Perhaps you can imagine my suppressed excitement as I waited at the door of his picturesque stone dwelling at Riverby for the response to my ring. A long wait, and the door was slowly opened by Mrs. Burroughs, who told me, inexorably, that Mr. Burroughs had gone to Slide Mountain in the Catskills and would not be home till the next Wednesday.

Now I had to return to Ohio before

"next Wednesday." Suddenly I became a sadder and a wiser man as it dawned upon me that I should have written to see if Mr. Burroughs would be at home, and whether it would be convenient for him to have me call. I must have assumed unconsciously that he who was always interested in Nature at his door would always be at home.

Although it was a case of "Hamlet with Hamlet left out," I did look about Riverby a bit,—saw the lay of the land, with its many acres of vineyards, as it slopes down to the river, the picturesque Bark Study, the summer-house, and the stone dwelling which was his home for more than forty years, the building of which he describes so vividly in "Rooftree," the last essay in *Signs and Seasons*. There he says: "Every man's house is in some sort an effigy of himself. It is not the snails and shellfish alone that excrete their tene-



West Park N.Y.
July 7. 1902

Dear Sir:

Replying to yours of the 5th my opinion is that animals have powers that are analogous to, or the same as, the first rudimentary steps of human reason — that is they draw inferences from facts & compare one thing with another.

Very Truly Yours
John Burroughs

Clyde Fisher
Sidney Ohio

The first letter Clyde Fisher received from Mr. Burroughs, dated July 7, 1902

SLABSIDES

Interior view, showing fireplace in which Burroughs cooked his food, and the table on which he did his writing

THE WOODS ROAD LEADING TO SLABSIDES
After leaving the main highway, the road to Slabsides winds through a beautiful stretch of hemlock forest

ments, but man as well. When you seriously build a house, you make public proclamation of your taste and manners, or your want of these." Speaking of his success in finding suitable blocks of stone on the surrounding slopes, he remarks, "But when you bait your hook with your heart, the fish always bite." His ideas of inside finishing are thus indicated in the same essay: "The natural color and grain of the wood give a richness and simplicity to an interior that no art can make up for. How the eye loves a genuine thing; how it delights in the nude beauty of the wood! A painted surface is a blank, meaningless surface; but the texture and figure of the wood is full of expression."

More than ten years passed before I had the opportunity of redeeming the disappointment concerning my first visit to Riverby. Mr. and Mrs. Burroughs were then living with Dr. Clara Barrus in "The Nest" at Riverby, an attractive cottage on a bench of land below the stone dwelling, a few rods from the Bark Study. Mrs. Fisher and I had the privilege of taking luncheon at "The Nest" with Mr. Burroughs and Doctor Barrus (who became later his literary executor and biographer). Mrs. Burroughs being ill at the time did not join us at luncheon.

Before going to Riverby, I had learned that Mr. Burroughs did his writing chiefly in the forenoon. I knew that he had said, "My mind works best, and my faith is strongest, when the day is waxing and not waning." He was never a burner of midnight oil. In view of his habits as to writing, we proposed not to disturb him until lunch time. I had brought my camera, hoping to get a picture of the poet-naturalist, so started out before noon to make a few pictures about his home, first undertaking to photograph the summer-house, a few steps from the bark-covered study. In this summer-house, which commands a wonderful

view up and down the river, Mr. Burroughs used to sit by the hour during the warmer months of the year, reading or thinking out the essays he has given us. Just as I was focusing my camera on the summer-house, Mr. Burroughs, who, from within, had seen me, appeared in the doorway of his study. He greeted me cordially, and said unaffectedly, "I thought you might like to have me in the picture." Delighted with his kind offer, I turned and photographed him as he stood in the door of the little bark-covered study; again, when he was examining the wren-box on the big sugar maple by the summer-house, and again as he sat by the fireplace in the study. My photographic wishes were thus unexpectedly more than fulfilled before lunch time.

At luncheon we talked of the farm. I have always felt that my stock went up with Mr. Burroughs when he learned that I was born and reared on a farm. In deference to my training as a botanist, he told us about some of the rare plants he had found in that vicinity, especially the climbing-fumitory, or mountain-fringe, and the showy lady's-slipper.

Besides having both been farm-boys, and having a keen interest in the wild flowers, we discovered another common bond—our ancestors, on both sides, had been Old School, or "Hard-shell," Baptists.

Now of course we were eager to see Slabsides, for of all the homes associated with Mr. Burroughs, Slabsides is the best known. After luncheon, he conducted us up to this rustic cabin, which is located about a mile and three-quarters in a westerly direction from Riverby. We left the main highway, and followed a winding woods road which leads through

FALLS ON BLACK CREEK NEAR SLABSIDES
Near this point Walt Whitman, when visiting John Burroughs, sat on a fallen log and wrote a description of the region which was later printed in *Specimen Days*

INTERIOR OF SLABSIDES

Showing the dining table; a rustic chair; the partition-wall between the living-room and the downstairs bedroom, made of yellow-birch poles with the bronze-colored bark still intact; Mr. Burroughs' bed through the open doorway; and a young visitor on the stair

a beautiful stretch of hemlock forest. It was a fine day in early November, and as we walked along, Mr. Burroughs would occasionally pluck a gorgeous leaf from a young oak tree, and, holding it up between his eye and the sun, would comment on its beauty. I never realized until then how much more beautiful an autumn leaf is by transmitted light than by reflected light.

On the way through the woods we flushed a ruffed grouse, or partridge, as Mr. Burroughs called it, from the road in front of us, and it whirred away through the woods. We were all delighted with this glimpse of wild life. As Mr. Burroughs watched the bird's flight he said fervently, "I hope it will escape the gunners this fall." On many subsequent visits to Slabsides I have been peculiarly gratified to see this bird, or its tell-tale "signs," around the cabin.

Slabsides is so well hidden by the encircling hills that one comes almost upon it before seeing it. It is sheltered under the brow of a steep, rocky cliff. The weather-boarding is made of slabs with the bark still on—hence the expressive name. At the south end is a chimney connecting with the large fireplace within, built from stones from the near-by cliff.

On the inside, Slabsides, with its rustic furniture, and its partitions of yellow birch with the beautiful bronze-colored bark still intact, is even more attractive than the outside. There are rustic hickory chairs, and two wonderful rustic beds, with old-fashioned, home-spun, woolen coverlets, which Mr. Burrough's mother had had made. The bed in the bedroom on the first floor is built into the house and has a substantial and comfortable look. The one in the south room upstairs is even more picturesque. It is made chiefly of bark-covered yellow birch, the upright pieces at the head being of sinuately fur-

rowed and ridged horn-beam (*Carpinus*). The legs of the writing table are tridents of stag-horn sumac. The author told me that he had found these inverted, symmetrical tripod-formations more frequently in stag-horn sumac than in any other of our trees or shrubs.

That Mr. Burroughs had an eye for the picturesque in the natural forms to be found in the woods is evidenced many times in his cabin, notably in the arm at the end of a window-seat, in the hemlock crosspiece above the fireplace, made spiral by climbing bittersweet or some other twiner, and in the peculiar, X-shaped pine root over the door of the bedroom downstairs. This last, and another similar to it, which lies back of the front door in the living-room, had been dug up when the swamp south of the cabin was drained. Mr. Burroughs told me about also unearthing from this peat soil a piece of wood that had been cut by beavers probably hundreds of years ago.

It was in 1895 that Mr. Burroughs built Slabsides, in order to get away from the annoyances and interruptions of civilization. During the late eighteen-nineties and early nineteen-hundreds he did much of his writing there. Although his residence continued to be at Riverby, he spent considerable time at Slabsides during these years, sometimes staying only a day or two at a time, again remaining for several weeks, usually, however, with daily trips to Riverby to keep an eye on the vineyards.

All the wild life about this mountain cabin holds unusual interest because it has been so sympathetically interpreted in the essays of Burroughs. He named the region round about Slabsides, including that of Black Creek, "Whitman Land." Not that Whitman ever saw Slabsides, for the cabin was not built till several years after the poet's death, but Whitman had roamed with Burroughs about that region and had written a vivid description of Black Creek and its en-

JOHN BURROUGHS' BED

Note the X-shaped pine root above the bedroom door, and the stag-horn-sumac legs of the stand. The headboard of the bed is made of yellow-birch poles split in half, with bark still intact

virons, which is printed in his *Specimen Days*. Furthermore, Burroughs said that the sentiment of the wild and the elemental, which one experiences there, suggests these same qualities so characteristic of Whitman.

I learned on my first visit to Slabsides that John Muir, the Naturalist of the Sierras, had been one of Slabsides' earliest guests. He had come in 1897 and had spent some days there.

"Muir told us the story of Stickeen one night while he was there," said Mr. Burroughs, who added that it is one of the greatest dog stories in literature, ranking with Dr. John Brown's "Rab and his Friends."

Our host talked much of his friend Muir, their journeyings together in Alaska, and, a dozen years later, in the Petrified Forests of Arizona, the Grand Cañon of the Colorado, and in Yosemite.

It was especially interesting to hear Mr. Burroughs' lively account of the visit of President and Mrs. Roosevelt to Slabsides in July, 1903. They had come up the Hudson in "The Sylph" on the hottest day of the summer—96 degrees in the shade at Slabsides. The host and his guests walked from the river up to the mountain cabin. At luncheon in Slabsides, the President jumped up several times during the meal to refill his cup at the pail of cold water brought from the near-by spring. As he told us of the strenuous life of the President, and their experiences during the camping trip the previous spring in Yellowstone Park, Mr. Burroughs said: "There is no dead wood in Roosevelt."

At President Roosevelt's summer place at Pine Knot, Virginia, Mr. Burroughs visited him one May during the height of bird migration. The two friends went birding and worked hard all day to see how many species they could identify. In all, they found some seventy different kinds, two of which were new to the President and two of which were new to Mr. Burroughs. Had they found the Lincoln's sparrow, which President Roosevelt had seen there before, but which Mr. Burroughs had never seen anywhere, the President would have been one ahead.

"And," said Mr. Burroughs, "I had been studying birds more than fifty years."

He told about the difficulty he and Roosevelt had in identifying a female blue grosbeak. In closing this story, Mr. Burroughs said with emphasis, "Roosevelt knows the birds."

When our naturalist President dedicated one of his outdoor books to Oom John, as he was pleased to call Mr. Burroughs, he wrote him, "It is a good thing for our people that you have lived."

It was a delight to find a wild flower in bloom so late in the fall (November 6) on that memorable day when I had my first woodland ramble with John Burroughs—a little reddish-purple flower, the herb-robert. The tiny flower seemed quite at home when placed between the leaves of *Wake-robin*, which I had brought along in order to get Mr. Burroughs to inscribe it for me; and it still graces the little volume, properly mounted, and duly labeled, as the first botanical specimen I ever gathered while walking with Burroughs.

The hearty words which Mr. Burroughs said as he bade us farewell that evening at the little station at West Park, rang in our ears all the way back to New York:

"Whenever you want to come to Slabsides the key is yours!"

Could hospitality farther go? In response to this generous invitation, we have camped in the rustic cabin for two or three days at a time, about twice a year since our first visit. We have been there in May when the warblers were abundant, and we have been there the last week in November, with the thermometer down to twenty at night, when,

THE BRIGAND STEAK
John Burroughs and Clyde Fisher cooking a brigand steak,—the last that Mr. Burroughs ever cooked at Slabsides

instead of warblers around the cabin, we had the winter wren, the junco, and the chickadee. On one of these trips, Thomas B. Harned, one of the literary executors of Walt Whitman, was among the guests.

My last visit with Mr. Burroughs was during the week-end of November 6–8, 1920, the first of these three days being the anniversary of my first visit. We camped in Slabsides, and on the second day (November 7) Mr. Burroughs spent several hours with us at the cabin. He cooked one of his favorite brigand steaks for luncheon—the last he ever cooked at Slabsides. The brigand steak reminds me of the *shish kebab* of the Armenian restaurants, and I wonder whether there is any relation in the origin of the two.

It was an event to see Mr. Burroughs prepare the brigand steak, first cutting sticks of sugar maple about six feet long and about three-quarters of an inch in diameter at the larger end, and from there sloping down to the size of a thick lead pencil. He removed the bark from about eighteen inches of the smaller end and sharpened the tip. The steak was sliced thin—about three-quarters of an inch—and then cut into pieces about two inches in diameter. Besides the steak, there were sliced bacon and young onions. Yes, onions! Mr. Burroughs reminded us that cooking takes all the conceit out of an onion. It is necessary to have young, succulent onions, which do not fall to pieces when threaded upon the skewer or spit. I noted how deftly he ran the sharpened stick through the young onion, transversely just above the bulb.

First, he pushed a piece of steak over the point of the spit, following it with a folded piece of bacon, and then a young onion; again a piece of steak, the bacon, and the onion, and so on, in this order, as beads on a string. Having placed a big stone on the opposite side of the fire, upon which to rest the tip of the long,

slender spit, he rotated the prepared food over the fire, the while a most appetizing odor regaled the standers-by.

When I saw Mr. Burroughs thrust the brigand steak right into the flame, I said to him,

"Aren't you going to wait until the fire burns down to a bed of coals?"

"Oh, no," he replied, "the brigands didn't have time to do that. The smoke won't hurt it."

And it did not. It requires but a few minutes to cook a brigand steak. Salt it, and eat it while it is hot, and you will detect in yourself a fellow feeling for Robin Hood and all his merry band, and for life under the greenwood trees.

Accepting the Universe had been published shortly before this visit of ours to Slabsides, and as Mr. Burroughs was preparing the brigand steak, we talked of the new book, its author expressing keen pleasure at the evident warmth with which it had been received.

On the afternoon of that November day, I made my last photograph of John Burroughs, and what also proved to be the last photograph made of him at Slabsides. A few days later he started for California.

My last visit with Mr. Burroughs at Slabsides was almost an exact anniversary of my first, and we found, as on the first visit, the punctual little herb-robert blooming there. We found in bloom two other flower neighbors with whom the Sage of Slabsides had long been on friendly terms,—the climbing-fumitory, or mountain fringe, and the flower with which Nature says goodbye for the year,—the delicate, pale yellow bloom of the witch-hazel.

Toward evening, as John Burroughs left Slabsides to go down to the Nest at Riverby, we walked with him to the bend of the road, and there, under the hemlocks, bade him goodbye. It proved to be our last goodbye, for in the spring his earthly journeyings ended as he was returning home from California.

We shall never speak with him again, or feel the friendly clasp of his hand, or look into his honest gray-blue eyes, but he lives in our hearts. John Burroughs did perhaps more than any one else to open our eyes to the beauty of nature, and he has left us a priceless legacy in his books. But greater even than the poet-naturalist and philosopher is John Burroughs, the simple, genuine, human man.

HERMIT THRUSH ON NEST

TO JOHN BURROUGHS THE SONG OF THE HERMIT THRUSH WAS THE FINEST SOUND IN NATURE

A
Jade Belt
Ornament

MODERN METHODS OF CARVING JADE[1]

The Art of the Chinese Lapidary of Today Shows Many Advances Over That of Two Centuries Ago

By HERBERT P. WHITLOCK
Curator, Minerals and Gems, American Museum

IN all the manual arts the artist depends upon perfection of skill in the execution of his work rather than upon elaborate tools or accessories. The same kinds of brushes, the same form of palette, and to a large extent the same pigments with which Raphael wrought his masterpieces would serve equally well the painter of today.

A modern violin virtuoso actually prefers to play upon an instrument made by Stradivarius two hundred and fifty years ago. It is because the tools of these arts are simple that we have not improved upon them; because the hand and the eye are so essential that they are hampered rather than aided by mechanical contrivances. It is said that Ruskin produced his best etching with the broken tine of a steel fork.

What is true of all the manual arts is especially and significantly true as applied to the carving of small objects executed by the Chinese and the Japanese.

Between these two groups of artisans there are certain essential differences. The Japanese express their glyphic sense mainly through the medium of ivory and wood. The sole exception to this generalization, if we may call it an exception, is the fashioning of polished spheres from rock crystal.

On the other hand Chinese carvers work chiefly in the decorative stones such as jade, rock crystal, amethyst, chalcedony, jasper, rose quartz, carnelian, turquois, lapis lazuli, not to mention softer mediums such as serpentine, malachite, and amber.

Again, whereas the Japanese artists employ an elaborate realism, albeit often with a certain grotesque humor, the lapidaries of China conventionalize their subjects, frequently developing this conventionalization into a symbolism rich in significance and beauty.

The ivory and wood carvers of Japan sign their work, thus handing down their names to posterity, whereas the master-

[1]The carved jade pieces illustrated in this article are from the collection of Dr. I. W. Drummond and were recently presented by him to the American Museum.

POLISHING EDGES

The Chinese lapidary craftsman is polishing the edge of a jade carving on a wheel made of successive layers of ox-leather charged with putty powder, rouge, or ruby dust. The two treadles which are attached to the ends of the belt passing around the spindle are operated by alternate pressure of the feet. The direction of rotation changes with every stroke of the foot

DRILLING

Drilling a hole in a piece of jade is the first step in the carving of a snuff bottle or vase. The drill is turned by means of a bow operated by the right hand. With his left hand the lapidary is feeding abrasive paste to the drill

CUTTING

These two men are cutting a block of jade by means of a wire charged with emery. The wire is operated much as a cross cut saw is used by lumbermen. The boy in the middle of the picture is keeping the cut liberally supplied with a thin paste of emery and water

PRIMITIVE EQUIPMENT

The mechanical stock in trade of the Chinese lapidary is primitive in the extreme. The disk of metal with which the craftsman shown in the picture is cutting the block of ornamental stone, is charged with a paste of abrasive. Other grinding and polishing attachments lie at his feet

piece of a Chinese lapidary, however elaborately or skillfully it may be wrought, is never signed. It would almost seem as though to the patient and highly skilled artists of the Flowery Kingdom the execution of an admirable work constitutes its own reward.

The most ancient as well as the most interesting medium employed by Chinese lapidary artists is that group of mineral varieties known as jade. At present the sources of raw material for Chinese carved jade are as various as the material itself. From the Khotan district of Eastern Turkistan comes the white or nearly white nephrite known as *yü*. The dark green colors include nephrite from the neighborhood of Lake Baikal, and the opaque brighter green jadeite from Yunnan. The choicest emerald green jadeite known to us as "imperial jade" is mined in the Mogaung district in upper Burmah.

Simple as are the tools of the modern Chinese carver of jade they are probably many steps in advance of those used prior to the K'ien Lung Dynasty. With the reign of the Emperor K'ien Lung in 1736, Chinese art experienced a rennaissance which in the instance of jade carving found expression in a supple and intricate technique.

In all probability the advent of this impulse toward more elaborate work in jade carving found the lapidaries using some primitive form of rotary drill probably aided and supplemented by incised tool work such as we find the world over in early carved work in hard stones.

POLISHING TOOLS

For polishing the parts of an intricate carving the craftsman uses a small gourd skin or ox-leather wheel. In the actual cutting of the design even smaller abrasive wheels and drills are employed

Today the block of jade is cut into slices by an iron wire drawn across from side to side, a liberal supply of abrasive mixed with water being supplied to the cutting wire. A circular disk of metal, rotated in alternating directions by foot treadles and also served with abrasive, is used to rough shape the piece much as a draughtsman would use charcoal to roughly outline a design.

The design in relief and what under cutting is necessary is executed with wheels of various sizes and thicknesses all operated by the simple device of a broad belt passing over the spindle of the cutting wheel and drawn backward and forward by the pressure of the feet on treadles.

OLD JADE TUBE

Carved about 800 A.D., with an incised geometric pattern. This piece shows no evidence of having been worked with a wheel

JADE SWINGING ORNAMENT

This piece shows the remarkable skill with which the K'ien Lung lapidaries carved from one piece of jade three links of a chain and a swiveled joint

JADE BOWL

Ming Dynasty (A.D. 1368–1643). Great simplicity of design characterizes this piece. There is no ornament and the tools and methods used were most primitive

JADE DISK DECORATED WITH DRAGONS

The carving shows the elaborate detail in relief and under cutting of the K'ien Lung period, with drill and wheel work

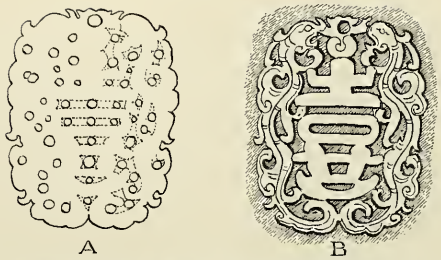
A BELL OF JADE

K'ien Lung period (1644–1912). This handsome piece is carved from old jade. The decoration shows elaborate drill and wheel work in sharp relief

OLD JADE BUCKLE

Decorated with a primitive incised pattern. Ming period (A. D. 1368–1643). The photograph shows the buckle mounted on a stand

When the design has been cut, the same device serves to rotate the polishing tools,—disks made of fine-grained wood or gourd skin, or ox-leather rolled into narrow but thick rolls and smeared with ruby dust.



JADE PENDANT
"A" SHOWS A THIN SLAB OF WHITE JADE DRILLED FOR THE INSERTION OF WIRE SAWS WHICH WILL CUT OUT ON THE DOTTED LINES OF THE RIGHT HALF OF "A". "B" SHOWS THE FINISHED DESIGN—THE SYMBOL FOR HAPPINESS SURROUNDED BY TWO DRAGONS AMID CLOUDS

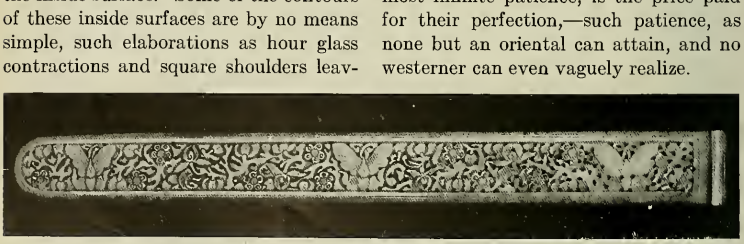
The intricate patterns of openwork which characterize many of the pendants and belt ornaments of the K'ien Lung period were achieved by numberless holes drilled through the thin jade plates in the corners of the design by the use of diamond drills operated by a wrapped bowstring. The holes thus made were connected by cuts made with wire saws, which neatly sawed out the piece represented by the opening. How this was accomplished in the case of a rather simple pierced work, is shown above.

The hollow which constitutes the inside of a snuff bottle is always cut before the outer surface. A hole is bored by means of a tubular drill which is rotated with a bow string to the depth needed. Then small lap wheels inserted through the neck gradually work out the shape of the inside surface. Some of the contours of these inside surfaces are by no means simple, such elaborations as hour glass contractions and square shoulders leaving us completely mystified as to how any rotating tool could have shaped them. The difficulty of the inside of the bottle having been successfully overcome, the outer surface presents no hardships being treated with various wheels like any other object.

For abrasives, the Chinese lapidary uses (a) yellow sand (quartz); (b) red sand (garnet); (c) black sand (emery); (d) jewel dust (powdered ruby).

It is with the last of these that the semi-final polishing is accomplished, the actual final polish being acquired by years of fingering and rubbing in the hands of generations of Chinamen who are the fortunate owners of such a piece.

These are the bare outlines of the jade carver's methods. It sounds simple, and so does the drawing of a bow across a violin string sound simple. One must remember that there are no sketches preceding these works of art. They must all be visualized before tool touches stone, and there must be no slip or mistake in the execution of the design. Patience, almost infinite patience, is the price paid for their perfection,—such patience, as none but an oriental can attain, and no westerner can even vaguely realize.



JADE MANCHU HAIRPIN
CARVED WITH THE OPEN PATTERN OF THE K'IEN LUNG PERIOD. THIS TECHNIQUE INVOLVED THE DRILLING OF MANY HOLES WHICH WERE SUBSEQUENTLY CONNECTED WITH CUTS MADE WITH A WIRE SAW TO FORM THE OPEN PARTS OF THE DESIGN

American Museum Photograph

The Beaver's Hut in Winter is an Impregnable Fortress

WHEN WINTER COMES TO THE MAMMAL WORLD

How Nature Provides During the Cold, Lean Months for the Survival of Many Warm-blooded Animals That Live in Variable Climates

By ROBERT T. HATT

Assistant Curator, Department of Mammals, American Museum

As the earth spins along its circuit of the sun, tilted as though Atlas was wearied by the weight of the land masses of the North, there comes a period of the year in which the northern hemisphere receives too little solar radiation for our comfort. The mercury in the thermometer emulates the woodchucks and hides away in its nest at the bottom of the tube. Waters expand, and the still lakes develop hard, slippery coats over their upper surfaces. Such water as drops from the sky stays on the ground as a mantle which levels the terrain and robs the landscape of all its familiar little features.

To the mammals, descendants of the tribe of scaly sun baskers, this is a catastrophy that must be avoided or overcome. Plant food is largely hidden, the entrances to the dens are masked, scent is killed. Land movers flounder in the drifts of snow, tunnelers find the ground too hard to dig, and swimmers may search in vain for air holes in the ice. The predator finds its dark summer coat too conspicuous against the new, white background for a successful stalk, and the preyed upon finds it difficult to hide from the foe. Light summer coats are inadequate protection against the penetrating north winds and no amount of shivering keeps the thinly clad mammal warm.

To flee the hostile winter is beyond the powers of most mammals and the only species which make migrations comparable to those of birds are such ocean dwellers as the sea lions and the whales. Bats and many others do migrate from one district to another but in no known case is the movement a very long one.

Some mammals which stay in or near

American Museum Photograph

BETWEEN SLEEPS

Between the seasons of snow the bears feed well and become as fat as pigs, so that by the time winter comes these great beasts are able to sleep through it

the summer range spend the winter in a profound comatose sleep called hibernation.

There are many of these great sleepers, among them bears, ground squirrels, woodchucks, chipmunks, skunks and jumping mice, chiefly members of the lower orders of mammals whose temperature regulation is less perfect than that of higher creatures.

A bear, whether polar, grizzly, brown or black, when it lives in northern latitudes or high mountains, feeds bounteously in the summer and autumn so that by the time winter sets in in earnest, bruin does not need to feed. For several days, if he is healthy, he will not eat. His stomach bunches up into a hard muscular knot bearing more resemblance to a gizzard than the distended bag of the berry season. Days or weeks before this the creature has probably hunted out a crevice in the rocks, a protected place beneath a fallen tree or some other site where the snow will drift. Here he doses off into a deep sleep which is more or less continuous until spring brings him forth.

The bear's sleep is not always profound, however, as is attested by the tales of hunters who have broken in on it. The cubs are born here in the winter den and the she-bear has not the advantages of a continued twilight sleep to help her in her travail. Her fat of the previous summer must sustain not only her through the long retirement but also the growing twins. Perhaps it is for this reason that bear cubs at birth are smaller in proportion to the size of their mother than any North American mammal other than the opossum. But in spite of all this drain on its resources, the bear is usually fat even when it comes out from the winter den and may not eat for a few days.

People do not often become over-inquisitive about bear dens, but many of us have disturbed the smaller sleepers, and from these our knowledge of hibernation comes.

Many changes occur in the animal when

MEADOW STORE

The meadow mice most frequently keep their houses under ground in winter but sometimes the grassy globes of the upper world are used the year around, and in winter the snow may be found melted just above the nests

Photograph by R. T. Hatt

it hibernates. The rodents curl up in a ball, their nose tucked tightly in between the rear legs, and the tail, such of it as there chances to be, coiled about the body. In this manner the animal presents the least possible surface to the cold world. No motion is perceptible except occasional shallow breathing movements. These latter in a ground squirrel are only about one-one hundredth of the average rate when awake—their number decreasing with lowered temperature. If respiration ceases entirely for several minutes the animal never breathes again. Heart beats drop to an eightieth of the number counted during normal slumber and the circulation becomes so sluggish that from a deep cut, which in summer would show spurting blood, now but a few drops ooze out. The body temperature sinks down to within a few degrees of the air temperature, and if the thermometer registers much below freezing, the animal's seeming death becomes actual.

The senses of the animal, if hibernation is deep, are functionless. Neither light, noise, nor touch disturbs it. More than one incredulous person has dissected out a nerve of a dormant rodent and pinched it without the animal exhibiting response.

Metabolism is however not entirely suspended, as proved by the observation that hibernating squirrels lose as much as forty per cent of their autumnal weight.

Waking may be produced by handling the animal for a long time or by warming it, and such waking usually occupies an hour or more, though this may be hastened. The golden-mantled ground squirrel shown on page 523, though so far below the level of activity that it would not move if pinched, under the influence of the bright sunlight uncurled and ran away in seventeen minutes. The waking-up process is often

THE JUMPING MOUSE

Though most of our mice keep active under the snow, the jumper rolls up into a tight ball, wraps his long tail about him, and all but suspends life itself, until the season of flowers

Photograph by M. C. Dickerson

Photograph by R. T. Hatt

FROSTED MUSHROOMS FOR A CHICKAREE

The red squirrels cut and dry great numbers of mushrooms which they hang in trees and seek out again when better foods are gone

first evident in shaking movements and a lessening in the tension of the flexor muscles. The head rocks violently. If touched on the face at this stage the head moves towards the pressure but the eyes remain closed and the animal makes no move to bite. The eyelids part slowly but for minutes after the eyes are open they seem not to see. The fore limbs gradually become active, and, eventually, the rear feet come under voluntary control so that the animal, senses alert, may run away.

The woodchuck is one of the most profound sleepers of the lot but is not so regular in his habits as he is given credit for being. These animals usually retire at the end of September, and, if the weather is mild, may come out on the appointed ground-hog day; but probably it is not their shadow that sends them back to the den for a last wink before the busy spring season comes.

Our several species of tree squirrels curl their bushy tails about their noses and remain quiet during days of very stormy weather but they do not hibernate even at the northern limit of tree growth.

The chipmunk sleeps from the first of November to March, but he buries a good supply of food in the winter den, and it is suspected that he frequently wakes up enough to slip out to the pantry to satisfy a well-earned appetite.

The winter sleep of bats may be called a hibernation for it is a long period of inactivity, yet their slumber is light, and a little handling will cause the animals to shake off all lethargy. Some of the species, at least, hang up in the warmest place that they are able to find. I remember finding a pair of brown bats suspended from a beam in the boiler room of a large building, but these, though I took them in midwinter, were wide awake.

Mankind has been so jealous of the ability of the "lower animals" to lie dor-

GRAY HARVESTERS

The gray squirrel, though less of a northerner than the red, has the instinct to put away food for the winter strongly developed, and without hibernation spends the winter comfortably

Photograph by M. C. Dickerson

mant, needing nothing, wanting nothing, for the bad months of the year, that a long line of researches has centered about the subject. So far have the researches gone that it has proved possible to produce in dogs and cats a state simulating the hibernation of animals that normally undergo this annual sleep. These mid-summer hibernating dogs and cats have been anesthetized, cooled off in a cold bath, and given insulin. Several hours later, with the blood sugar concentration greatly reduced, the animals did not shiver even though their body temperature was 30 degrees below normal. Wide-awake woodchucks, given enough insulin to produce a profound deficiency of blood sugar, pass into deep hibernation even though but moderately cooled. Ground squirrels, whose natural habits include the comatose sleep of the snow months, are encouraged to hibernate by obesity, by reduced food rations, low temperatures, and even confinement.

Photograph by R. T. Hatt

HIBERNATING GROUND SQUIRREL

Hibernation is a close approach to death. The heart slows down, breathing all but stops, and the animal is without sensation

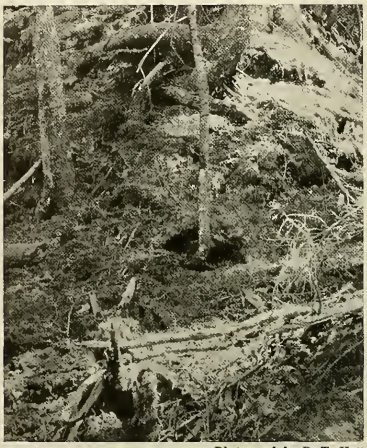
Many are the animals that stay near their summer homes without hibernating, and there probably is not one of these that does not insulate itself against the cold by donning a new coat of thick winter fur and by laying on fat. Some animals specialize in fur and others in fat. The porcupine for example could find little comfort in his coat if he did not carry beneath it enough suet to insulate an ocean dweller from the water's constant cold. Man's best fur supply comes not from the creatures whose fat is their chief defence against the cold, but from those who beneath a sleek guarding layer of long, thick hairs carry a dense, velvety mat of soft, woolly fur. The best of these pelts are found on the flesh-eaters and the water-dwelling rodents. The latter must face the problem of keeping a layer of air next to the skin, and they do this in the same way as the flesh-eaters whose enemy environment is the cold air. The beaver was once the basis for the great fur trade that first carried the civilization of the Old

A WINTER SLEEPER

The chipmunks busy themselves in autumn getting fat and putting away stores of food that must be used to satisfy a yearning for something to eat in a mid-winter awakening

Photograph by M. C. Dickerson

World into the north and west of America. Commodities were priced in beaver skins and these at the trading posts largely took the place of money. Today the range and abundance of the beaver has so decreased that the animal is a minor item in the fur business, but its little cousin, the muskrat, which parasitized the beaver ponds in beaver days has taken the dam builder's place as the chief item of the fur trade. Louisiana's broad marshes produce a major share of the crop, and the value of these furs is double that of all furs from all species produced by any other state, and very nearly double that of Ontario, the greatest fur-producing Canadian province. The total number of Louisiana pelts is close to that produced by the whole of the northern Dominion.



Photograph by R. T. Hatt

A CHICKAREE'S WAREHOUSE

Near the nest tree the little red squirrels put away underground both cones and nuts that they dig out when other supplies fail them

Though the pond- and stream-dwelling vegetarians give us many fine pelts, the most prized furs are borne by the rarer flesh-eaters. Sable, silver fox, and otter are famous for the beauty and the luxuriousness of their coats, and these are so much in demand that the creatures who bear them are now bred as farm animals, though not easily.

The caribou has a coat which, though without the air-retaining under-fur, is both light and warm. Each one of its hairs is a hollow cylinder of air and these hairs are so closely packed that the coat is as perfect for its purpose as any that we know.

If the animals had to carry these heavy, warm winter coats throughout the year, they would weary of the summer, so nature has provided that all mammals living in the zones of well marked warm and cold seasons may change their clothing twice a year.

The bi-annual shedding and replacement was most probably at first a provision for thermal regulation, but now among some species other changes than the heat-adjusting mechanism have followed with the shift, and these adjustments seem to those of us who would see harmony in everything, as adaptational. As was observed before, the obliterating summer color pattern of our mammals stands out against the snow as conspicuously as a white sail against the blue sea. A few of our four-footed neighbors have been so lucky as to have mutated or otherwise produced a causative factor for the winter appearance of a white coat. The weasel turns to ermine in the winter, the arctic fox changes from blue to white, the Greenland hare from a grayish tone to the shade of snow. The shifting shades are not quite absolute. The ermine holds the tip of its tail black, the northern hares the tips of their ears. And, as we must be logical, we excuse these slips of Nature's fitness by stating that the hares and ermines keep the black beauty spots so that their *friends* may find them.

It is good fortune for the species that the change in color does not follow the species and the calendar wherever the creatures go. Our southern weasels in snowless areas and the arctic hares in regions of perpetual snow are allowed to keep their most favoring coat color the year around. Hair is one of Nature's great inventions, possibly the greatest single one to which the mammals lay claim. It allows them to retain their heat, to change their color; it keeps off the rain, protects the skin from the scratches of vegetation and the fangs of foes. Some northerners have found another use for it: to broaden their feet that they may walk lightly over the drifted snow where small-footed animals would sink in to their bellies. The snow-shoe hare has gained his name from such a winter change of feet. The bob cat, too, expands its silent paws with a growth of stiff hairs, as though he had learned a lesson from his principal object of pursuit. The moose has been hard pressed by winter snows and has taken to long stilt-like legs that he may keep his belly well above the drifts; but even with this advantage over the deer, the deep northern snows prove too much for the species and, instead of wandering at will to browse where fancy dictates, a lone bull or a cow and her calf will take to some sheltered place of abundant food and, by moving back and forth over the space of a few acres, keep a well-packed yard free for their feeding and their exercise. As one section becomes exhausted of food, they will enlarge their yard to include new trees, or the animals will set out to establish a new stamping ground. Gunners take advantage of the yarded moose and easily shoot them when they are forced to leave their home circle for the treacherous drifts.

Photograph by R. T. Hatt

A DESERT HUT

The desert wood-rats build great, trashy houses full of thorns that in winter are blanketed with snow and must approach the comfort of a beaver's lodge

There are few mammals that circumvent the winter spectre by migration, for most of them are not capable of the long period of trek. Some seals, sea lions, and certain whales spend their summers in the northern

A SQUIRREL'S IDEA

One summer a camp's supply of candles mysteriously disappeared. Later this cache was found, and the campers knew that a red squirrel had a new idea concerning winter food

Photograph by R. T. Hatt

Photograph by R T. Hatt

AFTER GROUND-HOG DAY

The woodchuck sleeps deeply and the winter puts his home in disrepair. His reawakening is signalized by the fresh lot of earth pushed out of the hibernating den

latitudes and breed there, but move southward before the ice. The sea lions probably do this to fol'ow up the southward moving shoals of fish, the whalebone whales to feed where micro-organisms are the most abundant.

The caribou make great shifts in their feeding ranges but these shifts are not regular, and the Indians of Canada who look to these great herds of deer for meat to carry them through the winter do not know in advance where they must intercept the drift. It has often happened that a band of Esquimaux or Indians have perished in their search for the moving herd. Our western wapiti are more regular in their movements, but here the mountainous terrain gives the animals little choice of the routes that they shall follow. In the Yellowstone, one large group, the "southern herd," a diffuse mass of some 19,000 individuals, moves southward over the boundary of the Park into the Jackson's Hole region. At the moment of crossing the border of their summer refuge thousands have been slain by hunters who knew exactly where to expect them.

The mountain sheep and mountain goats, most wary of our game, spend the summers high in the hills, but the snows that early reach the peaks force the sheep to move down into the valleys and make it necessary for the goats to go below timber line. These creatures have a danger confronting them that even the most mountain-wise old billies cannot inevitably escape, the snow slides or avalanches, which in spring thunder down the steep slopes and completely wipe out everything in their way.

The seasonal movements of bats, though our ignorance concerning these is greater than our knowledge, are apparently chiefly local changes of habitat and hardly true migrations. The bats of our latitude are dependent on the insect supply, and when this fails with the onset of cold weather, the bats spend their time in sleep. Some species at least change their abodes from the cool, well aërated summer roost to a warmer or more protected site, where they are less likely to be discovered by the naturalist. It is improb-

Photograph by R. T. Hatt

THE PRAIRIE DOG'S HOME

Though prairie dogs may be seen on sunny days out on the snow, they usually keep inactive and live on their summer's fat

able that any phase of North American mammalogy is in a more virginal state than the study of the seasonal movements of bats, and any group of bird banders that switch their attention to these more elusive flyers will, if they can recover some of their bands, reap a harvest of unique information.

Few carnivores store up food, for most of them are too particular to touch meat that is long hung, and even though they choose to keep their kill for their own later consumption, flesh has a way of announcing its presence to a large and greedy population. The European mole is the best example of a carnivorous mammal that stores its food. It is known that it paralyzes earthworms and stores them away in great balls for future use, presumably the winter. Such proceedings have not yet been observed in this country, but this may only await the proper combination of patient investigator, trowel, and luck.

Vegetarians may provide better for the winter since their food will preserve more

Photograph by R. T. Hatt

A RABBIT'S FIND

The rabbits are not as provident as their cousins, the conies, and must hunt over the snow for the slender pickings that are left them

Photograph by H. E. Anthony

MOUNTAIN HAY

Up among the rocks the little conies make hay while the sun shines, to nourish them through the winter. The rock shown above is sheltering a thrifty store

readily. Some squirrels store nuts, mushrooms, truffles and cones. Our gray squirrels, above all southern creatures, are improvident and scatter their savings in countless little pockets which probably they may locate again only by chance, but the industrious little red creature of the North saves everything and tends to centralize his holdings. When the mushroom crop is at its height he eats his fill and then carries a bounteous supply of the left-overs to the trees where they are left to dry. Alaskan naturalists describe the mushroom storehouses of the squirrels as resembling Christmas trees. Around New York the worldly-wise squirrels do not put all their eggs in a single basket but, in fear of a raid, scatter the wherewithal for Christmas cheer. Cones of spruce, pine, balsam and of arbor vitæ are put away under ground while they are green so that the seeds will not be scattered by the wind. Under one rotted stump I dug out the winter playhouse of a pair of squirrels, and leading off from this, several pockets in which were more than one hundred cones.

WATER MIGRANTS
The sea lions give birth to their young on land, and for this they seek isolated islands in the far north; then, as winter approaches, they move southward along the coasts to warmer fishing grounds
Photograph by R.C. Andrews

The beaver cuts branches in the summer season which it sticks into the mud bottom of its pond. These soon become water-logged and stay well in place. In winter, when the lake is frozen over, a short swim out from the lodge to the underwater pantry is all the trouble that is necessary to obtain a meal. Usually these stores are of the beaver's favorite trees, aspen and the various soft woods of the stream border, but where food is scarce they will eat even the bark of the conifers and will store branches of these for the winter.

Two animals of the mountains of our West are haymakers, the cony or rock rabbit, and the "mountain beaver" or sewellel. This latter animal though living near streams is not the water-loving creature that it is commonly supposed to be. It cuts the vegetation into convenient lengths and drys it in low bushes or across logs. Some naturalists state that the sewellel uses this hay only for nest building but inasmuch as storerooms of it have been found carefully plugged up with solid balls of earth it seems probable that the animal may, if hungry, steal a little nest material to satisfy its appetite.

The creature that has made the Rocky Mountain rock slides famous is the rabbit's dwarf cousin, the cony, haymaker or pika. He does not live out in the barren center of a great talus, but within one hundred yards or less of its border where he may make forays to the surrounding green world in search of food. This he cuts and piles up beneath the shelter of some rock, where, nevertheless it will catch the sun and ripen. The cony is diurnal as strictly as may be, yet if a rain comes up at night out he comes to save his hay and carry it beneath the safety of the rocks. It is an old mountain fable that one may judge the severity of the coming winter by the size of the pika's haypile, but there is no reason to

SPRUCE UNDERWATER
Long before the season of ice, the beaver prepares for winter by sinking a copious supply of branches beneath the water. These soon become waterlogged and stay well in place
Photograph by R. T. Hatt

A SOURCE OF BEAVER FUR

The bark of the quaking aspen is the beaver's favorite food. With the denuded branches and logs, this giant rodent often builds the dams and huts that so moderate its winter life

Photograph by R. T. Hatt

believe that this lowly lagomorph can foretell the weather better than the dominant primate.

The summer nests of mammals are not always suited to the winter weather. The gray squirrel prefers to spend the warm weather in a lightly built "dray" out in the tree limbs, but in winter he appreciates the solid comfort of a hollow tree. Through the greater part of the range of the red squirrel, hollow trees or empty woodpecker holes are scarce, and the animals spend the winter between their underground nests and in the outside drays which usually become frozen solid early in the winter.

The meadow mice spend the breeding season, which in the East is by far the greater part of the year, in the grassy spheres which they construct on the surface of the ground, but usually with the passing of Indian summer they desert these for smaller nests along their subterranean burrows.

Beaver do not seem to alter their huts for winter. Indeed, it seems doubtful that they could improve the construction. The walls are always damp and in the summer must keep the interior cool. In winter these walls freeze as solidly as the lake surface, except for the ventilation shaft at the summit, and must keep the animals warm. Certainly the walls of the hut are, when frozen, impregnable to any enemy but man.

Muskrat huts are built freshly in late summer or the old one patched up at this season. At this time the population is at its peak and new houses are in demand. During spring and early summer the old individuals are busy with young and have little time for nest building. If these duties of construction are put off too long, however, the vegetation sinks to the bottom and rots, or early freezing catches the animals with their task undone.

A MASTER BUILDER

Largely because the beaver in winter is well sealed in his thick-walled hut and ice-coated pond, he has no enemies but man at this time of year

American Museum Photograph

Photograph by La Rochester, Mexico

Pyramid of the Sun, San Juan Teotihuacan, Mexico

ENLIVENING THE PAST

Models of Four Ancient Temples in the American Museum Suggest the Majesty of Bygone Times in Middle America

By GEORGE C. VAILLANT

Associate Curator of Mexican Archæology, American Museum

THEIR cases jammed with serried ranks of imperishable objects in pottery and stone, the American Museum's halls of archæology offer to many of its visitors a prospect of unmitigated boredom. The new halls of animal life, on the other hand, disclose captivating vistas of nature in their wondrously well-executed habitat groups. The inference is very naturally drawn that by a similar arrangement the archæological halls would be relieved of their monotony. In point of fact, had we the data to make them, there would, indeed, be habitat groups of the people of the past; but an examination of any one of these vital presentations of animal life will show that the charm of its realism depends upon details of fur and leaf and feather, perishable substances which are lost by decay in the course of time.

There are stimulating representations of the life of the Plains and Southwest Indians in the ethnological sections of the Museum, but in the case of these models and life groups, there are accessible for observation living Indians who still retain their native dress and customs, traits rarely recoverable from a bygone people studied by the trowel and spade of archæology. Moreover, these living Indians have a more or less simple and unified existence so that in a relatively small compass one can span the extent of their activities. It is apparent, therefore, that a successful reconstruction of a human group depends largely upon its primitive quality and its present existence. The social fabric must be simple in order that every important phase of the culture be depicted, and the people must be living so that knowledge and not inference may

govern the creation of those details that give vitality as well as verisimilitude.

Presentations have been made of details of more complex social orders, like the historical models in the Museum of the City of New York and elsewhere. Instead of a cultural cross-section, episodes are shown in this case which are buttressed by a rich literature not only of history, but also of social mores and individual personalities. Rome, Greece, and Egypt offer equivalent sources of information for the creation of similar models; and wherever the literature is inadequate, it is possible to refer to wall and vase paintings, and to the many perishable objects still preserved. So detailed a background is lacking when one attempts a life group illustrative of Middle American civilization. Dr. H. J. Spinden did achieve a very successful Maya group at the Buffalo Museum of Science, but the indigenous sculptures are often too conventionalized to be useful, and the Spanish chroniclers give, in last analysis, accounts of ceremonies too impressionistic to be of much avail in depicting a specific rite. Furthermore, the masses of figures necessary to vivify such a scene cause the sculptor profound technical difficulties in the amount of work involved, not to speak of such obstacles as the absence of data on details of costume and on the correct ritualistic arrangement of the participants.

Models of important temples offer one of the best ways at our command to recapture the spirit of the past in Middle America. They not only suggest the majesty of bygone times, but also indicate the course of cultural evolution in the development of architectural styles. A thoughtful person, contemplating these models, can richly savor the past as he peoples the temples according to his fancy and equips the imagined ceremonials with the objects in the cases.

Photograph by La Rochester, Mexico

THE TEMPLE OF TEOPANZALCO, CUERNAVACA, MEXICO

One of the best preserved Aztec temples. The original temples and stair are in the background; the stair of a later superimposed building rises in the foreground

Perhaps the mind is more stimulated by such suggestion than by the observation of a conception whose every detail is indicated. But we must defer judgment on this point until we can realize the effect upon visitors of the four models acquired last year for the Mexican Hall, which supplement notably those already on exhibition.

Each of these models represents a different civilization significant in the history of Middle America; they comprise examples of the architecture of the Mayas, the Totonacs, the Teotihuacan-Toltecs, and the Aztecs. The Teotihuacan-Toltec and the Aztec models were obtained through the generosity of Mr. Clarence L. Hay, secretary of the Board of Trustees of the Museum and sponsor of the program of stratigraphical research in the Valley of Mexico. The Maya model was the gift of the Carnegie Institution of Washington, and the Totonac model was donated by the Ministry of Public Education of the Mexican Government. These last two models enhance their historical value by commemorating the spirit of coöperation in research which animates the work of three great institutions, the Ministry of Public Education which, besides carrying on a program of significant archæological research in Mexico, preserves as national monuments its most important ruins; the Carnegie Institution which is attacking Maya history not only from the point of view of archæology, but also in its biological, sociological, and historical aspects; and the American Museum of Natural History which for the last four years has been working on Mexican chronology by the stratigraphical method. A brief description of the originals of the models will make clear to the reader the historical significance of our new acquisitions.

THE GREAT AZTEC CALENDAR STONE

The original is some twelve feet in diameter and its present weight is twenty tons. It represents the disk of the sun and the history of the world

The Totonacan model given the Museum by the Mexican Ministry of Public Education portrays the best preserved building at the ruins of Tajin, near Papantla, which lies in the jungles of the north central portion of the State of Vera Cruz. Although there are several tree-covered mounds in a disintegrated condition, this structure alone is well enough preserved to give an idea of its original state. The base of the pyramid is some thirty-five meters square and is composed of a hearting of rubble veneered with dressed slabs of volcanic stone. This substructure rises in six terraces to a thick-walled cella or temple whose walls are so designed as to give the effect of a seventh terrace. Cornices and rows of niches which are symmetrically disposed and originally contained statues, relieve the monotony of the vertical faces of terrace and temple wall. Access to the top was gained by a stair on the east side, consisting of a broad central flight broken by three groups of niches and flanked on either side by two narrower flights.

Although the Mexican Government has had a custodian at the site for many years to protect it from vandals and the

ever-encroaching jungle, no prolonged study was undertaken until this year when Dr. and Mrs. H. J. Spinden of the Brooklyn Museum cleared several buildings and made some important studies, an account of which they are soon to publish. Hitherto, the site had been visited by several scholars, who photographed and measured it and assigned it to the Totonac civilization without any implication of great antiquity. Since the finest sculpture in Mexico comes from the Totonac area and since the Spindens have begun their fruitful research, we are exceptionally fortunate in receiving from the Mexican Government an example of the architecture of these gifted people.

The model donated by the Carnegie Institution represents the most ancient Maya building known, Temple E VII-sub of the site of Uaxactun which is buried in the almost impenetrable bush of the Peten district of northern Guatemala. It forms part of a complex of buildings surrounding one of the several plazas which comprise the site. Mr. Sylvanus G. Morley discovered the ruins in his search for Maya cities and gave it the name Uaxactun, Maya for Eight Stone, in honor of the Eighth Cycle dates on the monuments, the earliest Maya stelæ ever discovered. Later Messrs. Ricketson and Amsden began excavations of the same plaza in which the stelæ were found, and while digging into a ruined pyramid, they came upon a corner of this structure within. The succeeding season Mr. Amsden cleared away the covering pyramid E-VII, and brought to light temple E-VII-sub in as good condition as the day it was finished. For some reason the Maya in enlarging the plaza had decided to cover up this building with another structure which, although itself disintegrated by the jungle growth, had preserved the temple it supplanted.

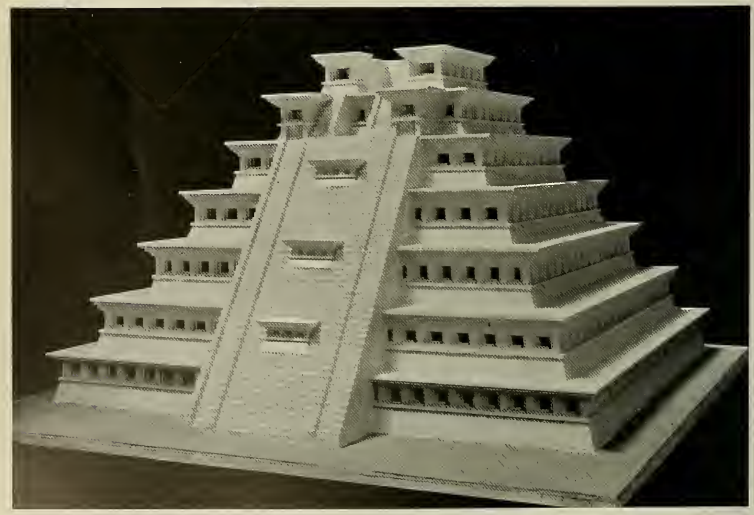
Temple E-VII-sub was built of rubble which was then covered with plaster, and in that soft medium, the ornamental masks were carved. There was no building on top of it although holes were found as if to socket the poles of a canopy. It has little of the appearance of a characteristic old Empire building. Dr. A. V.

CAST OF THE NATIONAL STONE

An Aztec sculpture which might be called a model, since it probably represents the Calendar Stone (page 532) set on a pyramid (page 531). The original is about a metre square and is richly adorned with carvings pertaining to worship of the Sun God

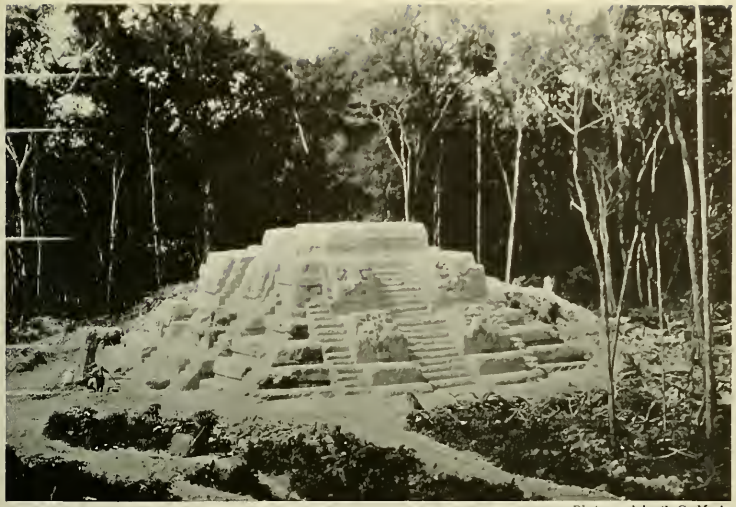
THE TEMPLE OF TAJIN, CENTRAL VERA CRUZ, MEXICO

Bands of niches, which probably contained statues, are built into the stair, the temple walls, and each of the six terraces



MODEL OF THE TEMPLE OF TAJIN

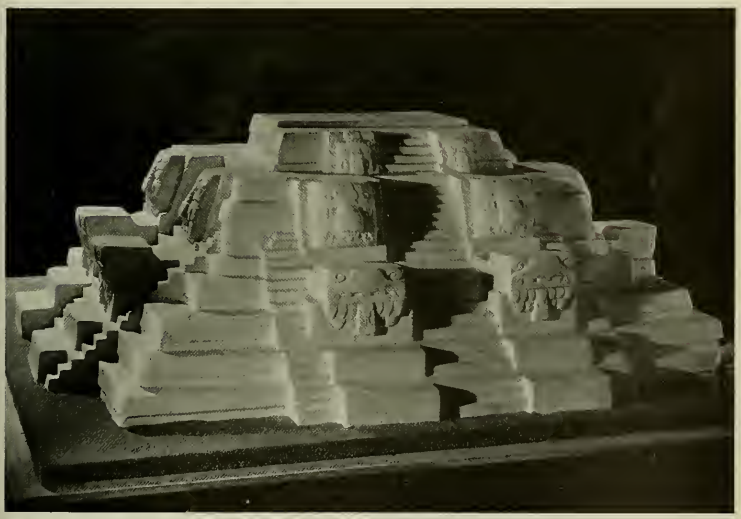
Donated by the Mexican Government. This gives an impression of the stateliness of the building before vegetation had begun its destructive action. Observe the decorative effect of the niches



Photograph by S. G. Morley

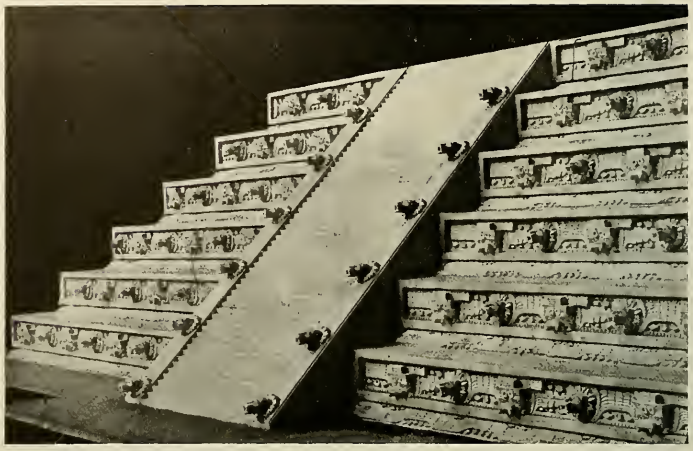
UAXACTUN, GUATEMALA, TEMPLE E-VII-SUB

Just after excavation. Its perfect preservation is due to the superposition of another building over this structure. Note the heavy jungle



MODEL OF TEMPLE E-VII-SUB AT UAXACTUN

Donated by the Carnegie Institution of Washington. This is the oldest temple yet discovered in the Maya area, and comparison with the photograph above shows its remarkable preservation



MODEL OF THE TEMPLE OF QUETZALCOATL

This is the most ornate building discovered at the Toltec ceremonial center of San Juan Teotihuacan. Note the alternating heads of Quetzalcoatl, the Feathered Serpent, and the Obsidian Butterfly, two of the chief divinities of these ancient people

Kidder, chief of the Division of Historical Research of Carnegie Institution, and the writer, then a guest of that Institution, visited the site that year and made excavations which proved this temple to be older than the stela before it, thus substantiating the evidence of antiquity offered by the non-Maya quality of the architecture. Moreover, in digging underneath Temple E–VII–sub we found beds of débris yielding pottery and figurines cruder than any group of Maya pottery encountered before, a discovery which led to intensive work by Mr. Ricketson the following year.

The site of Uaxactun is then of consummate importance in Maya archæology by reason of its early dates and the stratification which produced several stages of an archaic Maya civilization. To have an example of proto-Maya architecture in the Museum, with the models we already possess, will make it possible to show much of the evolution of Maya architecture. Furthermore, the spirit of fostering the research of other scientific organizations which the Carnegie Institution has displayed is well exemplified not only by this magnificent gift, but also by the many courtesies extended to the writer.

The Toltec-Teotihuacan model, which is still under construction, represents the Temple of Quetzalcoatl at San Juan Teotihuacan. It is as important to the archæology of the Valley of Mexico as Temple E–VII–sub is to that of the Maya. This temple was uncovered by the Mexican Government at Teotihuacan during the excavation and reconstruction of the mound groups called the Ciudadela, when, in the trenching of a large mound, an ornate façade was disclosed. This had been preserved like the Maya pyramid by the ancient custom of using an existing structure as the core for a newer and larger building.

The stairway and front façade of the substructure were well preserved, but the corrosive forces of weather and neglect,

coupled with certain demolitions demanded by architectural necessity, have razed the temple and destroyed much of the façade on the other three sides. The construction of this foundation, like that of practically every Middle American building, was of rubble veneered by cut stone. The platform rises in six terraces, each of which is framed by a cornice and rests on a sloping foundation. Within the frames are set projecting heads of the Obsidian Butterfly, a much revered Toltec deity, and the Feathered Serpent which symbolizes Quetzalcoatl, the eponymous hero of the ancient Mexicans. The sinuous coils of the Feathered Serpent, with various kinds of sea shells carved in the spaces left by the undulations, form a background to the heads, while his body in profile adorns the sloping foundation. Heads of the same divinity are set in the balustrade of the stair. All these ornamental details were painted and the eyes of the divinities were made of inlays of obsidian.

The site of Teotihuacan is dominated by two great pyramids, called according to legend the Sun and the Moon. A series of plazas, composed of small sub-structures surmounted by buildings and joined by long platforms, are disposed with vague symmetry around them. The largest of these groups is the Ciudadela wherein the temple of Quetzalcoatl is situated. In almost every plaza there has been a reconstruction whereby, as in the case of this temple, the original buildings were covered up to act as foundations for later structures. Yet none of the earlier or the later buildings are as elaborately carved as the temple of Quetzalcoatl, although many are richly adorned by frescoes. If one could know the relationship between the various stages of building in the site and tie these relationships in with the sequences of pottery and figurine styles, one would greatly advance knowledge of Mexican archæology. To this problem the next season of stratigraphical work in the Valley of Mexico is to be devoted. Consequently, if we are successful in our work, the Temple of Quetzalcoatl will loom large as a time

THE TEMPLE OF QUETZALCOATL, SAN JUAN TEOTIHUACAN, MEXICO

The building at the left of the picture was erected over the original temple and this preserved its ornate façade, even as the Uaxactun temple was preserved. (See page 535.)

marker in Mexican history, besides being a magnificent example of pre-Columbian architecture in the Valley of Mexico. It is especially fitting, moreoever, to have a model of this temple, since the Museum possesses through the generosity of the Paramount-Famous-Players-Lasky Corporation one of the original heads which is the only architectural detail of the monument outside of Mexico.

Our model of Aztec architecture is the cast of a stone sculpture, about four feet high and three feet square, now in the National Museum in Mexico. It was discovered in the foundations of the National Palace in the Eighteenth Century, but it was too heavy to move although its position was carefully noted. In 1926 the sculpture was extricated successfully and removed to the Museum. It represents apparently a pyramid surmounted by the great Aztec Calendar Stone, but the sides and top are so ornately carved that it is unlikely that an exact replica was intended. The figures and inscriptions have been minutely studied and two interpretations have been made of its purpose. The carving on the back depicts an eagle killing a rattle snake which signifies in Aztec glyphs the founding of Tenochtitlan or Mexico City. Since this device is used on the coat of arms of modern Mexico, the sculpture has been called the National Stone and is thought to commemorate the prehistoric founding of the Mexican nation. The second interpretation, that of Professor Caso, which is more probably correct, ascribes a more esoteric purpose to the sculpture; namely, to symbolize the sacrifices men and gods must make to enjoy the Sun God's favor. According to this theory, the eagle and the snake are part of the symbolic aspects of the sun in the west as opposed to those of the rising sun depicted on the front of the monument. Thus, by this miniature of the calendar stone on its pyramid the Aztecs epitomized their theology.

Our collections already contain such leading examples of Maya architecture as temples from the Old Empire site of Tikal and from the New Empire cities of Palenque and Chichen Itza. Moreover, a model of a tomb in Oaxaca gives a specimen of Zapotec architecture. Thus with the Totonac temple represented by the Mexican Government's gift, with the archaic Maya building donated by the Carnegie Institution, and with the Aztec and Toltec models given by Mr. Hay, the Museum's collection is probably unsurpassed in the United States. However, several more models must be acquired before we can synthesize completely Middle American architecture; and the aim of a museum is not so much to surpass other institutions as to achieve lucid expositions of life in its infinite manifestations.

The Home of Kingfishers and Jacamars

THE ASCENT OF MOUNT TURUMIQUIRE

The Hub of the Mountainous Portion of Venezuela Adjoining Trinidad Is Climbed for the First Time

By GEORGE H. H. TATE
Assistant Curator of South American Mammals, American Museum

Subsequent to its discovery and settlement, the history of the exploration of the Turumiquire region is relatively brief. The earliest visitor with a scientific training seems to have been Humboldt who in 1799 and 1800, with the botanist Bonpland, climbed 2600 feet. Since then, others have explored all around its base, but the mountain never has been ascended above 6000 feet. It was practically virgin territory, therefore, when in 1925 Mr. Tate decided to explore the mountain and its general vicinity. Accompanied by Mr. H. J. Clement of the American Museum, he reached the summit, and brought back with him a small collection of mammals, reptiles, birds, plants, etc., which contained a number of species new to science.—The Editors.

SEEN from the blue waters of the Gulf of Cariaco a line of low sun-drenched coast broken by a tiny pier and a few houses, the port of Cumaná, contrasts sharply with its background of sombre mountains with their dark, mantling clouds. Ashore, a mile of motor road crosses the shimmering, sandy plain, so well pictured by Humboldt, toward large groves of coconut palms marking the sites of the Manzanares River and Cumaná proper, a town of perhaps 5000 inhabitants.

In 1925 Cumaná was developing cotton and copra manufactures which promised to bring it to the fore commercially, but a short while ago another of the earthquakes from which it has suffered repeatedly, destroyed most of the town.

Our arrival at Cumaná coincided with the date of the greatest festival of the year—the Carnival. Because all shops were closed and everybody was celebrating happily, we managed only after considerable delay to have our baggage taken from the port to the hotel in the town. And as for arranging to go out at once, well, that was simply out of the question. So, after we had disposed our possessions conveniently about our rooms and partaken of a very good lunch, we strolled forth to view the town. The sun was still high and although occasional sounds of revelry could be heard behind closed shutters, few persons were about. As the day cooled, more and more movement became apparent. Cars with gaily colored streamers fluttering behind them ap-

THE RIVER JUAJUA
After leaving its gorge in the mountains, this stream meanders through the cane fields to the Manzanares River

peared touring the streets. People began to stroll about in the open and a general concentration of humanity occurred at the plaza where the great event of the day—the procession, would appear. The parade, observed by us from a point along its route, consisted of a number of vehicles dressed up to represent various conceptions: one was a battle-ship crammed with sailors and admirals; another a chariot driven by gladiators; a third a palm-leaf pavilion inhabited by Hawaiian girls in grass skirts who threw candies at the spectators. From these and similar elaborate displays the procession dwindled down through several Fords to an appendage composed of ox-carts and "burros." As darkness fell the parade broke up, and the rest of the evening was spent in dancing and merry-making.

On February 22, leaving the coast we journeyed by auto truck through the long, winding ravine of the Manzanares River to Cumanacoa. Thence on March 4, using pack-animals, we crossed the southwestern chain of hills into the headwaters of the Neverí River. On March 18 we returned to Cumanacoa and ascended to Cocollar at the eastern foot of Turumiquire. After completing work at these first camps we prepared for the ascent of the mountain, during which excursion two stations on the slopes were occupied; Carapas, 5600 feet, and a camp at 7900 feet from which the eastern peak, about 9800 feet, was several times visited. Afterward, between April 20 and May 24 we collected at San Antonio de Maturin; La Latal, about five miles south of Cumanacoa; Barbacoas, in the cactus scrub region a few miles west of Cumaná; and in the mangroves bordering the Gulf of Cariaco some miles to the east of Cumaná.

Cumanacoa, in the upper valley of the River Manzanares, is a small town of several hundred inhabitants. The floor of the hill-encircled valley, which is several miles across, seems level and apparently formed by sedimentation. Almost the whole rather densely populated area appears to be under cultivation—principally sugar cane. Northwest the valley narrows to form the ravine of the Manzanares which flows out to Cumaná and the sea. We were invited to stay at a sugar-cane estate, Cuchivano, at the foot of the slope on the southwest side of the valley a few miles from Cumanacoa. On one hand lay the cultivated valley, on the other rose seamed limestone slopes. The hills were cut into at intervals by deep, bat-haunted gorges such as that of the brook Juajua at Cuchivano. On the

exposed, rock-strewn hillsides a trailing ribbon cactus grew plentifully and amongst the brush at their foot the raucous-voiced but toothsome "cha-chalaca," a bird resembling a very small turkey, gave voice morning and evening. Trapping among the cane fields of the valley showed four sorts of rats plentiful: *Heteromys* (pouched rat), *Oryzomys* (rice rat), *Akodon* (South American field mouse), and *Proechimys* (spiny rat). These animals, given conditions causing their undue increase, might well form a serious menace to the crops of the area.

At Cuchivano we always had a few visitors lounging around our skinning table, watching every operation closely, commenting on the appearance of our outfit, our specimens and ourselves. Some came and went again in a few minutes, but the majority stayed for hours. Not content with one visit they returned day after day to stand and watch. This close surveillance was apt to get on one's nerves, and I could see that it worried Clement more than he would admit.

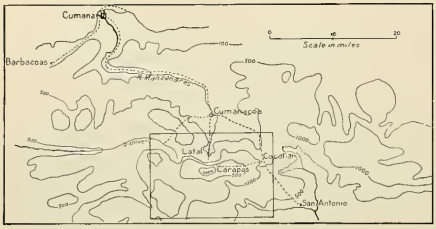
From Cuchivano, Turumiquire appears composed of twin peaks nearly equal in height connected by a slightly lower ridge. The eastern peak, which we later reached, is slightly higher than the western. The mountain, framed by a foreground of canefields and the slopes of the near-by hills, stands much too far away for one to distinguish the character of the vegetation on its sides or even on those of the great northward jutting promontory which we first had to ascend.

The humid region at the headwaters of the Neverí River which was next visited, provided an environment from which many interesting forms were secured, particularly a new genus of the group known as fish-eating rats described by Mr. H. E. Anthony in American Museum *Novitates* No. 383, 1929. The valley is rough and irregular, bounded by high hills, and clothed with heavy tropical forest. Camp was built at 2400 feet in a woodcutter's clearing, where yams and Irish potatoes were growing.

In crossing the divide between Cumanacoa and the Neverí we climbed at once to the top of a lateral spur and then traveled inward along the crest to the scarcely higher main chain. Even as low as 3500 feet we observed the denuded condition of the crests and the modified vegetation brought about by the exposed environment with its thin soil and low water table. In contrast, the forest of the valleys on either side extended up the slopes almost to the crests.

Between 3000 and 6000 feet one is in

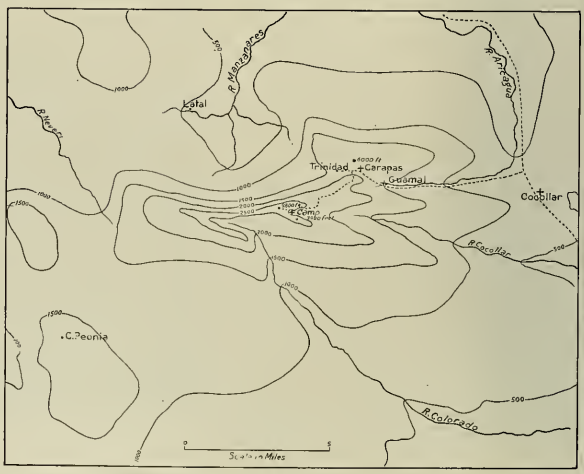
THE CLEARING AT NEVERÍ
Here in the heart of a splendid forest the roar of howling monkeys resounded almost daily



AREA VISITED BY THE EXPEDITION
THE DOTTED LINE SHOWS THE PLACES VISITED IN THE TURUMIQUIRE REGION. HEIGHTS IN METERS. MAP PREPARED BY COURTESY OF THE AMERICAN GEOGRAPHICAL SOCIETY FROM AN ADVANCE COPY OF THEIR "MILLIONTH MAP"

the heart of the coffee-growing belt. The plantations, which vary much in size, are prepared by first partially clearing the hillsides of forest, then setting out both the coffee bushes and the trees (*Inga* sp.) which are to give them shade. Many of the older estates have no original forest left, but consist solely of coffee and *Inga*. At some central point along the road as it passes through each coffee *hacienda* are constructed an adobe house for the supervisor and a large, level, cleared space some 50 by 100 feet for drying the coffee. The latter is simply a dirt floor, packed hard and kept free from weeds, where the ripe berries are spread out to ferment and later the seeds are left to dry.

Cocollar (3600 feet), which forms part of the divide joining Turumiquire to Cerro Negro, we found in strong contrast to the rest of the region. Its climate in the dry season is almost arid. The land produces coarse, low grass, which gives nourishment to numbers of cattle. The most striking vegetational feature is offered by the great, banyan-like "copé" trees, growing as a rule wherever the bare limestone breaks through. These trees, of the family Guttiferae, seldom reach a height greater than fifty feet, but their branches, which send down supplementary roots to be converted in time into additional trunks, achieve an enormous horizontal spread. In this way one tree may cover half an acre of ground. Small woods composed mainly of *Mimosa* and the like occur here and there in hollows. Although they are rather low and their leaves fall off during dry weather, their branches interlace over head and all the birds of Cocollar seem to gather in them. For this reason they provide ideal collecting conditions. Water at Cocollar in the dry season is so scarce and yet so very dirty that a bath



THE COURSE UP MT. TURUMIQUIRE
ENLARGEMENT OF THE SMALL SQUARE SHOWN ON THE MAP ABOVE. THE CONTOURS ARE MODIFIED TO CONFORM WITH OBSERVATIONS MADE BY MR. TATE WHILE ON THE MOUNTAIN-TOP. BAROMETER READINGS SHOWN IN FEET

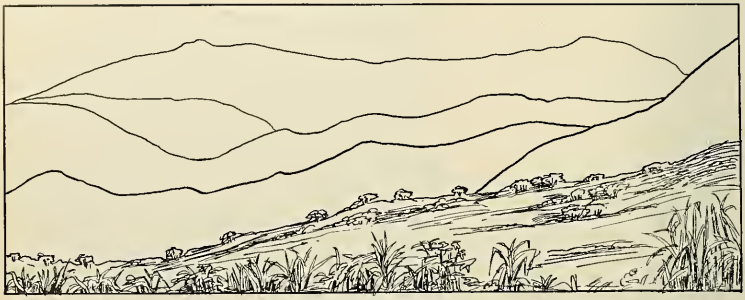
AT THE NEVERÍ
Even at as early an age as five or six years, the youngsters in the remoter parts of Venezuela are taught to use the machete and are sent out to gather firewood

may be considered both a luxury and a penance.

From Cocollar a burro-trail leads southeast through a maze of small ravines to the prosperous little town of San Antonio de Maturin, situated in a rather broad valley through which a stream flows toward the Atlantic. The bottom land of this valley is planted with sugar cane and garden crops, the hill slopes with coffee. At San Antonio I was conducted to see a "mina de azufre" or sulphur mine, which proved to be nothing more than a spring whose water was impregnated with sulphur. The river below the town is the home of several pairs of capybaras (animals like gigantic guinea-pigs with aquatic habits).

During our stay in San Antonio we enjoyed the hospitality of a very delightful family named Tucker. Mr. Tucker, a professional orchid hunter, who was not at home at the time of our visit, was an Englishman who had settled in Venezuela many years before. Mrs. Tucker, a Venezuelan lady, and her grown-up son and two daughters very kindly put a room at our disposal. We found it most agreeable after months of camping in the open to sit at meals on their porch overlooking a delightful garden filled with choice tropical plants and converse with intelligent and understanding people. Victor, the son, conducted me one day to a pond on the top of a near-by hill where I shot jacanas and pied-billed grebes. Much later at Cumanacoa we met Mr. Tucker, who was just bringing an orchid collecting *sortie* to a successful close. He showed us the results of the

THE CAMP AT THE NEVERÍ
Camp life at the Neverí was a simple affair. The wife of the owner of the clearing was an interested spectator while Clement was preparing his bird specimens



A VIEW FROM CUMANACOA

The twin peaks of Mt. Turumiquire ten miles south of Cumanacoa, although hazy through the day, stood out sharply morning and evening. The highest peak at the left is that ascended by Mr. Tate. Drawn from a photograph

work—hundreds of orchids, most of them Cattleyas, packed closely on the cool stone floor of a small house where they might be watered easily; and in another room the crates in which they would be packed for their trip to Europe.

In preparation for the climb up the mountain we returned to Cumanacoa to refit. Since few mules or horses were to be had, burros were again used to carry equipment around the northeastern spur of Turumiquire up on to the savana of Cocollar. Thence we followed a pack-trail southwest up the narrow valley of the Aricagua River to the junction of the above mentioned spur with the parent mass (6000 feet). At this altitude a sub-tropical climate prevails and the two highest coffee plantations—indeed the highest habitations of the entire region—Carapas and La Trinidad, are located.

At Carapas some two weeks were spent. It was then March, and the climate remained generally fair, but winds of gale force blew almost every night from the east. Most of the land was originally covered with tall forest, of which, although much still exists, a certain portion has been cut to make room for coffee plantations. At two places on the crest of the ridge the soil is washed clear and the limestone juts out. Here the vegetation becomes specialized, various rock-loving plants such as the orchid *Habenaria* being at home.

From the biological standpoint Carapas was the most important station occupied by the expedition. The birds, which include five new forms, have already been reported upon by Dr. Frank M. Chapman in American Museum *Novitates*, No. 191, 1925. Mammals found there were squirrels, three genera of rats and two of bats. One hundred and nine plants were collected.

Just below Carapas and La Trinidad, in the valleys on either hand tropical and subtropical conditions inosculate. At El Guamal in the eastern valley one comes upon the tropical butterflies, *Heliconius* and *Euptychia* and others; in the opposite direction, west of La Trinidad, the ground falls away so rapidly that the torrid zone is soon reached.

Above Carapas difficulties began to appear. The mountain rose up boldly in successive jutting headlands which formed the outer ends of narrow knife-edges. It was necessary first to choose the easiest-appearing way up and then sketch and partly memorize the precipitous topography, in order that after the ascent

had been begun and we had entered the maze of gullies and ridges, we might hold to our main plan of ascent.

For the first part of the climb we found that some years before fire had swept the slopes, leaving a tangle of fallen trees which the steep slope and a concealing growth of bracken rendered difficult and dangerous to penetrate. Also, at steep places the soil was so friable that it scarcely supported one's weight. After chopping trail for three days on the bracken slopes, breathing dusty, spore-laden air, scrambling up crumbling ridges where little sedums with flame-colored flowers grew, we reached a zone of vegetation known locally as "suro" or "juajui." Juajui is allied to bamboo; but instead of growing erect, thick and tall, its slender stems, which are endowed with sufficient toughness to deflect the edge of any but the sharpest machetes, arch over almost to the ground. This plant forms densely matted thickets on the hillsides from six to ten feet deep which can be penetrated only with much labor. As a rule, when well established it successfully eliminates other vegetation.

Above the juajui we found ourselves entering the very beautiful cloud forest present on most equatorial mountains at this altitude (7500 feet). The trees, growing outward at an angle from the slope, were small-leaved, low, thick, and gnarled. Their branches were literally laden with closely packed bromeliads. In addition, every bit of surface, not only of bark but even of the leaf-blades, was coated by varied forms of liverworts and mosses. Underfoot a yielding carpet of frond-like *Selaginella* rendered our steps almost noiseless.

Thus far the work had all been done from the base camp at Carapas, the walks out in the morning and in again at night becoming longer and longer as the trail head advanced. To facilitate the completion of the trail a small camp was now established in the high forest at 7900 feet close to the foot of the final steep ascent. This place, in a narrow ravine, was the highest at which at that season water could be had. It was taken a cupful at a time from a tiny seepage basin. All about the gully grew a delicate *Tropaeolum* with graceful, finely formed flowers scarcely half the size of the garden variety. It thrived amazingly in that cool, shady place.

Owing to the steepness and difficulty presented by several parts of the ascent only the barest necessities could be taken to this upper station. Indeed, much credit was due to the several men from La Trinidad for carrying the packages up such a trail. Loads were of course as light

A NEVERÍ DWELLING

The owner of this palm-thatched hut at Neverí raised only a few potatoes and some cassava for himself and his family. Their only source of meat was the wild creatures of the forest

ONE OF THE TWIN PEAKS OF MT. TURUMIQUIRE
Part of the summit of the eastern peak of Mt. Turumiquire. Among the weather-beaten limestone everywhere exposed grow many small heathlike shrubs and herbs

as possible, articles being packed for the occasion in kerosene boxes, since our regular trunks were far too ponderous. Food, collecting materials, blankets, and a single tent-fly were all we allowed ourselves. In this camp we spent several cold and uncomfortable nights lying on beds of cut "suro" cane on an incline which, in spite of earlier efforts to terrace the ground, repeatedly rolled us out of bed.

The final ascent, probably averaging 45°, led steeply up for about 700 feet. Trees grew out from the hillside almost horizontally, so that our trail resolved itself into a series of great steps whose treads were formed by nearly prone trunks and whose backs were composed of soil or rock. Moist festoons of moss and débris so swathed everything that in places the way became almost a tunnel. About 8500 feet marked a decrease in steepness together with dwarfing of the trees and a proportionate increase in the brush. The interlaced stems were now so wiry and so densely matted that as we climbed upward they supported us several feet above solid ground. The constantly dimishing slope showed that we were approaching the top of the mountain. Vegetation became smaller and smaller. Trees were left behind. Huge cushions of pinkish-brown sphagnum moss two and three feet deep swelled out from between bowlders. With the slope reduced to only about 10°, we found ourselves at one moment walking over splintered masses of limestone, again plunging waist deep into crevices filled with wiry, harsh-leaved shrubs which rather resembled the American mountain laurel. At length, emerging on a spot where a little humic soil had become compacted, we rested comfortably upon the low, heathery growth which covered it. We had reached the top.

From the eastern of the two main peaks, where our trail had ended, a narrow knife-edge connected with the western point. Southeast another ridge joined a slightly lower third peak. Southwest our view was cut off by a large, nearly parallel ridge with high cliffs which seemed to be

CONTINUATION OF PART OF THE EASTERN PEAK

From the eastern peak a ridge, invisible from Cumanacoa, extends southeast to a slightly lower peak, shown on the topographical map at the bottom of page 542

an offshoot from the western peak. The intervening valley in the foreground, the upper part of which contained small savanas, deepened rapidly in a southwesterly direction. In short, the highest parts of Turumiquire were seen to occupy only a small area and to comprise nothing but one main and several subsidiary ridges which fell steeply away on either side. Certainly there was no space for the fabulous lake we had been told of in Cumanacoa. The crests were rugged and seamed with disintegrating limestone in the form of rocks and bosses everywhere sticking out. Although we moved about considerably in our search for specimens we made no attempt to reach any other part of the summit.

A splendid view was afforded to the north. Below, seemingly within a stone's throw, we could discern Carapas and La Trinidad, their clearings dwarfed by distance to checkerboard dimensions. Beyond, the flat valley of the Manzanares showed very clearly—although on account of intervening foothills Cumanacoa could not be seen. To the northwest a dwindling series of hills marked the divide between the Manzanares and the wet Neverí basin visited by us some weeks before. Beyond Cumanacoa to the north, sharp and distinct we saw the blue of the Gulf of Cariaco and the Caribbean Sea with the Araya Peninsula between them. And farthest of all the Island of Margarita. This view was possible during the first ascent, on the afternoon of April 6, 1925. During subsequent visits to the summit, swirling mist prevented us from obtaining even a glimpse of Carapas.

The aneroid reading of the first afternoon was 9750 feet; three days later it registered 9850 feet. A compensated Keufel and Esser aneroid barometer was used. The marked difference between the readings and the altitudes obtained by Humboldt suggest that although Turumiquire may not reach 9000 feet it probably exceeds 2047 meters.

At the time of our visit the weather remained fair, for although clouds usually gathered in the immediate neighborhood

of the peaks, conditions in general were dry. The lichen *Usnea* became so brittle that specimens broke to fragments when pressed. On the other hand, a handful of the hygroscopic sphagnum moss when squeezed dripped water as a wet sponge would.

Under stones at the summit a small snake, and some Teiid lizards were discovered, and some insects (wasp, flies, yellow Pierid butterfly) were taken in flight. The reptiles are noted by Burt in the *Bulletin* of the American Museum of Natural History, LXI, 1931. Birds seen or collected at the summit were a species of hawk, giant swift, black thrush, and a small flycatcher. No evidence was found denoting the presence of mammals near the summit, although a small mouse (*Oligoryzomys*) was trapped at the 7900-foot camp. On the summit 98 numbers of plants and at 7800 feet and downward along the trail 146 numbers were collected.

The descent from the mountain top was made with ease. The men came at the hour agreed upon and carried our equipment down to Carapas whence in due course we set out for the lowlands. After going over our materials, we made a short excursion from Cumanacoa to La Latal, 3000 feet, among the foothills of Turumiquire. This was part of the property of Señor Francisco Martel of Cumanacoa, whose kindness and hospitality it is a pleasure to acknowledge. Here both coffee and cocoa grew well. Although collecting showed that pouched rats were abundant, few other forms were caught. Among larger animals, foxes, red howling monkeys, collared peccaries, tapirs, and kinkajous were rather plentful. The climate (May) was relatively dry.

Returning to Cumaná two other brief excursions were made. First a day was spent at a hamlet named Barbacoas in the arid scrub land to the west. The hills here, although scarcely reaching 500 feet above sea level, were broken and much dissected, and the vegetation was thorny with low trees scattered through dense, leafless brush. Cacti were numerous. Fortunately, many woodcutters' roads traversed the region so that one could move about with considerable freedom. At the time of our visit the water in a small river was so low that only a series of unconnected pools containing numbers of small fish remained. In this region deer and a small species of rabbit, neither seen by us, were said to be common.

East of Cumaná the mud flats and beaches of the Gulf of Cariaco, where we made our last collecting station, are bordered by low growing mangroves which harbor numerous kinds of shore birds. After going by boat for some four miles we landed. Many herons, scarlet ibis, spoonbills, cormorants, plovers, sandpipers, stilts—the complete list is too long to give—were either observed or secured.

It is hoped that this preliminary survey may form the basis for further scientific research on this little known mountain.

THE HIGHEST STATION OCCUPIED IN TURUMIQUIRE. THE VERY MINIMUM OF MATERIALS WAS CARRIED UP TO THIS SPOT (7900 FT.) THIS WAS THE HIGHEST POINT AT WHICH EVEN A TRICKLE OF DRINKING WATER COULD BE FOUND. THE SUMMIT WAS MORE THAN 1000 FEET HIGHER

Photograph by H. J. Clement

Melanesia in the American Museum

A MINIATURE MELANESIA

A New Exhibition Model at the American Museum Shows in Miniature How the Manus of the South Seas Construct the Necessities of Life in Their Watery Domain

By DOROTHY L. EDWARDS
Editorial Staff, Natural History Magazine

IN the present age of skyscrapers a community of gigantic proportions is being constructed in the heart of New York—Radio City. At the American Museum of Natural History another community of equally astonishing dimensions has just been completed. No towering skyscrapers here, but diminutive dwellings approximately a foot in height; no tremendous masses of steel and cement, but gracefully curved structures of wood and thatch. For, while this community is in New York, it is not of it. Indeed, to find its duplicate one must journey halfway around the world to a remote corner of the South Seas known as Melanesia. Here one will see rows of rust-colored houses supported on sturdy wooden pillars extending above the shallow, turbid water dotted here and there with tiny islands. And here one will feel the ordered activity of many people intent on the occupations which are part of their every-day lives.

Few of us are fortunate enough to be able to journey to this distant region, but Dr. Margaret Mead, assistant curator of ethnology at the American Museum, has not only made such a voyage, but has spent many months in intimate association with this Melanesian world, sharing the troubles, participating in the festivities, observing the tabus and the many strange customs of the natives there. Returning to America, she brought with her not only specimens of their handiwork and other concrete material, but, of even greater interest, a thorough understanding of these primitive people which she had acquired. In her book *Growing Up in New Guinea*, and in numerous articles, two of which have appeared in former

PHOTOGRAPHED ON THE OTHER SIDE OF THE WORLD

Dr. Margaret Mead obtained numerous camera studies of Melanesian life during her months of field work in the South Seas. Above is one of these showing the relatives of a Manus bridegroom congregating to make a marriage payment to the relatives of the bride

issues of NATURAL HISTORY (March–April, 1930, and January–February, 1931), Doctor Mead has vividly described the lives of the Melanesians and their complex social organization.

Their material culture has now been depicted by Mr. Basil E. Martin of the Museum's preparation staff, in a miniature group which covers no more than approximately sixteen square feet of space, yet which gives a complete and accurate picture of this little known area. By reproducing a representative section of Melanesia on a scale of one-half inch to the foot, it has been made available for the study and pleasure of the thousands who visit the Museum, affording a striking contrast to the turmoil of western civilization that lies outside the Museum's doors.

The Manus, possessors and inhabitors of the wide lagoons which are formed between part of the south coast of the Great Admiralty Island and a coral reef over which break the waves of the Pacific, are an ingenious people. Numerous are the handicaps which they must overcome, and varied the obstacles they must face, yet they surpass in commercial success their nearest land neighbors. Numbering altogether about 2000, the Manus live in small groups, the average community embracing a cluster of about twenty-five houses. In the Museum group are included two homes of typical people, and one larger house. This last differs from the others in so far as it is occupied by the man who would be the community's leader in case of war. It is distinguished not only by its greater size but also by its location, as such a leader is privileged to build nearest the largest patch of land, or land platform. The *ovalis* shells which are hung

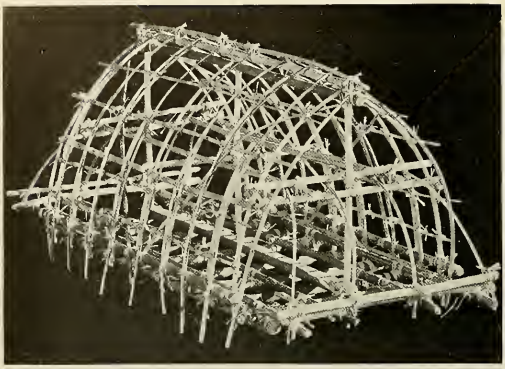
along the verandah are also indications of his rank.

Building a house in Melanesia is a task not lightly undertaken. Since building lots consist solely of muddy water, the first step in the construction of a home is to sink foundation piles into the lagoon. Immediately the question arises as to where these wooden piles may be obtained, for obviously no sizable trees can grow where the only land consists of scattered bits of volcanic outcroppings or small, man-made islets. However, by skillful trade with their land neighbors, they exchange fish for the necessary wood, and the foundation of the home can then be laid. Next, the arched walls are constructed and thatched with sago leaves—provided additional trading has been done to obtain the sago leaves. The carpenters are content to forego windows in these long, graceful dwellings, an opening at each end taking care of light and ventilation, although some air seeps through the slats which form the floor. But a concession has been made to the curiosity of the natives, for in the thatched walls of every house there is a small portion which may be pushed upward and outward, allowing a view of whatever is going on outside. Thus, unobserved, the inquisitive Manus may keep a check on the activities of his neighbors—or of an ethnologist who inexplicably has become part of the community.

One of the miniature dwellings, however, has been constructed with thatch covering only one side of the arched walls. This gives the Museum visitor an opportunity which a visitor to Melanesia

PHOTOGRAPHED AT THE AMERICAN MUSEUM

The miniature group constructed by Mr. Basil E. Martin for the South Sea Hall of the American Museum reproduces a typical scene in the Admiralty. Between the two native dwellings may be seen a pig-sty, which indicates that one of them belongs to a prosperous family, for the Manus use pigs as a medium of exchange much as occidentals use paper money



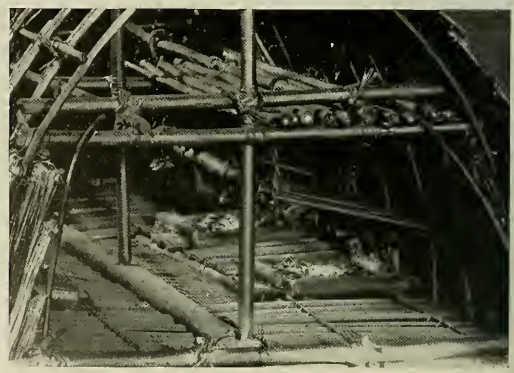
THE FRAMEWORK OF A MANUS HOME

This miniature structure is a replica of that of a typical Manus dwelling. It is made of supple wood, and is supported on heavy wooden piles in the water. At this stage it is ready to be thatched with sago palm leaves

would not have, of looking, unobserved, into a Manus home. Inside, the houses are most unpretentious. Though they are usually spacious, the average house having a length of thirty to fifty feet and a width of about one third of that, they are shared by so many people that this space is none too adequate. Too, in considering the plans of a house, one must bear the native tabus in mind. For instance, a married woman may not be seen by her husband's older male relatives nor by the husbands or fiances of her younger female relatives. Therefore, almost always when two families are sharing a house, certain members of one family may not be seen by certain members of the other, so long mats are an essential equipment in each household, for these may be hung in the center of the room to secure the necessary privacy.

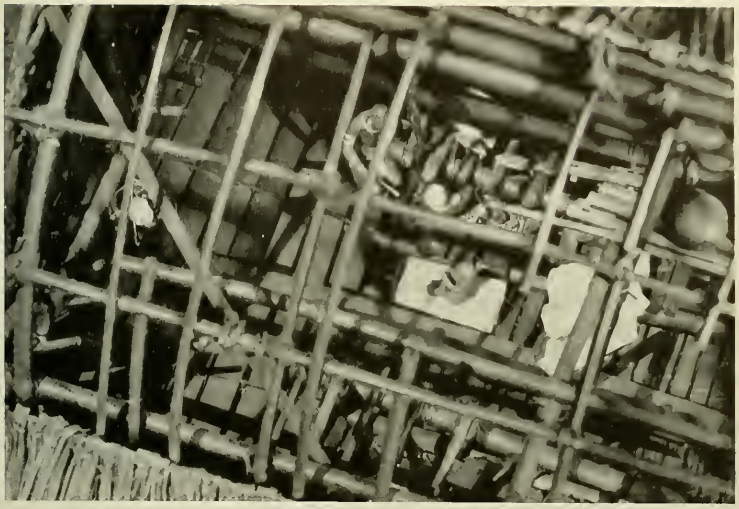
Also because of tabus, not one, but four hearths are needed. As well as making it possible for one in-law to shun another when necessary, there are times when one fire must be devoted to a particular person. For instance, after a boy has had his ears pierced, everything he eats for thirty days must be cooked on a fire that is used for nobody else. The fireplaces are constructed of wood ashes on an old mat, framed with wood logs on which are placed several large stones. On these may be propped the cooking pots. The women squat on the bare floor boards while cooking their simple fare. Smoke from these fires soon blackens the interior of the house, thereby giving an increasingly dingy appearance to the never-festive room.

Sets of swinging shelves hanging from the ceiling are all that might, by a stretch of the imagination, be termed "furni-



THE ONE-ROOM INTERIOR

Before the front was put on this house a photograph of the interior was made. Two of the four hearths which are built in every house may be seen, and the racks on which will be stored pots and fish



A VIEW THROUGH THE ROOF

In the Museum group one half of the roof of one of the miniature houses has been left unthatched, permitting an aërial view of the interior. A woman may be seen cooking at a hearth, while her baby sits near by on a mat. A mother never takes her baby out of the house until it can be depended upon to cling to her neck under the most strenuous conditons

ture," and these are used merely to accommodate drying fish and clay pots. Necessarily the shelves are always well stocked, for fish must constantly be on hand for trading and for food. In a prosperous home will be found a goodly supply of the black clay pots, for these are also an important factor in Melanesian trade. The larger ones also do duty as containers for oil and water, while the shallower ones are used for cooking.

Canoes play perhaps as important a part in the lives of the Manus as do their homes. Although the natives must depend on trading to obtain the necessary wood, they are so proficient in the manufacture and use of these light craft that they are nevertheless masters of the water. In them they are able to make great hauls of fish, and in them they carry their wares to be exchanged for other essentials in trade with their shore neighbors. Canoes are also as essential for social use as are automobiles and trains to New York civilization. Naturally, therefore, there are various types: the large, broad-beamed outrigger canoes which carry the heavier cargoes; the medium-sized outrigger canoes which are most adaptable for fishing; the small canoes used for house to house transportation; and canoes which even the very young children can manipulate efficiently. The larger craft are usually elaborately decorated, and on the canoe platform is supported a small hearth to carry fire on overseas trips. Since a journey to the mainland of New Guinea or the Bismark archipelago where valuables are traded means a trip of about 200 miles across the open water, it is most desirable to have some sort of shelter on the canoes used for such great distances. Accordingly a half arch of thatch forming a curve

about three feet high, which may easily be supplemented by more thatch to form a small, round hut, is built on the canoe platform. In open water the canoes are sailed with occasional paddling by the natives, while in the shallow water of the lagoons they are punted.

Except for scattered bits of volcanic outcroppings, even the tiny islets so useful to the natives must be built by them. First, stakes must be driven to form a boundary; then a platform of coral rubble is built which rises above the water level even at high tide. On this is thrown quantities of bark and leaves. Eventually one or two small trees will spring up whose roots aid materially in holding together this bit of man-made territory, even if the trees serve no other purpose. On these islands feasts may be held, ceremonials enacted, and work carried on. Each Manus village has its share—perhaps three or four of them.

In the model which Mr. Martin has constructed the chief activity at the moment is centered about one of these small islands. Due to the elaborate Manus customs, so many occasions call for a special ceremony or feast that rarely a day passes without one or the other, or both, occurring. Betrothals, marriages, births, ear piercings, deaths—all mean that certain rites must be performed. In this particular instance a presentation of goods is to be made by the relatives of a newly married woman to the relatives of her husband. As a bride price, the man has given shell money and dog's teeth to his in-laws, and the the wife's relatives are now gathering to make a return gift of grass skirts and pots. This will be accomplished with much ceremony.

MAKING A FISH TRAP

The Manus are dependent upon fish not only for food but for trade. In exchange for them they obtain other necessities of life from their land neighbors. The cylindrical trap upon which this fisherman is working is made of wooden withes, and has an opening at one end through which the fish enter

A CARGO OF CLAY POTS

Large outrigger canoes are used to carry clay pots and other valuables to neighboring communities where they are exchanged for other commodities. The Manus are past-masters at constructing types of canoes to meet all their needs

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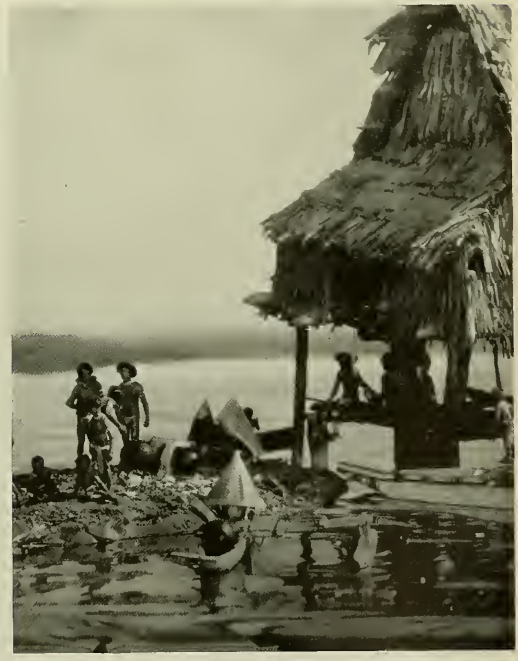


THE THRESHOLD OF A MANUS HOME

Since the only land in this community consists of man-made islets, the small porches on the front and back of each home are used for work and play as well as for landing platforms for canoes. At high tide the porches are almost level with the water, but at low tide one must use a ladder to ascend from the canoe

UNDER FULL SAIL

In open water the canoes are propelled by sail and sometimes by paddling. A voyage to the Bismark archipelago or the mainland of New Guiana means crossing about 200 miles of water

In this festive group the people are, of course, in gala costume, which consists of bracelets and beads added to the ordinary dress. The women wear snug-fitting belts from which are suspended skirts formed by two aprons made of large leaves, shredded until they resemble crinkled grass ribbons. It is quite a feat to put on one of these belts, for since they are so tight about the waist, the difficulties encountered in pulling them over the shoulders are considerable. Usually a woman requires the help of three or four friends in donning her simple costume. Married and unmarried women are easily distinguishable, as immediately after marriage a woman shaves her head in order to lessen her charms. The older unmarried children wear bead belts. The mats covering the heads of some of the women are not really part of their costumes, but are used to shield them from the sight of tabued relatives. A man merely wears a gi string made of bark cloth; and the small children are unencumbered with clothes of any sort.

Adornments of all kinds, as among all primitive races, are extremely popular. The ear lobes are greatly elongated as a result of the heavy rings continually hung on them. Beaded armlets into which are stuck the bones of dead relatives are worn by both men and women, as are beaded anklets and wristlets. A display of style and wealth is combined in the necklaces of dogs' teeth which gleam on many a dusky throat. The men affect complicated head-dressings, tying their hair in Psyche knots.

A sign of affluence is the presence of a pig sty next to the home. Pigs are used in exchange much as we use paper money, and they sometimes change hands six or seven times in a single day. Eventually, of course, they replenish the larder of some fortunate family. Incidentally, they furnish amusement as pets, for children delight in riding on their backs in the water, and each pig is given a name which it recognizes. Every evening they are released and allowed to swim about till

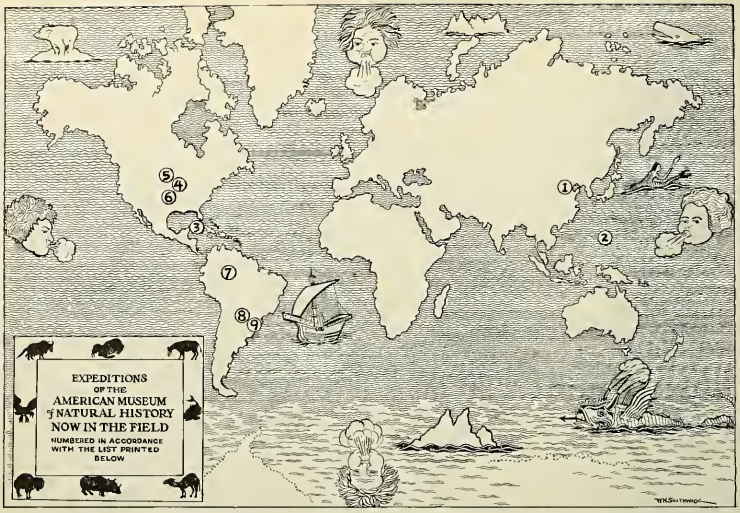
morning, when they are lifted bodily from the water to be penned for another day. This work is done by the women.

Further ingenuity is demonstrated by the Manus in the making of fish traps. One kind is a long fence eight feet tall, made of pieces of split bamboo, which are bound together with rattan. This type of fence, which may be seen on the landing platform of one of the miniature houses, is set in the water in a complicated maze which fish can readily enter, but cannot easily leave. After several days the fishermen enter this labyrinth in their canoes, and with little difficulty spear great quantities of fish. A cylindrical fish trap is also popular. Made of wooden withes, it has a funnel-shaped opening at one end which leads into the other end of the trap. These traps are lowered in the reef and weighted with stones. Here they are left for several days, during which the active fish population is decreased by many scores. The Manus boys early in life take an interest in fishing and find amusement in spearing fish or shooting at them with bow and arrow. This trains their eyes to an amazing alertness, so that by young-manhood every Manus man is an adept fisherman.

The unique and little known civilization worked out by the Melanesians, as yet unchanged by missionaries or by too much contact with the more progressive world, is of special value to the ethnologist, and Doctor Mead has made the most of her ethnological and linguistic abilities to glean a wealth of information concerning them. To the South Seas Hall of the American Museum the Manus group has added new vitality and interest.

IN MINIATURE

The average height of the Manus men is about 5 feet 6 inches, and of the women about 5 feet. In fashioning the Museum model Mr. Martin has used a scale of one half inch to a foot, as may be seen by this family group and their canoe, which rest comfortably in the palm of Mr. Martin's hand



1. Central Asiatic Expeditions; 2. Whitney, South Sea, Island of Kwasie, for birds; 3. Boekelman Shell Heap Project; 4. Frick-Blick, Colorado, for fossils; 5. Frick-Falkenbach, Wyoming, for fossils; 6. Frick-Rak, Santa Fé, New Mexico, for fossils; 7. Olalla Brothers, Brazil, for birds and mammals; 8. Naumburg-Kaempfer, Southern Brazil for birds; 9. Scarritt, Patagonia, for fossil mammals

AMERICAN MUSEUM EXPEDITIONS AND NOTES

EDITED BY A. KATHERINE BERGER

It is the purpose of this department to keep readers of NATURAL HISTORY *informed as to the latest news of the Museum expeditions in the field at the time the magazine goes to press. In many instances, however, the sources of information are so distant that it is not possible to include up-to-date data*

CENTRAL ASIATIC EXPEDITION.—Dr. Roy Chapman Andrews, leader of the Central Asiatic Expedition, returns to the Museum in early October after a summer spent in Peking in an unsuccessful attempt to induce the Chinese authorities to grant permission for further work by the expedition in the Gobi. The expedition headquarters in Peking have been closed temporarily. In the meantime the magnificent collection obtained in 1930 is being rapidly prepared in the laboratory of the department of vertebrate palæontology, and the preliminary scientific reports on this material will begin to appear shortly.

SCARRITT-PATAGONIAN EXPEDITION.—Dr. George Gaylord Simpson, leader of the Scarritt-Patagonian Expedition, who is at present in Buenos Ayres studying the great Ameghino collection of Patagonian fossils, is due back at the American Museum October 1. Mr. Coleman Williams, assistant on this expedition, returned in June after the close of their highly successful field work in the Eocene deposits of Patagonia, and brought the entire collection with him to the Museum. Preparation work on this most important addition to the department collections is proceeding, and a special exhibit will be made this autumn.

A PRIMITIVE TRIASSIC REPTILE FROM ARIZONA.—Mr. Barnum Brown, curator of fossil reptiles, American Museum, reports a most successful field season in the western states. At Cameron, Arizona, he found, early in the season, a nearly complete and most perfectly preserved little skeleton of one of the primitive Triassic reptiles, Pseudosuchians, which are closely related to the stem forms that gave rise to the crocodiles. This remarkable specimen,

about three feet long, is creamy white in color and lies imbedded in brick-red sandstone. As both the dorsal and abdominal plates are present and but little displaced, the slab is being prepared for exhibition in a vertical position so that both sides may be seen. This specimen appears to represent a form new to science and will undoubtedly throw much light on the origin of the Crocodilia.

DINOSAUR SKELETON FROM MONTANA.—Near Billings, Montana, Mr. Peter Kaisen, of the department of vertebrate paleontology, excavated a skeleton of a small dinosaur which was located by Mr. Brown four years ago and the exposed parts covered up and left until such time as he could return. Curator Brown reports that the skeleton proves to be complete, except for ten inches of the tail, and is beautifully preserved. It comes from the Lakota, Cretaceous, beds and belongs to the group of small herbivorous bipedal dinosaurs known as Camptosaurs. Preparation work on this specimen will begin directly upon Mr. Kaisen's return from the field in early September and the mounting will probably be taken up this winter. It is described as one of the medium-sized Camptosaurs, which would mean a length of fifteen or twenty feet.

THE MADAGASCAR EXPEDITION.—Philip DuMont and Austin L. Rand of the Mission Zoologique Franco-Anglo-Americaine both returned to the United States during the summer after the successful completion of the work in Madagascar. The splendid collection of birds and mammals made by this international expedition was studied at the Paris Museum by Mr. J. Delacour, Mr. G. Grandidier, and Professor Bourdelle, and divided into three equal parts: one part will remain at the Paris Museum while the other two have been sent to the British Museum and the American Museum respectively. The American Museum's share in the collection amounting to some 4000 specimens of birds has now been received.

The expedition collected all but a half dozen of the species of birds known with certainty to inhabit Madagascar. About a dozen new forms of birds, including one genus of warbler which has been named *Randia*, have been discovered by this expedition. In addition to the birds, a large and very valuable mammal collection was included in the shipment. Since Madagascar has been represented in the Museum series by merely a handful of specimens, the acquisition of this splendid material which represents almost all the known mammal fauna of Madagascar is an event of major importance. After the mammals are unpacked, an additional note describing them more in detail will appear in a later number of NATURAL HISTORY MAGAZINE.

THE LEGENDRE INDO-CHINA EXPEDITION.—An expedition under the auspices of Mr. and Mrs. Sidney Legendre with Mr. T. Donald Carter as the American Museum representative left for Indo-China late in August. The expedition will enter at Hanoi and proceed south through the mountains to Saigon.

Although the plans include general collecting, the primary object is to collect mammals and birds of this region. The Museum's collections contain very little material from this part of the world, so any specimens brought back will be of great value.

ETHNOLOGICAL FIELD WORK IN NEW GUINEA.—Dr. Margaret Mead is sailing on August 22 for New Guinea where she will do two years' ethnological field work. She will make collections of specimens and obtain notes for the construction of a small model so as to complete the South Seas Hall with a representative New Guinea exhibit from one carefully studied area. At the completion of this expedition the South Seas Hall will have six detailed local South Sea exhibits in addition to the synoptic collections from many parts of the South Seas. Doctor Mead will also make special studies of primitive women and children. She has selected as her special problem the genesis of the attitudes which are typical of the sexes in an endeavor to discover what factors are cultural and what biological. Doctor Mead will work in conjunction with her husband, Dr. Reo Fortune, who will pursue parallel researches into the religion and social organization of the same tribes. Doctor Fortune is working under the auspices of the Columbia University Council for Research in the Social Sciences.

NOTES

FALL PROGRAM OF THE AMATEUR ASTRONOMERS ASSOCIATION.—The officers of the Amateur Astronomers Association take great pleasure in announcing for the fall series of lectures the speakers listed herein. It is hoped that this year may be one of the most interesting the Association has had. The meetings of the society are held ordinarily on the first and third Wednesdays

of each month, at 8:15 P.M., in the large auditorium of the American Museum of Natural History. The public is cordially invited to attend.

SEPTEMBER 16—Dr. Harlow Shapley, director of the Harvard College Observatory, will speak on "The Harvard Program of Galactic Explorations," describing the work being done at Harvard in extending the known limits of the universe.

OCTOBER 7—Dr. E. E. Free will discuss "Cosmic Chemistry"—how chemical calculations of what must happen to atoms and molecules in a cooling mass of gases may help to explain the histories of stars and what other planets are like, as well as the origin of life on earth.

OCTOBER 14—(This is not the regular date, but is chosen to suit the speaker's convenience.) Dr. William de Sitter, the Dutch astronomer who demonstrated that the movement of the perihelion point of Mercury is in accordance with Einstein's Theory of Relativity, will talk before the society.

NOVEMBER 4—Mr. David B. Pickering, a member of the Executive Council of the Amateur Astronomers Association, will speak on "Observatories on the Pacific Coast and in Japan." Mr. Pickering has just returned from an extensive tour and detailed personal investigation of these observatories.

NOVEMBER 18—Dr. Clyde Fisher, president of the Amateur Astronomers Association, will speak on "Mars, the Ruddy Wanderer of the Sky."

CONSERVATION

THE STATUS OF THE BEAR.—In the February and March issues of *Outdoor Life*, Harry McGuire has taken up the cudgel for the bear, in two articles entitled respectively, "Staking out the Sportsman's Claims in Alaska" and "The Status of the Bear." In this day of the specialist, when conservation is so apt to be tempered to the taste of special interests, it behooves every nature lover to maintain constant attention upon the status of our wild life lest the privileges granted to a few demand a prohibitive concession from the many.

Mr. McGuire writes upon a timely subject, one that is of paramount importance not only to the naturalist but to the sportsman. He concludes that the Alaska brown bear is faced with the threat of excessive killing, if not actual extermination over much of its range and makes a plea for a sane and careful consideration of all the factors which enter into the case of the bear versus the residents of Alaska. New game laws have been drafted and recently put into effect, providing what is tantamount to an open season on Alaska brown bears throughout the year for the resident of Alaska.

> The old regulations set a season limit of September 1 to June 20. The new law provides absolutely *no closed season* for a resident, except in certain areas where the season is September 1 to June 20. And both the old and new regulations allow a resident to kill any number of bears whenever he judges them to be dangerous 'to persons or property.'
>
> Plainly, the new regulations have taken all legal bars away from the resident who wants to kill bears. So much for the camouflage about the new law giving more protection than the old. We may as well face the fact that as long as a resident can kill as many bears as he wants to—the only provision being that he convince himself the bears are dangerous before he shoots them!—there is no genuine protection except such as is afforded by the bear's habits and habitat, and his remoteness from human beings.
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> One of the most interesting documents on what is to be done about the brown bear is included in the annual report of the Commissioner for the Department of Agriculture for Alaska, to the Secretary of Agriculture. It is written by Jay P. Williams, U. S. Forest examiner. After giving some sound advice about brown bear habits and about how those who have to work in bear country should prepare themselves for an emergency meeting with a brownie, he points out the dangers of anti-bear agitation: 'The Forest Service, as an organization, can not consistently espouse a policy of extermination against the brown bear. Neither should we make commercial expediency the all-embracing criterion which determines our attitude. Many things are quickly done but slowly undone. Before anything be done, the bear question should be weighed carefully, constructively, and broad-mindedly. The largest carnivorous animal in the world, he helps give distinction and fascination to our territory.
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> The immediate need is for sportsmen and conservation societies to hold conferences, forget personalities, and agree upon (1) the passage of a bill through Congress for creating one or more brown bear sanctuaries; (2) the location of those sanctuaries.
>
> Influential societies like the Western Association of State Game and Fish Commissioners, the American Society of Mammalogists, etc., have already joined *Outdoor Life* in officially advocating such sanctuaries. At the moment it is not necessary that sportsmen concern themselves about the details of such preserves—but it is vitally necessary that you get your game and fish associations to pass resolutions favoring the idea, and it is necessary that you let your Senators and Congressmen know that you want the brown bear of Alaska given protection.
>
> * * * * *
>
> Do *you* want poison or protection for the great brown bear of Alaska?

The above quotations relate to the situation in Alaska, but McGuire in "The Status of the Bear" shows that closer at hand the case is equally depressing for those who would like to have bears as part of our great fauna.

> In short, the last and most important reason why bear protection is so often a cruel farce is that Federal and state officials, holding offices primarily dedicated to the service of sportsmen, have often given that service to sheep interests and a few powerful stockmen. They discourage laws designed to perpetuate the bear. They spread propaganda about his alleged destructiveness. They ignore the protests of sportsmen, except to shed a few stage tears.
>
> As a last specimen of the attitude which will lead to bear extermination if the sheep interests have their way, I quote from the last annual report of the New Mexico game commissioner, printed in the *New Mexico Conservationist*. As an example of the extent to which some western game commissioners take their orders from the enemies of wild life, I think this statement is unparalleled (italics mine):"
>
> 'Contrary to popular prediction there has been little complaint of damage by bears to live stock, but we have made it a point to issue permits promptly to any stockman making such a complaint, to remove the guilty individual. *So long as this policy is adhered to, I believe that there will be but little friction between stockmen and sportsmen on the score of bear protection.*
>
> '*The grizzly bear is practically, if not quite, extinct* in New Mexico at this writing. One specimen was killed under

permit during the past spring in the Black Range, and it is said that another still exists there. It is with regret that we write the obituary of this great creature, but his passing is perhaps inevitable. Prone by nature to be a killer, he has caused every stockman's hand to be raised against him.'

The irony in that!

There is *one* grizzly left in New Mexico! And 'So long as this policy is adhered to, I believe that there will be but little friction between stockmen and sportsmen on the score of bear protection.'

MARINE MAMMALS.—In a report delivered at the May meeting of the Board of Managers of the New York Zoological Society, Dr. Charles H. Townsend, director of the New York Aquarium, discussed the status of the elephant seal (*Mirounga angustirostris*) and the Townsend fur seal (*Arctocephalus townsendi*), both of which were long considered extinct. The fact that these two species of marine mammals can no longer be so considered is largely due to Doctor Townsend's unceasing efforts toward their restoration.

After a prolonged period of supposed extermination the elephant seal was rediscovered on Guadalupe Island off the west coast of Mexico in 1911. The herd at this time numbered about 100, but under the protection of the Mexican Government it has increased to such an extent that an expedition recently sent out by the Zoological Society of San Diego was able to count well over 1400 members.

The Townsend fur seal, of great commercial importance one hundred years ago and formerly abundant in the region of Guadalupe Island, was also recently rediscovered. An extended account by Doctor Townsend on this rare sea lion has recently been published by the New York Zoological Society.

Of considerable interest was Doctor Townsend's review of the whaling industry. Under the impetus of modern methods the industry today constitutes a real menace to the maintenance of the stocks of whales. This is in part due to the use of "factory steamers" some of which are as large as 22,000 tons and are equipped with airplanes and steam hunting boats which kill the whales and bring them to the floating factory where the animal is reduced to oil, fertilizer and canned meat. It is believed that the catch for the season of 1930 may exceed 30,000 whales. With whale oil selling at $26 a barrel and the average yield from each whale approximating 50 barrels, this would represent, in a normal market, a dollar value of some 40 millions, sufficient economic stimulus to render the situation serious.

It is only to be expected then that some concern should be evidenced, and in this respect Norway, who has the greatest commercial interest in the question, has taken the lead. Legislation enacted in 1929 forbids the killing by all Norwegian whalers of the right whale and all whale cows with calves. To discourage slaughter, whaling crews are no longer to be paid according to the number of whales killed, and all parts of the animal containing oil must be utilized. Overproduction of whale oil in the past few years and the generally depressed condition of the oil market throughout the world have further led the Norwegians to suspend whaling activities for the season of 1931.

This is a step in the right direction, but as Doctor Townsend points out, much remains to be accomplished in the field of whale conservation.

EDUCATION

AUTUMN LECTURE COURSES.—Arrangements for the autumn lecture courses have been completed by the department of public education of the American Museum. The free lectures for the children of the public schools will begin on October 5. There will be nine exhibitions of educational motion pictures, seven lectures on nature and industries, seven on geography and history, and two on hygiene and civics. The first Saturday afternoon program for school children, parents, and the general public will be given on September 12 at 2:30 P. M. This series will include fifteen motion pictures and six lectures. The series of ten weekly free lectures in biologic science for students of the high schools and training schools opens on October 1 at 3:40 P. M. Special lectures have been arranged as usual for pupils of the public schools who are handicapped by defective vision. Exhibition hall talks, with emphasis on the study of Museum exhibits, have also been arranged for school children. The Junior Astronomy Club will have an attractive series of lectures, starting on November 7.

Several courses will be given especially for teachers. Dr. Clyde Fisher will conduct a course for high school teachers on the identification and classification of natural history objects, and Mrs. Grace Ramsey will direct two courses for teachers, in the Theory and Practice of Visual Instruction and in the Mechanics of Visual Instruction. In the latter course Mr. L. Wales Holden, in charge of projection at the Museum, will give most of the lectures.

Further information about all lectures may be obtained upon application to Room 306, School Service Building, American Museum of Natural History.

LECTURES FOR MEMBERS.—The special lectures for members of the American Museum will begin on Thursday, October 22, at 8:15 P. M.

when Mr. H. C. Raven will have some interesting material about "Gorillas at Home." Other subjects for the season are "The Fishing Bank and Fishing," by Bassett Jones, November 5; "With Byrd to the Bottom of the World," by Laurence M. Gould, November 19; "The Glories of the Apache Trail," by Robert Frothingham, December 3; and "Mountain Lions," by William L. Finley, December 17.

LECTURES FOR CHILDREN OF MEMBERS start Saturday morning, at 10:30 o'clock, October 24, with "Nature Poems and Pictures," by Mrs. Ruth Crosby Noble; to be followed November 7, by "Indian Music," interpreted by Rosebud Seymour; "The Story of the Beaver," by William H. Carr, November 21; and "From Coast to Coast Across Africa," by Harold L. Green, December 5.

ANOTHER COURSE OF LECTURES FOR TEACHERS in experimental schools begins Wednesday, September 30, at four o'clock, continuing until May 25, 1932. This course is in collaboration with the Metropolitan Museum of Art, and is entitled "Backgrounds for Progressive School Units."

THE BEAR MOUNTAIN NATURE TRAILS AND TRAILSIDE MUSEUM opened the fifth season on May 1, under the direction of Mr. William H. Carr, assistant curator in the department of public education of the American Museum. Mr. Carr reports the most successful season since the Museum started the project, with a total of 186,000 visitors from May 1 through August. The trails are visited by large numbers of camp groups from the surrounding region, as well as by visitors from all over the world, many of whom use these trails and the Trailside Museum as models for similar projects of their own. Regular meetings are held every two weeks for all nature councillors and museum directors of the regional museums and camps. Nature teaching at the Trailside Workshop, or "Craftshop," has been expanded and enriched this year, making it a most important project. Botany, fish, and turtle pools have been added in the vicinity of the Craftshop, as well as a large rustic snake cage, and a fernery with the various species labelled. Major Welch, general manager and chief engineer of Interstate Park, calls the Craftshop with the surrounding teaching aids, an "Outdoor University." Grateful acknowledgment is here made of the valuable coöperation extended in many ways by the Commissioners of the Interstate Park.

Mr. Carr has recently been appointed director-in-chief of all the Regional Museums in Interstate Park. The Trailside Museum has thus been officially recognized as the leading nature headquarters in the area. It also means that the department of public education of the American Museum now actively directs natural history instruction in 106 camps during July and August, reaching 90,000 children and adults.

FISHES

SOME INTERESTING ACCESSIONS FOR THE DEPARTMENT OF FISHES.—Mr. Ellis S. Joseph, the well-known importer of wild animals, has presented to the American Museum specimens of the interesting South American "electric eel," *Electrophorus electricus*, and lungfish, *Lepidosiren*. Of the three genera of lungfishes living in the world today, one in Africa, one in Australia, and one in South America, this is the rarest in museum collections in our country. It occurs along the course of the Amazon River and its main affluents in wide-spreading marshes and swamps almost choked by vegetation, rising to the surface to breathe with its "double lung" when the oxygen content of the water becomes low, and hibernating in a deep tubular burrow in the mud when the swamps dry up in the dry season. The eggs are laid shortly after the fish is liberated from this prison by the advent of the rains. The male remains to guard them, and it is thought that highly vascular blood-red filaments which develop on his pelvic fins at this time act as accessory gills to enable him to guard the eggs without being forced to resort to the surface for air.

STURGEONS FROM THE CASPIAN SEA.—The American Museum has recently received as a gift from Mr. Ferdinand Hansen, president of the Romanoff Caviar Company, two large mounted sturgeons from the Caspian Sea, both more than five feet in length, and representing different species important in the Russian sturgeon fishery. They will form a valuable addition to the Museum's world series of this group of fishes, and will have, as well, especial interest due to their commercial importance.

CHINESE FISHES.—The Department of fishes at the American Museum has for some years been giving particular attention to a study of the fresh-water fishes of China, and may, we think, claim some credit for recent growth of interest in ichthyology among Chinese students. In any event a very useful check list of Chinese fishes, *Index Piscium Sinensium*," the most recent product of the industry of Prof. Yuanting T. Chu of St. Johns University, Shanghai, which has reached us, gives much credit to work in this Museum. Among several others who are now actively working in this field we may mention

Dr. C. F. Wu of Yenching University; Messrs. P. W. Fang of the Metropolitan Museum, Nanking, and Tsen-Hwang Shaw of the Fan Memorial Institute of Biology and Tsing-Hua University, Peiping; also Dr. Tchung-Lin Tchang, who has been studying in Paris.

LINDSAY MORRIS STERLING

THE department of vertebrate palæontology at the American Museum has the sad duty of recording the death, on July 30, at the Englewood, New Jersey, Hospital, of Mrs. Lindsay Morris Sterling, the head of the department staff of artists.

Mrs. Sterling, who died in her fifty-fifth year, began her work with the American Museum in 1901 under the direction of Professor Henry Fairfield Osborn. Prior to this time she had been making drawings of the comparative anatomy of vertebrates, for use in the Columbia University course, taught by Professor Osborn. This collection of drawings is now in Dr. Gregory's hands, and will be used by him in his volume on the Evolution of the Vertebrates.

LINDSAY MORRIS STERLING
1876–1931
Former head of the staff of artists for the department of vertebrate palæontology at the American Museum

In 1908, Mrs. Sterling began a series of drawings on the osteology of the Proboscidea, chiefly the crania of fossil and living forms. She continued this work through many years, completing for the Proboscidea Memoir several hundred drawings. The last of her work was concerned with the final touches on the illustrations for Chapter XX of the Proboscidea Memoir.

Her work is marked by extraordinary accuracy, a fidelity to truth, and an artistic finish. The high-water mark was reached in the illustrations of the crania of living Proboscideans.

It is difficult to express, in a few words, our appreciation of her very fine qualities of personal character and cheerfulness, and her intense scientific and artistic enthusiasm. Her name ranks with that of Erwin Christman among the artists in the department of vertebrate palæontology. H. F. O.

MAPS

NEW EQUAL AREA MAP OF THE CONTINENTS. One of the last and most enduring works of Lindsay Morris Sterling was a new world map, technically known as 'homalographic' because so far as possible the continents are drawn in equal areas, with the exception of the north polar region including Greenland, which is relatively enlarged.

This map will form a new basis for plotting all the American Museum expeditions and exploration of the continents. Its especially novel and outstanding feature, in contrast with all maps in current use, is that the great mother continent of Asia is placed in the center, with North America to the east and Europe and Africa to the west; this central zoogeographical position of the great continent of Asia is practically the result of the remarkable discoveries made by our Central Asiatic Expeditions under Roy Chapman Andrews and Walter Granger, for these expeditions have demonstrated that Asia is not only the mother of the continents but the foster mother of the greater part of the forms of reptile, mammal, and probably bird life. It is not only the center but the chief migration route eastward and westward of animals originating in the lesser continents of America and Africa. The well-known homalographic base map of Professor Goode of the University of Chicago follows the old method of placing Eurasia and Africa on the east and the American continents on the west; it is inferior to our new Sterling map also in inadequately coping with the extremely difficult problem of the flattening out of any part of a sphere.

Curator Chester A. Reeds from the beginning has supervised the making of this new equal area

map, and during the past two years with the advice of Curator Osborn has devoted a great deal of time to its preparation. It will be distributed immediately throughout the Museum for plotting purposes and will be available for other institutions. An important and effective use is being made by Doctor Antevs with the coöperation of Doctor Reeds in plotting the four glaciations of the Northern Hemisphere; this will also be printed in color and issued by Doctor Reeds as a Museum *Bulletin*. In the autumn a second printing of the Sterling map will be issued in four colors, also a second edition of it so arranged as to bring the North American continent close to Asia at the Behring Strait junction.

HONORS

ON June 29, the Belgian Consul in New York City delivered to Dr. James P. Chapin the insigna of the "Ordre de la Couronne." This decoration was conferred by King Albert in recognition of Doctor Chapin's twenty-two years of researches in the zoölogy of the Belgian Congo.

MEETINGS OF SOCIETIES

CANADIAN Biological Conference.—Mr. H. E. Anthony, curator of the department of mammals, represented the American Museum as a delegate to the 1931 Canadian Biological Conference held at Mr. Copley Amory's camp on the Matamek River on the north shore of the St. Lawrence, July 23 to August 1.

This conference was planned and called by Mr. Copley Amory, an American who has been a summer resident at Matamek for many years and has noted the great economic effect of the cycles of animal abundance and scarcity upon the population of Labrador. The periodic fluctuations in the abundance of cod or of fur-bearers have a profound influence upon the people of a region where the principle natural resources are animal in nature. The records of the Hudson's Bay Company, covering a period of several hundred years, upon analysis by Charles Elton of Oxford, disclosed a regular rythm of increase and decrease in the number of furs taken. Mr. Amory has been hoping that a better understanding of such phenomena might enable one to prophesy such an event as the disappearance of the cod for a given period from their normal banks in the Gulf of St. Lawrence and the people might make provision in advance of what ordinarily proves to be an economic calamity.

The conference was attended by scientists from many institutions and representing many fields of research. Several delegates from Europe were present, but the majority were from Canada and the United States. Canadian officials both of the National Government and of the Province of Quebec were much interested in the conference and its purposes. A luncheon was given to the delegates at Quebec on July 22 by the Provincial government. The Clarke Steamship Company placed a steamer on a special run from Rimouski to Matamek and return to carry the delegates to Mr. Amory's camp. At Matamek they were the guests of Mr. Amory who had gone to great length to provide admirable facilities for the deliberations of the conference and the comfort and recreation of the members.

A full daily program occupied the time of the conference from 8:30 each morning until five or later in the afternoon. The occasion was unique among scientific gatherings in the fact that practically one hundred per cent attendance marked each session. It was the unanimous opinion of those present that the conference was eminently successful and that a real beginning upon the problems of periodic fluctuations had been made.

An abstract of the daily proceedings will be published at an early date and special papers presented at the conference will doubtless be published. In general, the program brought together and correlated a host of observations upon the cyclic phenomena of animal life. The outstanding cases of such fluctuations are the lemmings of Scandinavia, a four-year cycle, the varying hares of northern North America, a ten-year cycle, and the ruffed grouse of eastern North America, also a ten-year cycle. Fluctuations in the numbers of salmon and of cod show that pulsations in numbers occur in the waters as well as on the land. A study of the growth rings of trees reveals a periodicity in the annual factors of climate favorable to growth. While there seemed to be little question as to the existence of a flow and ebb in animal populations, the interpretation of these phenomena brought forth some differences of opinion among the delegates. It soon became apparent that there must be cycles of different lengths, but these were accounted for by the climatologists with an array of solar and lunar cycles of activity which might well lay the ground work for these biological events through a direct action upon climate. Sun-spot cycles were frequently cited as the underlying cause of fluctuations.

One of the points which was well established is the need of thorough research into life histories of the species which display fluctuations in number, as well as those which do not, in order to discover the mechanism by which numbers are built up or destroyed. One of the most significant topics discussed was the effect of epizootic

disease upon large animal populations and a possible cycle of virulence shown by the epizootic. Furthermore, it would appear that well marked cyclic phenomena are confined to particular geographical regions, and this suggests a geographi-

was a good example, while the least fluctuation took place in the great tropical rain forests of South America and Africa. He also served on the Committee on Resolutions and is a member of the Committee on Future Arrangements.

A NEW ARRIVAL FROM THE GOBI DESERT

Examining a skull of the remarkable new amblypod related to Dinoceras of the Rocky Mountains. Left to right are Albert Thomson, assistant on the staff of the Central Asiatic Expeditions; H. F. Osborn, president of the American Museum and honorary curator of the deptartment of vertebrate palæontology; Walter Granger, chief of the palæontological division of the Central Asiatic Expeditions

cal pattern of fluctuation which may be correlated with certain climatic factors.

The conference closed with the hope that such an auspicious beginning would lead to noteworthy accomplishments in the future. With a much better understanding of the problems involved, many of the members outlined plans for promising lines of research. A second conference was expected to result, possibly after three years, and details of this meeting as well as of a permanent organization to deal with fluctuations was referred to a committee of which Mr. Amory will be the guiding spirit.

Mr. Anthony presented a paper on the general subject of fluctuations in the numbers of mammals, with special reference to the scarcity of cyclic phenomena in South America, and suggested that the greatest degree of fluctuation was to be found in special areas, ofwhich Canada

THE NATIONAL EDUCATION ASSOCIATION.—During the week beginning June 29, Mrs. Grace Fisher Ramsey represented the department of public education of the American Museum at the annual meeting of the National Education Association held in Los Angeles. She attended the meetings of the department of visual instruction in which she holds the office of Secretary-Treasurer. The emphasis of the meetings was placed on the need for training teachers in the use of visual and other sensory aids.

VERTEBRATE PALÆONTOLOGY

A REMARKABLE NEW AMBLYPOD FROM THE GOBI DESERT.—One of the most surprising of the new animals discovered by the Central Asiatic Expedition in the Gobi in 1930, in strata of Upper Eocene age, is an Amblypod closely re-

lated to the *Dinoceras* of North America. One of the several skulls obtained of the new form is shown in the photograph on page 565. Evidently the Gobi region was highly favorable to the development of the heavy-footed Amblypods, for the group survived into Middle Oligocene time, contemporaneously with the giant *Baluchitherium*, whereas in the Rocky Mountains the *Dinoceras* line died out in Upper Eocene time, and the *Coryphodon* line died out in Lower Eocene time. In the Gobi there survived the coryphodon known as *Eudinoceras*, previously described, also a giant supercoryphodont, of a most surprising new type and of Oligocene age, which will be described by Curators Osborn and Granger in an autumn issue of *Novitates*.

CHILDREN'S SCIENCE FAIR

THIS year the American Institute Children's Science Fair will be held from December 9 to 11, at the American Museum of Natural History.

Since 1821, the American Institute has held fairs in New York City; early in the Nineteenth Century, in Niblo's Garden and Castle Garden, later in its own building.

In 1928 the American Institute, coöperating with the American Museum of Natural History and the School Nature League held the first Children's Science Fair, an exposition for boys and girls designed to focus attention on the sciences and to foster a scientific interest in agriculture, gardening, nature study, and conservation.

In this, the Fourth Children's Science Fair, organizations, schools, and individuals eighteen years of age or younger may exhibit work in many fields of science,—biology, chemistry, physics, astronomy, geology, agriculture, nature study, and conservation. For information concerning the plans for the fair, address The Children's Science Fair, Office of the American Institute, Lincoln Building, New York City.

APPOINTMENTS

DR. WENDELL C. BENNETT has been appointed assistant curator in anthropology beginning September 1, 1931.

MISS KATHERINE F. KUMPF, of Mount Holyoke College, South Hadley, Massachusetts, took up her duties as assistant in experimental biology, at the American Museum, September 1, 1931.

THE ROOSEVELT MEMORIAL

ON October 27, 1931, Governor Roosevelt will lay the cornerstone of the New York State Roosevelt Memorial Building, which is being erected at the axis of Seventy-ninth Street and Central Park West, New York City. The date selected for the ceremony will be the seventy-third anniversary of the birth of Theodore Roosevelt, former President of the United States, to whom the building is to be dedicated.

RECENT PUBLICATIONS

"*Wild Game.—Its Legal Status.*" By E. I. Du Pont de Nemours & Co., Wilmington, Delaware.

THIS is a compilation of the laws and court decisions relating to the ownership and regulation of wild game from early times down to the present. It is a useful resumé of such legal data and is available for distribution, free of charge, to those interested as long as the supply lasts. Naturalists and nature lovers who are interested in posting themselves upon the legal status of game would do well to write to this company for a copy of the brochure.

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total membership 12,100.

Life Members

Mrs. CHARLES E. F. MCCANN.
Mr. PAUL MOORE.

Sustaining Member

Mr. G. F. STEELE.

Annual Members

Mesdames R. P. BASS, FREDERIC W. LINCOLN.
Misses A. LAGEMANN, MARJORIE MCINTOSH.
Dr. FREDERIC DAVID ZEMAN.
Messrs. PERKINS BASS, LEON A. BIRCK, O. B. CARROTT, DRURY W. COOPER, JR., WM. DE KRAFFT, THOMAS E. DUNN, ROBERT S. FLETCHER, J. RITCHIE KIMBALL, NATHAN J. LEVINE, EDMUND PLATT, A. PHIMISTER PROCTOR, BEN LEROY STOWELL, OTTO WILLI ULRICH, I. K. WARD, SYLVAN E. WEIL.

Associate Members

Baronne DE RADZITZKY-D'OSTHOWICKY.
Mesdames JOHN F. BIDDLE, ALFRED H. BRYAN, HARRY L. CARRETT, T. S. MURFITT, W. J. SURGANTY.
Misses EDDIE LEE DAVIS, MARGUERITE GEER, FLORENCE F. LANDRY, RUTH JANET PIRKLE.
Prince TAKA-TSUKASA.
Count NILS GYLDENSTOLPE.
Prof. WM. J. KERR.
Doctors EDMOND BECHTOLD, HARMON P. B. JORDAN, NAGAMICHI KURODA, HOOKER OLIVER LINDSEY, JOSEPH MULLEN, ALIPIO DE MIRANDA RIBEIRO, THOS. E. WINECOFF.
Colonel DAVID M. MCKELL.
Messrs. FRANK A. BEIER, JEFFERSON S. BENNER, J. L. BHADURI, FRANS ERNST BLAAUW, LEONARD H. CADWELL, JOHN D. CARTER, M. J. CASSIDY, WALTER E. COE, HENRY B. CROSS, C. B. CUNNINGHAM, JAMES C. DAILEY, ALFRED E. DART, LEONARD H. DREMAN, JR., HERBERT EDDY EASTON, SPENCER ERVIN, ARTHUR M. GRASS, BURGESS GREEN, MARCUS H. GREEN, WILLIS B. HALL, R. W. HAMMOND, SAMUEL HAWKES, FRED HEILFURTH, BENJAMIN CHAPMAN HIATT, HENRY A. HOOVER, JACOB KJODE, GUSTAVE LANGELIER, WILLIAM F. LEGGETT, BORIS A. LUTS, RODERICK L. MACLEAY, E. W. MAYNARD, HUGO L. MENKE, ALBERT K. MILLER, ROBERT M. MOORE, J. T. POWER, JOSEPH GALES RAMSAY, CHARLES RAY, HOWARD ROBERTSON, FRITZ ROHRIG, ROBERT H. ROSE, JOHN W. SHERWOOD, A. B. SMITH, G. RUSSELL STEININGER, A. G. SUDHEIMER, JAMES G. SUTHARD, ARTHUR T. WATSON, MARCUS WHITE, CARTER R. WHITTAKER, WILLIS B. WOOD, R. G. WOODBRIDGE, 3D., THOMAS WORTHEN.

THE AMERICAN MUSEUM OF NATURAL HISTORY

FOUNDED IN 1869

SIXTY years of public and scientific service have won for the American Museum of Natural History a position of recognized importance in the educational and scientific life of the nation, and in the progress of civilization throughout the world. Expeditions from the American Museum and members of the scientific staff are interested in facts of science wherever they may be found. As a result, representatives of this institution are forever studying, investigating, exploring, not merely in their laboratories and their libraries, but actually in the field, in remote and uncivilized corners of the world, as well as in lands nearer home.

From these adventuring scientists and from observers and scientists connected with other institutions, NATURAL HISTORY MAGAZINE obtains the articles that it publishes. Thus it is able to present to the members of the American Museum the most fascinating, the most important, and the most dramatic of the facts that are being added to the sum total of human knowledge.

MEMBERSHIP MORE THAN TWELVE THOUSAND

For the enlargement of its collections, for the support of its exploration and scientific research, and for the maintenance of its many publications, the American Museum is dependent wholly upon members' fees and the generosity of its friends. More than 12,000 members are now enrolled and are thus supporting the work of the Museum. There are ten different classes of members, which are as follows:

Associate Member (Persons residing fifty miles or more from New York City)	annually	$3
Annual Member	annually	$10
Sustaining Member	annually	$25
Life Member		$200
Fellow		$500
Patron		$1,000
Associate Benefactor		$10,000
Associate Founder		$25,000
Benefactor		$50,000
Endowment Member		$100,000

Memberships are open to all those interested in natural history and in the American Museum. Subscriptions by check, and inquiries regarding membership should be addressed: James H Perkins. Treasurer, American Museum of Natural History, New York City.

FREE TO MEMBERS

NATURAL HISTORY: JOURNAL OF THE AMERICAN MUSEUM

This magazine, published bi-monthly by the American Museum, is sent to all classes of members, as one of their privileges.

AUTUMN AND SPRING COURSES OF PUBLIC LECTURES

Series of illustrated lectures held on alternate Thursday evenings in the autumn and spring of the year are open only to members or to those holding tickets given them by members.

In addition to these lectures, illustrated stories for the children of members are presented on alternate Saturday mornings in the autumn and in the spring.

MEMBERS' CLUB ROOM AND GUIDE SERVICE

A handsome room on the third floor of the Museum, equipped with every convenience for rest, reading, and correspondence, is set apart during Museum hours for the exclusive use of members when visiting the Museum. Members are also privileged to avail themselves of the services of an instructor for guidance.

SCIENCE
EDUCATION

RESEARCH
EXPLORATION

SIXTIETH ANNIVERSARY ENDOWMENT FUND. Already, $2,500,000 has been contributed to this $10,000,000 fund, opened in January, 1929, to commemorate the Sixtieth Anniversary of the Founding of the American Museum of Natural History and to further the growth of its world-wide activities in Exploration, Research, Preparation, Exhibition, Publication, and Education. Committees are now engaged in seeking the $7,500,000 which remains to be contributed. It is greatly to be desired that this fund, so vital to the scientific and educational progress of the Museum, shall reach completion at an early date.

EXPEDITIONS from the American Museum are constantly in the field, gathering information in many odd corners of the world. During 1930, thirty-four expeditions visited scores of different parts of North, South, and Central America, of Europe, Asia, Africa, and Polynesia. New expeditions are constantly going into the field as others are returning with their work completed, or in order to digest material gathered preparatory to beginning new studies.

SCIENTIFIC PUBLICATIONS of the Museum, based on its explorations and the study of its collections, include the *Memoirs*, devoted to monographs requiring large or fine illustrations and exhaustive treatment; the *Bulletin*, issued in octavo form since 1881, dealing with the scientific activities of the departments except for the department of anthropology; the *Anthropological Papers*, which record the work of the department of anthropology; and *Novitates*, which are devoted to the publication of preliminary scientific announcements, descriptions of new forms, and similar matter.

POPULAR PUBLICATIONS, as well as scientific ones, come from the American Museum Press, which is housed within the Museum itself. In addition to NATURAL HISTORY MAGAZINE, the journal of the American Museum, the popular publications include many hand books, which deal with subjects illustrated by the collections, and guide leaflets which describe individual exhibits or series of exhibits that are of especial interest or importance. These are all available at purely nominal cost to anyone who cares for them.

THE LIBRARY of the American Museum is available for those interested in scientific research or study on natural history subjects. It contains 115,000 volumes, and for the accommodation of those who wish to use this storehouse of knowledge, a well-equipped and well-manned reading room is provided. The LIBRARY may be called upon for detailed lists of both popular and scientific publications with their prices.

COLLEGE AND UNIVERSITY SERVICE. The President of the Museum and the Curator of Public Education are constantly extending and intensifying the courses of college and university instruction. Among some of the institutions with which the Museum is cooperating are Columbia University, New York University, College of the City of New York, Hunter College, University of Vermont, Lafayette College, Yale University, and Rutgers College.

PUBLIC AND NORMAL SCHOOL SERVICE. The increased facilities offered by this department of the Museum make it possible to augument greatly the Museum's work, not only in New York City public schools, but also throughout the United States. More than 22,500,000 contacts were made with boys and girls in the schools of Greater New York alone, and educational institutions in more than thirty states took advantage of the Museum's free film service during 1930. Inquiries from all over the United States, and even from many foreign countries are constantly coming to the school service department. Thousands of lantern slides are prepared at cost for distant educational institutions, and the American Museum, because of this and other phases of its work, can more and more be considered not a local but a national—even an international—institution.

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77th STREET and CENTRAL PARK WEST
NEW YORK, N. Y.

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Entered as second-class matter April 3, 1919, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

BLAZING THE TRAIL

LIVING the year round in tents on a high plateau, 15,000 feet and more above sea level, and constantly swept by terrific winds, is a race of people who have literally conquered the elements. Last summer Mr. C. Suydam Cutting traveled and camped on the nomad plateau of Southern Tibet, and he describes in the next issue of NATURAL HISTORY, how the hardy nomads manage to keep happy and comfortable, despite their unpropitious environment.

MR. JAMES L. CLARK, Vice-Director of the Museum in charge of Preparation, has recently returned from a difficult collecting trip in the region of the Upper Nile, where he went in company with Mr. C. Oliver O'Donnell to obtain specimens of giant eland. In the twenty-one hunting days he was able to spend, he covered 227 miles on foot, often at temperatures exceeding 100° in the shade, and in that time obtained only two shots. It speaks much for Mr. Clark's patience and his marksmanship that with those two shots he obtained an excellent male and an equally good female of the species required for the Museum's collections. It is concerning this expedition that Mr. Clark will write in the November-December issue.

DR. JAMES P. CHAPIN, whose article "Up the Congo to Lukolela" appears in this number, will write an account of his scientific work and the collections he made in the heart of Africa. The difficulties of collecting, observing, and photographing under the conditions that one must face in tropical Africa are such as to make the stay-at-home wonder at the scientific enthusiasm that alone makes possible the success of such an undertaking.

THE AMERICAN MUSEUM now has under construction four huge additions to the already enormous structure that houses its collections. Furthermore, plans for beautifying the new approach to the partially built Roosevelt Memorial, are under way. Mr. George N. Pindar, Registrar of the American Museum, will write on this new development of the Museum.

SOME time ago a snowy owl, wandering far from its Arctic or sub-arctic haunts, was shot not far from New York. Luckily, however, the bird was not killed, nor was it seriously injured. A fracture of one wing bone did make possible its capture, and the bird was turned over to Mr. T. Donald Carter, of the Department of Mammalogy, at the American Museum to be "stuffed." Mr. Carter, however, had other ideas, and for the better part of a year entertained this unusual visitor from distant parts as a guest in his New York apartment. The bird was "stuffed," if at all, only by the food presented to it by its host, and during its sojourn in the city, not only recovered perfectly from the effects of its injury but also became a thoroughly entertaining member of the household. Ultimately the bird was released on Long Island, and no doubt betook itself to lands farther north. NATURAL HISTORY MAGAZINE, however, has obtained from Mr. Carter for the next number an account of the bird's activities as a resident of New York.

THE COVER OF THIS ISSUE

IT is unfortunate that NATURAL HISTORY MAGAZINE has not been able to reproduce in color all the selections from Hubert Stowitts' remarkable series of ethnographic paintings that appear in this issue.

The picturesque "Hindu Gypsy of the Nath Tribe" that has been chosen to adorn the cover of the September-October number is only a single example of the richness of color and the exactness of detail possible in the use of Fresco Secco, the medium with which Mr. Stowitts has so magnificently portrayed the fast vanishing types, arts, and crafts of ancient India.

The Fresco Secco method of painting was used by the early Italians, who mixed the pigment with yolk of egg, diluted it with water, and applied it on dry plaster, as contrasted with the true Fresco method which consisted of applying water color on wet plaster. Mr. Stowitts used the Fresco Secco method on canvas.

THOSE of us who are gardeners, as well as those of us who do not fully appreciate such enthusiasms, are often prone to think of plant life in connection only with spring, summer, and autumn. Plant life in winter, however, can, in some of its phases, be as interesting as plant life at other seasons of the year. For the next number of NATURAL HISTORY, Mr. Oliver Perry Medsger has written an article on this aspect of the subject.

CANOE country reaches from the arctic tundra of the barren grounds northwest of Hudson's Bay, southward to the International Boundary between Lake Superior and the Lake of the Woods, and dipping into Minnesota. These enormous areas in Canada, rich in lakes and water courses, have been reached only by the canoe and paddle, except for the recent flights of the airplane. Mr. F. L. Jaques, artist on the American Museum staff, has paddled along this ancient canoe route of the Indians. In the next issue of NATURAL HISTORY he will tell of this true wilderness unmarred by civilization, and will illustrate the story with his own unique pen drawings of the animal life he has seen there.

OTHER material covering the progress of the American Museum in the field and in the laboratory will keep the readers informed of the many scientific and educational activities in which the Museum is engaged at the present time.

NATURAL HISTORY

Vol. XXXI, No. 6 1931 Nov.-Dec.

GIANT ELAND OF THE SOUTHERN SUDAN

JOURNAL OF THE AMERICAN MUSEUM OF NATURAL HISTORY

NEW YORK, N. Y.

Fifty Cents a Copy

Three Dollars a Year

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BLAZING THE TRAIL

AMONG the travelers and explorers who have penetrated to the heart of Asia behind the forbidding wall of the Himalayas, few are better known or more accurately informed than William J. Morden. He has spent more than a little time on the caravan trails of the lands to the north of India, and for the January–February number of NATURAL HISTORY has written on the devil dancers of Tibet. His information was, of course, gained at first hand, and the article will be illustrated by photographs taken by Mr. Morden himself.

THE readers of NATURAL HISTORY are familiar with the charming articles and photographs of birds written and taken by Alfred M. Bailey, director of the Chicago Academy of Sciences. For the next number of the magazine Mr. Bailey has written another article, but this time giving an account of an expedition to the Simyen Mountains of Northern Ethiopia. It is illustrated, of course, by Mr. Bailey's own excellent photographs, and while far afield from his delightful study of American birds, is done in his own inimitable style.

DURING the past summer Mr. Barnum Brown, of the American Museum's department of vertebrate palæontology, discovered a spot in Montana where he unearthed some hundreds of flint arrow heads. Furthermore, a careful study of the site showed him plainly that it was there that the Indians formerly drove herds of buffalo over a low cliff, thus obtaining food and skins in abundance. Mr. Brown has written an article describing his "find," while Arthur A. Jansson, whose paintings so often appear on the covers of NATURAL HISTORY, has drawn two stirring pictures of the stampeding buffaloes as they approach and plunge over the cliff at the base of which the arrow heads were found.

SOME of the most dramatic of all historical accounts deal with Cortez in Mexico and Pizarro in Peru. Nor are their stories complete without some mention being made of the gold of the people they conquered. NATURAL HISTORY has an article, which will appear in the next number, telling of the gold of the nations conquered by the Spaniards. It has been written by Dr. Wendell C. Bennett, who has recently joined the staff of the American Museum as assistant curator in anthropology.

READERS of NATURAL HISTORY will recall an article by Dr. G. Kingsley Noble which appeared in the January–February, 1931, number, describing the yawl "Basilisk" built especially for voyaging among the islands of the West Indies in order to further scientific study there. Gilbert C. Klingel, the builder and captain of this little vessel, has now written an article giving his account of the adventures and studies carried on by him. The story of the "Basilisk" has never, so far, been completely told, and NATURAL HISTORY is glad to be able to present this additional information in its next number.

THE COVER OF THIS ISSUE

THE cover of this number, painted by Mr. Arthur Jansson, of the department of preparation staff, who has made most of the outstanding cover designs familiar to our readers, shows a male and female giant eland in a characteristic setting.

This issue presents an interesting article on the quest of these fine animals for a Museum group. Owing to the use of black and white pictures in illustration and the fact that no photographs exist of the live animal in the wilds, by reason of the extreme difficulty of even seeing them, we have chosen this subject for the cover in order to give our readers some appreciation of the handsome coloring of these antelope and a conception of what a beautiful exhibit the final group will be.

NEW GUINEA is one of the world's greatest islands, and contains, at the same time, large areas of unexplored country. It is of a journey to the Arfak Mountains of New Guinea that Dr. Ernest Mayr has written for the next number of NATURAL HISTORY. Alone, save for his native "boys," Doctor Mayr climbed the difficult slopes of these little known mountains in his study of birds, and for the first time has written a popular account of his scientific journey.

IN referring to individuals who find themselves in positions in which they do not seem to fit we often use the expression "like fish out of water." But now Miss Francesca La Monte of the department of ichthyology of the American Museum has written an article entitled "Fish Out of Water," which shows very plainly indeed that it is far from impossible for certain fish to take care of themselves perfectly well even when they are not surrounded by the medium with which we all naturally associate them. That certain fish can fly all of us know well enough. That other fish burrow in the mud above water mark while others, still, occasionally climb trees, is less widely appreciated. It is of such odd creatures that Miss La Monte has written.

IN the study of astronomy it is obvious that those heavenly bodies closest to the earth are most intimately known. By terrestrial measurements they are all—even the moon—at vast distances from us, of course, but astronomically speaking they are very near. Proxima Centauri, the nearest star, is about four light years away—that is, about 100 million times as far as the moon, and about 260,000 times as far as the sun is from the earth. Consequently we can view the sun and the planets as being comfortably near by. Dr. Clyde Fisher, curator of astronomy of the American Museum, has written an article about these closest associates of the earth—the planets, and NATURAL HISTORY is looking forward to its publication in the next number.

VOLUME XXXI
NUMBER 6

NATURAL HISTORY

NOV.-DEC.
1931

The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor

A. KATHERINE BERGER
Associate Editor

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Published bimonthly by The American Museum of Natural History, New York, N. Y. Subscription price $3 a year.

Subscriptions should be addressed to James H. Perkins, Treasurer, American Museum of Natural History, 77th St. and Central Park West, New York, N. Y.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

EASTERLY APPROACH TO THE ROOSEVELT MEMORIAL

A bird's-eye view looking toward the west across Central Park, showing how the American Museum will look when it is completed, and the concourse 160 feet wide and 500 feet long, as planned by the architect, John Russell Pope

VOLUME XXXI

NATURAL HISTORY

NUMBER SIX

NOVEMBER–DECEMBER, 1931

THE THEODORE ROOSEVELT MEMORIAL

The Structure Being Erected by the State of New York Adjacent to the American Museum of Natural History in Memory of a Great Naturalist and Statesman

By GEORGE N. PINDAR

Secretary of the Board of Trustees, New York State Roosevelt Memorial

On the axis of Seventy-ninth Street and Central Park West, in the city of New York, there is being erected a building by the people of the state of New York which, in the hearts of Americans, always will be associated intimately with the man it memorializes. The corner stone of this building, which is known as The New York State Roosevelt Memorial, was laid with appropriate ceremonies on October 27, 1931 by Franklin D. Roosevelt, governor of the state of New York.—THE EDITORS.

With something of the savant and the sage,
He was, when all is said and sung, a man;
The flower imperishable of this valiant age,
A True American.*
—CLINTON SCOLLARD.

AFTER the death, on January 6, 1919, of Theodore Roosevelt, President Henry Fairfield Osborn, of the American Museum of Natural History, in coöperation with the *New York Times* and the *New York World*, advocated the erection of a memorial to Roosevelt that would be educational in character and connected with the American Museum, inasmuch as Roosevelt was a keen student of natural history, with the result that the Legislature of New York, in 1920, created a Commission consisting of two senators, Samuel J. Ramsperger and George L. Thompson; two assemblymen, Louis A. Cuvillier and Raymond T. Kenyon, and two members at large, Peter D. Kiernan and Henry Fairfield Osborn. The law provided "An Act creating a commission to investigate and report on the proposed Roosevelt memorials, and making an appropriation therefor." In his advice to the Commission, Governor Smith stated that he would like to see a plan which "would for all time stand as a visible expression of the recognition of the services of one who had been most active in the welfare and development of our State and Nation."

In planning the Memorial, three factors were considered:

FIRST, to interpret the character of Roosevelt as naturalist and as citizen. John Burroughs wrote of him with an understanding acquired through close association and kindred tastes:

> Such unbounded energy and vitality impressed one like the perennial forces of nature. . . . He was a naturalist on the broadest grounds, uniting much technical knowledge with knowledge of the daily lives and habits of all forms of wild life. He probably knew tenfold more natural history than all the presidents who preceded him,

*The last stanza from the poem "A Man," written by Clinton Scollard on the occasion of Roosevelt's death.

and I think one is safe in saying, more human history also.

Roosevelt was a many-sided man and every side was like an electric battery. Such versatility, such vitality, such thoroughness and such copiousness have rarely been united in one man. . . . His Americanism reached in to the very marrow of his bones. The charge that he was an impulsive man has no foundation; it was a wrong interpretation of his power of quick decision. . . . His uncompromising character made him many enemies, but without it he would not have been the Roosevelt who stamped himself so deeply upon the hearts and the history of his countrymen.

This Memorial must reflect that character and translate it in unmistakable terms to the generations to follow.

Second, it must be essentially an educational institution. No other would adequately memorialize the broad, humanitarian intelligence that Roosevelt possessed. To those who wish to study nature in all its phases should be given every facility from every possible angle in order that they may appreciate and be led to emulate the extraordinary knowledge that Roosevelt attained.

Third, it should suggest a lofty standard of idealism through harmonious lines inspired by models chosen from the golden age of architecture. There should be evolved a design that will symbolize the spirit of Roosevelt, and by its impressiveness infuse those ideals for which Roosevelt strove and many of which he attained. The words of John Ruskin most aptly describe the goal of the builders of this Memorial:

When we build, let us think that we build forever. Let it not be for present delight nor for present use alone. Let it be such work as our descendants will thank us for.

Thus was started a great monument, dedicated to the perpetuation of the ideals of civic integrity, to the amelioration of those conditions which are oppressive and to a fearless stride forward to hold the nation to a higher social and humanitarian level.

As soon as the form of the Memorial was decided, there arose the question of location; whether Albany, as the Capital City, was the more fitting place, or New York City, where such a memorial would not only be accessible to millions of people but also could more adequately function as an educational factor in the life of the nation. In 1924 the Legislature decided that it should be placed in New York, adjacent to the American Museum of Natural History, at a cost to the state not to exceed $2,500,000 and the sum of $250,000 was appropriated to defray the expenses made necessary by the Act.

In October, 1924, when the first Commission had completed its work, Governor Alfred E. Smith appointed a Board of Trustees for the New York State Roosevelt Memorial as follows: The Governor, ex-officio; Henry Fairfield Osborn, chairman; Peter D. Kiernan, vice-chairman; Chauncey J. Hamlin of Buffalo; Dr. Charles W. Flint of Syracuse; Sullivan W. Jones of Yonkers; Mrs. Douglas Robinson of New York City; Mrs. William H. Good of Brooklyn. The personnel of the Commission has remained the same except that in 1930 Mr. George Gordon Battle was appointed to fill the vacancy created by Mr. Sullivan W. Jones whose term of office had expired. In 1925, the Board of Trustees decided to invite the leading architects of New York State to enter a competition and present plans for the Memorial. Eight architects took part in the competition and submitted their plans. Mr. Arnold W. Brunner was selected to act as the professional adviser of the Board of Trustees and formulated the program of competition. At his death, on February 14, 1925, the work was taken over and completed by Mr. Charles Butler. The judges were Mr. William Mitchell Kendall, of the firm of McKim, Mead & White, and Mr. Milton B. Medary, Jr., of Philadelphia. In this competition the

ENTRANCE TO THE THEODORE ROOSEVELT MEMORIAL
Facing Central Park West, at the intersection of Seventy-ninth Street. The sketch model of the equestrian statue is by James E. Fraser. The figures give an idea of the scale

design of John Russell Pope of New York won the award.

The Program of Competition stated that "The nature lover should be stressed by monumental architecture, sculpture and mural paintings. The design should symbolize the scientific, educational, outdoor and exploration aspects of Theodore Roosevelt's life rather than the political or literary." In Mr. Pope's plan these features are blended most harmoniously. A monumental structure, graceful in every line and inspired by the stately designs of the old Roman architecture, it conveys to the beholder an impression of spaciousness and enduring strength.

The façade is modeled on the triumphal arches of ancient Rome. The entrance arch rises to a height of sixty feet above the base, and is flanked on either side by huge granite columns supporting heroic figures of Lewis, Clark, Audubon, and Boone, outstanding characters in early American history. It will be crowned by a solid parapet wall which will bear the following inscriptions:

STATE OF NEW YORK MEMORIAL
TO
THEODORE ROOSEVELT
A GREAT LEADER OF THE YOUTH OF AMERICA, IN ENERGY AND FORTITUDE, IN THE FAITH OF OUR FATHERS, IN DEFENSE OF THE RIGHTS OF THE PEOPLE, IN THE LOVE AND CONSERVATION OF NATURE AND OF THE BEST IN LIFE AND IN MAN.

These prominent features, together with its deep recesses, shadows, and reflections, and its mammoth bronze screened window, most successfully unite the exterior with the interior.

From the practical and educational standpoint the building is splendidly

equipped with class rooms, exhibition rooms, a lecture hall that will seat six hundred people, a hall for the display of the resources of New York State, and a room devoted to Rooseveltiana. At the right of the entrance vestibule will be placed administration offices and a Trustees' Room, while at the left will be a group of superbly finished panelled wood interiors, forming a suite of rooms to be known as the Governor's Rooms. A cafeteria will be arranged in the basement and from that floor direct access will be had to the platform of the Eighth Avenue Subway.

The façade of the building will be executed in pink granite. A paved terrace, 350 feet in length, will be flanked at both ends by pedestals carved in bas relief. A vehicular driveway will adjoin this terrace, passing about the rear and will lead to the first floor entrance. In the center of the terrace, immediately in front of the great entrance arch, upon a polished granite pedestal, will be an equestrian statue of Roosevelt with two accompanying figures on foot, one an American Indian and the other a native African, representing his gun bearers and suggestive of Roosevelt's interest in the original peoples of these widely separated countries. This group will rise to a height of thirty feet above the sidewalk. It is the work of James E. Fraser, the well-known sculptor, who will also design and execute the four statues to surmount the columns in front of the façade.

In niches at either side of the entrance arch will be sculptured figures of two typical specimens of American big game, the bison and the bear. They will be the work of Mr. James L. Clark, and it is intended that the bear shall typify courage, tenacity, and power; the bison, romance, fortitude, and endurance, outstanding characteristics of Roosevelt. The arch itself is a coffered granite vault, and in the background is a mammoth screen composed of bronze, glass, and marble, by means of which direct lighting of the interior hall is obtained.

Passing through this entrance, one steps into the Memorial Hall itself, a conception of grandeur and dignity in harmony with the spirit of Roosevelt's lofty ideals and fearless character. This hall, exclusive of recesses, will be 67 feet wide by 120 feet in length. The floor will be richly patterned in marble mosaic, the walls, to a height of nine feet, being of dark green marble surmounted by mellowed limestone extending to an elaborate Corinthian cornice and culminated by an octagonal coffered barrel vault, reaching to a height of 100 feet above the floor. At either end of this vaulted ceiling the walls are penetrated by large circular-headed windows which will furnish the hall with ample daylight. In order to avoid the deteriorating effects of direct daylight on murals, the architect has skilfully designed recesses in the walls at three sides of the room. The vaulted ceiling will be supported by marble columns fifty feet high, crowned with Corinthian capitals and executed in antique red marble.

Spaces have been reserved within the Memorial for quotations from Roosevelt's writings and sayings, arranged under four headings as follows:

NATURE

"There is a delight in the hardy life of the open."

"There are no words that can tell the hidden spirit of the wilderness, that can reveal its mystery, its melancholy and its charm."

"The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased, and not impaired in value."

"Conservation means development as much as it does protection."

"THE SENATE BUST"
By James E. Fraser
A portrait that will always live

MANHOOD

"A man's usefulness depends upon his living up to his ideals insofar as he can."

"It is hard to fail, but it is worse never to have tried to succeed."

"All daring and courage, all iron endurance of misfortune, * * * make for a finer, nobler type of manhood."

"Only those are fit to live who do not fear to die; and none are fit to die who have shrunk from the joy of life and the duty of life."

YOUTH

"I want to see you game, boys, I want to see you brave and manly, and I also want to see you gentle and tender."

"Be practical as well as generous in your ideals. Keep your eyes on the stars and keep your feet on the ground."

"Courage, hard work, self-mastery, and intelligent effort are all essential to a successful life."

"Character, in the long run, is the decisive factor in the life of an individual and of nations alike."

THE STATE

"Ours is a government of liberty by, through, and under the law."

"A great democracy must be progressive or it will soon cease to be great or a democracy."

"Let us give every man in this country his rights without regard to creed or birthplace or national origin or color."

"In popular government results worth having can only be achieved by men who combine worthy ideals with practical good sense."

On the first floor, in the New York Hall, space is planned for five wall tablets; two to contain the names of eminent scientists, native or adopted sons of New York State, and two others to contain the history and purpose of the Memorial. And, finally, one tablet to contain the names of the Trustees, the Architect, the State Superintendent of Public Works, and others, with the heading:

ERECTED BY
THE PEOPLE OF THE STATE OF NEW YORK
1932

On the axis of the great hall, and from within the receptive recesses, monumental doorways with massive bronze doors lead directly into a wide, encircling corridor. This corridor provides a spacious connection to the present and future wings of the Museum, to the stairways and elevators, to the class rooms, educational and exhibition rooms. The doorway opposite the main entrance connects not only with the corridor, but leads to the future Akeley African Hall. Since Mr. Akeley and Colonel Roosevelt were co-workers and companions on several hunting expeditions and on the latter's trip to Africa, it seems most fitting to perpetuate this close relationship in such a lasting association of memorials.

With great energy and perseverance Architect Pope succeeded in completing the plans and specifications on July 26, 1926, and they were forwarded to the State Architect on December 14, 1926. Since that time various members of the Board and the Secretary have studied the needs and requirements of public buildings and obtained all possible suggestions that might aid in establishing in the Memorial every convenience for the hosts of visitors who will be encouraged to make use of it.

As an aid in vizualizing the completed Memorial, a model in plaster was prepared which has served to illustrate the plan better than any drawing could do. By means of this model, now standing in Memorial Hall of the Museum, one can study all the outward details in their relations to one another. The details inside the Memorial, doorways, location of lecture halls, and all such matters, have been fully adjusted in conferences. To further assist the Trustees in their work, the Secretary, with the approval of the Chairman, prepared a book of condensed plans which includes views of the Memorial, together with new perspective and interior views and sufficient text material for complete explanation.

Chairman Osborn, assisted by the Secretary, has labored, often under great difficulties, to secure the appropriations for this Memorial which he feels will be a powerful influence for the dissemination of patriotic ideas and to instruct future citizens, both American and foreign born, in the responsibilities of freedom. He once stated in an annual report to the Legislature that he wished "to make this Memorial a living tribute to the memory of a man whose chief thought and hope

INTERIOR OF MEMORIAL HALL

This great memorial hall will be 67 feet wide and 120 feet long, reaching 100 feet above the floor. With walls of green marble and mellowed limestone, it will truly form a material conception of grandeur and dignity

and deed was directed toward the betterment of his fellow man through a liberal and broad-minded education."

In the year 1929 an appropriation of $1,000,000 was granted by the Legislature for the foundations up to the second floor of the great building which is to be the dominant feature in the façade of buildings facing and overlooking Central Park. Adjacent to the Memorial will be Museum structures. Upon the south will be the Hall of South Asiatic Mammals, a hall devoted to living reptiles and fishes, and an unexcelled collection of fossil reptiles. On the north will be the new Whitney Wing for birds. On the west is the almost completed Akeley African Hall, which will contain a series of specimens of the faunal life of Africa, a series to which Roosevelt contributed.

At the instance of Chairman Osborn and in order to facilitate construction, amendments were made to previous laws which placed the construction of the Memorial under the direction of the Department of Public Works and authorized the Superintendent of the Department to advertise for bids and award contracts for construction. On July 25, 1929, the deed of land for the Memorial was received from the city of New York. On September 24 bids for the foundations

SKETCH MODEL OF BISON
For the niche at the left of the entrance. Submitted by James L. Clark

and sanitary work were opened and the contracts awarded. On October 16 Secretary Pindar turned over the first shovelful of earth to start the construction and the great Memorial was under way.

In April, 1930, with the approval of the Governor, there was included in the State bond budget an allocation of $2,100,000 for the continuance of the building program. During the summer Architect Pope completed the detailed plans in order that the contract could be advertised, and on November 25, 1930, the contract for the superstructure was awarded to the firm of J. Harry McNally & Company. On November 1 work under the first contract was completed by M. Shapiro & Son up to the level of the second floor, and this contractor accomplished a difficult problem to the entire satisfaction of the Trustees and the Superintendent of Public Works. The Commission has at all times been conducted with the lowest possible expenditure of funds, but during the years in which the project has been materializing, the costs of building have been mounting, so that the original appropriation of $2,500,000 became insufficient and was increased by law on April 1, 1930, to $3,500,000. Of this amount, $3,350,000 has been appropriated to date.

When Chairman Osborn accomplished the objective of the Memorial, he again turned his attention to the matter of a proper approach from Central Park to the building. In the year 1922 he began working for an inter-museum pathway to connect the Metropolitan Museum of Art and the American Museum of Natural History. In that year he appeared before the Board of Estimate and Apportionment and presented a diagram showing the location of the Memorial and its easterly approaches across Central Park. At the time he suggested a committee representing the City and the two Museums to consider the matter. Borough President Miller advised the appointment of a committee from the City for the conference and the Board of Estimate adopted the following resolution:

Resolved, That the Board of Estimate and Apportionment hereby appoints the Comptroller,

the President of the Borough of Manhattan, the President of the Board of Aldermen, the Commissioner of Water Supply, Gas and Electricity, and the Commissioner of Parks, Borough of Manhattan, as a Special Committee to confer with representatives of the Metropolitan Museum of Art and of the American Museum of Natural History as to the use to be made of the southern reservoir area in Central Park when said area is released for other than water supply purposes.

Since that time Chairman Osborn has steadily continued his efforts for such an approach. In 1924 Commissioner Gallatin of the Park Department gave his support to the plan of an approach to the Memorial, and in 1925, each architect who competed for the design of the Memorial was supplied with a plan of the Park and was informed that a broad plan of approach to the Memorial was contemplated. The plan of the approach which was submitted was not approved by the Park Department because of the engineering difficulties. In October of 1930 another hearing was had before the Board of Estimate and, in the enforced absence of the Chairman, the Vice-Chairman addressed the Board on a request for $500,000 to build an approach to the Memorial. His request was received and referred to the corporate stock and tax note calendar.

SKETCH MODEL OF BEAR
For the niche at the right of the entrance. Submitted by James L. Clark

The plan of the Approach as designed by the architect, John Russell Pope, provides for a concourse 160 feet wide and almost 500 feet long, consisting of a broad central space for lawn, flanked on either side by wide drives bordered with ginko trees or elms shading foot paths still farther removed from the central green, the whole running from the west drive of Central Park to the Memorial building.

The vista opening from such a drive showing the stately façade of the Memorial and the remarkably fine equestrian statue of Roosevelt by the sculptor James E. Fraser, will be striking. No visitor in Washington approaching the Lincoln Memorial from the Mall can question the mutual enhancement of both landscape and architecture in the combination of a deep, formal approach with the monument.

In the case of the Roosevelt Memorial,

in addition to its architectural value and utilitarian features as a direct approach, such a tree-bordered concourse with its wide open vista will no doubt attract numerous visitors passing through the park who might otherwise, with the present screen of foliage, be entirely oblivious of the proximity of this national monument and the beauty of its architecture and setting. The importance of this Approach has never been lost sight of since the Memorial was decided upon, for the winning design, as well as those of the other seven competing architects, emphasized this approach as part of the desired final scheme.

To envisage the Roman architectural quality of simple, restrained detail in the building proper, executed in such massive proportions as has been afforded, the broad paved terrace, and at its focal point, the equestrian group rising to a height of some thirty-four feet, it is to be hoped that the city authorities, with all the vision displayed by their predecessors in providing Central Park itself, will add to its beauties by such an approach, the worthy setting for such a gem.

The plan proposed provides for a concourse 160 feet wide and almost 500 feet long, extending from the west drive of Central Park to the Memorial Building

MINIATURE SKETCH MODEL OF THE GIANT ELAND GROUP FOR THE AMERICAN MUSEUM. DESIGNED BY JAMES L. CLARK AND EXECUTED BY JOHN W. HOPE AND DUDLEY DLAKELY

THE GIANT ELAND OF SOUTHERN SUDAN

Through the Arid Plains of Africa on a Quest for the Largest of All Antelope—An American Museum Expedition Collects for a New Group for the Akeley African Hall

By JAMES L. CLARK
Vice Director (In Charge of Preparation and Exhibition), American Museum

IT was like "looking for a needle in a haystack" when we went in search of the giant eland in the Southern Sudan. Early in December Mr. C. Oliver O'Donnell had expressed a desire to participate in some "worthwhile expedition" and asked in what animals the American Museum was particularly interested. The new building for the Akeley African Hall was nearing completion. More groups were needed and the giant eland was one of them. This appealed to Mr. O'Donnell and after President Osborn had accepted his offer of coöperation, the expedition was organized, leaving in January, 1931.

It was a month before we reached Khartoum, our point of outfitting. Here the Sudan Government Railways and Steamers Department supplied us with one of their regular hunting boats with full staff and provisions for our personnel of six. We set sail up the Nile, and ten days later we reached Shambe, 860 miles south of Khartoum.

Disembarking here with supplies and two autos, three of us headed inland to learn where we might best try for eland. At Khartoum almost no definite information could be obtained concerning these animals. The Game Department could help us but little, as they apparently did not know.

The eland is the largest of all the antelope—a beautiful and finely shaped animal, with straight horns carrying a heavy twist. There are but two species, both of which are found only in Africa. To the layman they are much the same, unless we point out the smaller horns (averaging about 25 inches in length) of the lesser eland, the narrow and pointed ears, and a dewlap which starts at the throat instead of at the chin. The rest of the body in form and color is about the same in both species.

The lesser eland is not as shy as his giant cousin, and ranges over open grassy

EN ROUTE TO THE ELAND COUNTRY

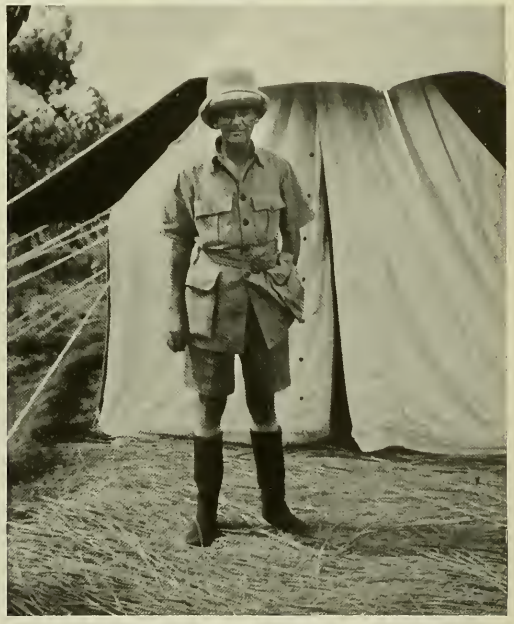
The expedition's boat steamed through the Bahr el Zeraf, a branch of the Nile resembling a canal across an arid desert. Many kinds of antelope were often seen close to the river

THE RIVER STEAMER "AMKA"

The Museum party lived on the second deck of the steamer while its auto equipment and supplies were conveyed on the barge to the right. The forward barge carried 100 tins of gasoline below deck and firewood for the boiler on top

THE PERSONNEL OF THE EXPEDITION

On the forward deck of the river steamer. Left to right are John W. Hope, preparator, W. T. Hunt, field assistant, Dudley Blakely, field artist, C. Oliver O'Donnell, associate leader, James L. Clark, leader. Jack Robertson, the expedition's photographer, took the picture



MR. C. OLIVER O'DONNELL

The associate leader and organizer of the O'Donnell-Clark African Expedition for Eland

plains and bush country. Practically all African hunters secure one or more of these lesser eland without much trouble, as they are quite easily seen and shot.

The giant, or Derby, eland is quite different in habit and temperament. His typical habitat is flat, dry country, thickly covered with small trees, and is localized in two comparatively small areas. (See map below). The type specimen described was from Senegambia on the west coast.

Scientists have classified them in four groups:

1. Lord Derby's Eland (*Taurotragus derbianus*), the typical race of Senegambia.
2. Cameroon Race (*Taurotragus derbianus cameroonensis*) from northwest Cameroons. A race apparently smaller than the typical race, though no complete skins have yet reached us.
3. Congo Race. (*Taurotragus derbianus congolanus.*)
4. Sudan Race (*Taurotragus derbianus gigas*). Found on the west bank of the Nile where a few herds are scattered, throughout the Mongalla and Bahr el Gazeh Province and southwestern Sudan.

(See *Game Animals of the Sudan*, by Capt. H. C. Brocklehurst).

Accessibility was the main reason for hunting the Sudan variety.

Generally they stand about 5 feet 7 inches at the shoulders and carry a very fine,

THE RANGE OF THE GIANT ELAND

As shown in *Life Histories of African Game Animals* by Roosevelt and Heller. The type specimen described was from Senegambia on the west coast, and it is probable that at one time these two ranges were connected

ARRIVING AT SHAMBE
A river station. From here the party disembarked for the back country to search for eland

smooth coat of hair of a grayish buff, with eight or ten narrow white stripes running down the sides of the body.

This tan color of the body, which tends to blue-gray in the older bulls, continues down the outer surfaces of the legs, terminating in black ankles, with a small white patch in the front. A black patch also is conspicuous on the rear of the front leg above the knee.

The slender, bovine tail is tufted with an abundance of soft, black hair. The head is colorful and vividly marked, with a dark forehead which is cut by a white chevron. Above the eye and on the cheek are two white patches which accentuate the dark eyes. The lips and chin are also white.

Large, well-rounded ears for keen hearing are fringed with white and a salmon pink on the inner parts, while the back is almost a solid black.

On the back of the neck is a thick layer of long, dark hair which sometimes girdles the base of the neck completely.

It is surprising to find such an exquisitely delicate and well-chiseled face with trim, small muzzle on so big an animal. It is, in fact, that of the bongo and bushbuck rather than the elongated face of the grazing antelope.

Closely related to the bongo, which still inhabits the densest jungle bush, the giant eland is in a state of transition from the bush to the plains. Already the common eland has made his way to the open bush and plains, and has lost his big ears and his protective spots of color and lengthened his face for grazing. The giant eland has now left the deep forest but still lingers in the intermediate belt of thick bush and grass country while yet retaining many of his jungle characteristics.

Few people, even among the local officials, have ever hunted these giant eland, and they could tell us little except where they were supposed to be. Much time was therefore spent in traveling hundreds of miles seeking what information we could gather to guide us in establishing an inland base.

While on the Nile in '28 I had met a British officer, Major Bostock, who a year or two before had secured one eland after much effort, and it was his information we were endeavoring to amplify.

At Khartoum we had met Captain

A DINKA VILLAGE

South of the great papyrus swamp are Dinka villages. The Dinkas are a haughty and independent people still untamed by white man. They are much like the Masai and have great herds of cattle, sheep, and goats

Holland, who for eight years had been stationed at Amadi, but had retired and left the country some three years since. He gave us the most valuable advice, which checked with that of Bostock, but admitted that during the three years he had been away, disease had attacked the herds and conditions might have materially changed.

And so it was. Disease had greatly diminished the eland and in certain localities had wiped them out completely.

We were told in Khartoum, "If you get your eland, you will have very well deserved them," a phrase the true significance of which we later learned to appreciate. We were told of their extreme wariness and that "the minute they see you, they leave the country."

Our first attempt was after a hundred-mile journey westward to a place called Rumbeck. Here we saw Captain Laughfrey, the D. C., who advised us to go another fifty miles farther west to a spot known as "York House," which was only a grass hut by a water hole where the Duke and Duchess of York had, on their recent visit, established this camp to try for lions.

It was in this remote part of the already remote Sudan that eland were supposed to be, but the royal party had never seen them.

We tried here, and by good luck on the first day jumped the only herd in the country. There was absolutely no chance of a shot and, after eight hours' trekking, we gave them up.

The conditions were so bad and the heat so extreme, that we decided to waste no time here, but try elsewhere. Although reluctant to leave a place where we had actually seen eland, we believed hunting conditions could surely be no worse, and the next morning found us on our way via Yirol Post.

From here Dudley Blakely, the expedition's field artist, continued with two trucks to Shambe to bring back John Hope, our zoölogical preparator, and supplies from our boat. At eight the next morning they were back at Yirol and we were soon off, headed south through the same waterless, flat, bush country, which is characteristic of this whole section.

An all-day grind brought us to Amadi Post at 4 P. M. We found it a delightful little spot under District Commissioner Cann, who had been officially informed of our expedition and did much to get us started right.

Staying but one night, we were off early, backtracking on the road by which we had come to a point some sixteen miles distant, where one of the rest-camps was assigned to us. A deep well dug by the natives supplied this camp with the only available water, but at this time it was very low and was not fit to be used except in emergency.

At Amadi, however, ran a good-sized river, and although this was now but a series of big pools in a sandy bed, the water was clear and drinkable after boiling.

A ROAD CAMP
This served as a maintenance base when the expedition party was in camp six miles away. Eland camp was established in an arid country, and each day it was necessary to send 44 miles for water

BY THE GREAT PAPYRUS BEDS
Dinkas were seen in their dugout canoes paddling through these immense grassy beds of the Nile

Due south from our road camp lay a big section of country in the form of a triangle, each side of which was twenty-five miles or more. It was in here that another small herd of eland ranged.

Our first move was to send out scouts to locate signs. But only word of tracks, and mostly old ones, came back. They informed us, however, that about three hours' march away there was an old, native camp around which signs were most plentiful. I decided to take Hope and start very early the next morning to make a personal reconnaissance and determine, if possible, whether this country was worth trying.

Four o'clock the following morning found us in total darkness, trailing our guides by feel and sound along native paths. When daylight broke, we were well on our grounds and another hour brought us to the old camp. Here we left our men and made a big circuit through the same type of country we had found at York House.

Not an eland was to be seen. Old tracks and many broken trees on which

PREPARING ACCESSORIES

The collection and preparation of trees, bushes, grasses, and other accessories, which are an important part of a museum group, is as necessary a part of the expedition's work as securing and preparing the skins of the animals

PAINTING THE BACKGROUND FOR THE GROUP

Mr. Blakely, the expedition's artist, painting a detailed study for the group background. Besides this there were made many detailed color studies of accessories to be reconstructed for the group

TYPICAL GIANT ELAND COUNTRY

Showing several trees broken by the eland when feeding. The burned grass helped the hunting considerably. With the rains comes the new, thick grass, which grows six or seven feet high, completely shutting off the hunter's view

A PRIZE CATCH

This photograph of the fine giant eland bull just as he fell, shows well the massive horns and the narrow white stripes running down the sides of the body

GIANT ELAND AND LESSER ELAND HORNS

Left, horns of the cow giant eland. The beautiful, well-modeled twist is characteristic of the giant eland. In a straight line these horns measure 27½ inches from base to tip. Center, horns of the male giant eland. These horns are heavier and have wider tips than those of the female. These are 35 inches long and 26 inches from tip to tip. Right, an average pair of horns of a male common or lesser eland. Their length is 24 inches. Their divergence is slight and the rib of the twist not so pronounced

they had fed indicated their occasional presence and, although the outlook was generally discouraging, we decided to try it out.

The following day was spent in organizing our campaign and equipment. Two trucks were sent to Amadi with all available tins for water. We were going into a waterless country where each day to maintain our camp we must send forty-four miles to Amadi and back for our supply. Arrangements were made for the rest-house to serve as base camp, and for our foot-safari into the thick bush food and equipment were packed for going light.

By noon the camp staff with thirty porters were on their way with orders to proceed and pitch camp, while Hope and I were to follow in the "cool" of the afternoon. During this period of establishing our new camp, O'Donnell and Blakely returned to our steamer on the Nile to look over some elephants which, it was reported, were spending much time along the banks. Upon returning, they were to bring in Robertson, our photographer, and all the supplies they could carry.

After seeing this eland country, I began to realize the great part luck would play in our success, even though we hunted hard and conscientiously. The first thing was to locate the eland; second, to see them first; and third, to see enough of them to pick the desired specimen.

Although we had come to the Sudan officially from our Museum and were so accepted by the government, we were very limited as to eland. Two full licenses were taken out by Mr. O'Donnell and myself, each permitting us to shoot one eland only. Director Sherwood had officially applied for permission for us to collect two more, which would give us a male and female and young, with a margin of one in reserve as a factor of safety.

Although for a scientific institution and especially for the Akeley African Hall, this very usual request was officially and flatly refused, though their game regulations provide for the granting of such concessions to science. Instead, they found a way to sell their game, which they are so carefully protecting, at the highest possible price, and they finally granted us the privilege of killing two extra eland

if the Museum would pay the "export duty" fee "on live animals" listed at $500 each. With a misplaced shot costing $500, our difficulties in picking a proper specimen were increased just so much.

As on the morning previous, Hope and I were well on our way long before daylight, and we hunted faithfully the better part of the day, but with no success and little enlightenment as to what we could do to better our chances. Eland tracks were about—many old, some promisingly fresh, yet we toiled and searched far and wide and never saw hide nor hair.

Native fires had cleared much of the ground of grass, leaving the small trees and bush, which strangely enough were quite green, thickly but evenly dispersed over the entire country. Occasionally a larger tree towered high above and offered some shade, while here and there were still a few areas of unburned grass, six or seven feet high.

In country such as this one gets no long vistas. Our average visibility was about 75 yards. Hunting under these conditions was necessarily slow and ever cautious. At best, it would be the switch of a tail, the movement of a single ear, or a suspicious-looking spot in the bush that might prove to be an eland. As for color, these animals blend almost perfectly with their surroundings.

Wary to the extreme, the eland never stop to feed, but travel along, zigzagging only to reach for leaves or to break down with their horns the small trees which bear them.

Many times fresh tracks took us on long, winding journeys, only to find that

CLAY MODEL OF THE GIANT ELAND BULL

Modeled by John W. Hope from field observations, detailed measurements, and many photographs. From this clay model a plaster mold and a final manikin are made, over which the tanned skin is applied

the eland were still "on their way," traveling faster through this maze of bush than we could cautiously follow them. When the sun neared the zenith, the wind would become erratic and blow in all directions, compelling us to give up rather than to have them get our scent and travel far beyond our hunting radius of another day.

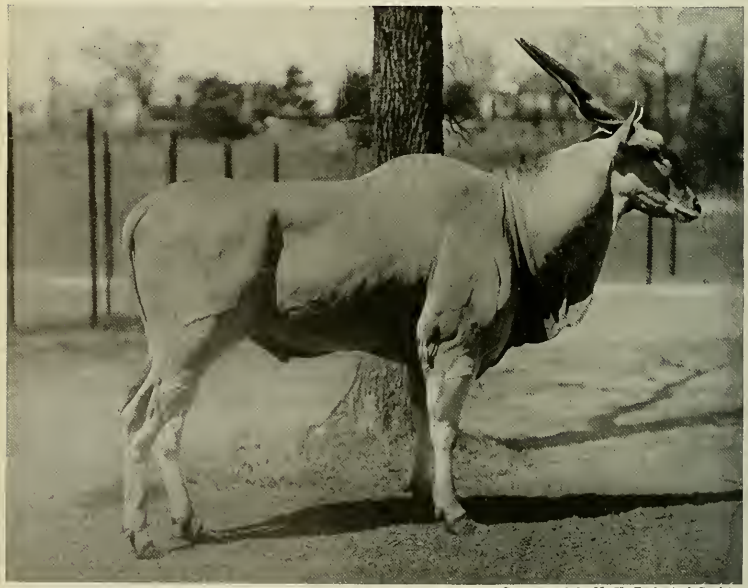
On the third day our luck changed. We had been proceeding methodically for some hours when my bearer spotted eland to our right. They were spread through the bush, coming and going from sight as they moved to feed, and all we could see was a tail here, a shoulder there, a bit of a side, and so on.

Luck had favored us. We had seen them first. We dropped to the ground, but they were moving along and fast leaving us. Something had to be done. I had to take a chance or lose contact, which we had at last successfully made.

Slowly I rose among a cluster of small trees and searched the bush all about with my glasses. I saw a head sweep up, pull off some leaves, and move on. I could not tell whether it was cow or bull. Then, in the far distance, another body with horns came into view and passed. I felt sure those patches ahead were the last of the herd and would soon disappear.

As I stood motionless wondering what best to do, there came a deep bellow. Immediately the bush was alive with eland and off they went, and with them went my first opportunity.

Then day followed day, while we hunted faithfully, leaving camp long before daylight to be well out in the bush



Courtesy of the N. Y. Zoological Society

COMMON OR LESSER ELAND

A fine old bull photographed at the New York Zoological Park. Compare this head with that of the giant eland shown on page 593

in the cool and quiet of the early morning when it was light enough to shoot.

We were becoming hardened to the intense heat and each day seemed easier, in spite of increased distances.

O'Donnell had now returned from his river trip and we took a swing around together. This we learned was not practical. There were too many of us.

The next day we hunted in different directions. This also had its drawbacks for, if luck favored us both, we might both draw a bull or both a cow; opportunities were too few to specify which one we should choose, and to let one go by was to lose a rare chance.

HEAD OF GIANT ELAND BULL
This photograph shows the large rounded ear and the white markings on the face

As there was much work to be done about camp on accessories, I took time off and helped Robertson with the photographs and Blakely with the collecting and preserving of accessories, while O'Donnell took another turn at the hunting.

For three days he hunted hard and long without seeing an eland and little other game, except a few scattered hartebeest and a couple of warthogs. Bird life was practically nil and, in all, the hunting was just long, hard tramping, with little to interes one otherwise. It was indeed unfortunate for him that at this time, just as we were really getting started, he was called home by the serious illness of his mother and had to be deprived of the participation in the thrills and joys which later came with our success.

Two weeks had now gone, and still no eland. Tracks were followed for hours, which only led us on and on until the shifting winds defeated our hunting and forced us to return.

And again, one morning I swung westward back over ground hunted many times before. At the bottom of a slight descent our ever-watchful guide stopped, went ahead, and stopped again. I saw what looked to be a fresh track, merely a displacement of a tiny bit of dusty gravel. We followed as he slowly advanced zigzagging through grassy patches and around clumps of bush. Nipped terminal branches and bits of leaves on the ground indicated that the trail was very fresh. Apparently there was but a single animal, probably a bull.

The growth was particularly thick and the dry, unburnt grass made progress difficult and noisy. Often we could see less than twenty yards ahead. Step by step we cautiously advanced, balancing on one foot until we could properly place the other, moving slowly and with the utmost care.

We came to an opening, looked about, but saw no eland. On the ground we saw well-defined foot marks. He had jumped and made off. We had been almost on top of him, yet we neither heard a sound nor saw the slightest movement.

Our hopes sank, but we followed the marks of long strides and spread toes as

THE FOOD OF THE ELAND

Not only were entire trees brought back to the Museum, but plaster casts and detailed color notes were also made of the "accessories" of the group to guide in their reconstruction in wax at the Museum

they went over some open ground. Then we noticed a second track and stopped to examine it.

While intent on this, my shikari suddenly motioned for us to get down quick. Cautiously he pointed to a spot in some thick bush about 150 yards to the left. It was part of an eland, standing perfectly still.

Here we were—clean in the open, with hardly a blade of grass to shield us. How we had gone this far without being detected and how the shikari picked up this tiny spot is one of those breaks in hunting that can't be explained and which we call "luck."

I looked through my glasses, but all I could see was a single spot of tan. I could not distinguish just what part of the animal it was, but I was sure it was an eland. Then to the right my eye caught the swish of a tail. This gave me his general position, and looking at the other side of the spot, I saw the tip of a horn. Everything else was a wall of leaves.

Apparently he was facing left and almost broadside. Fortunately the same leaves that shielded him also shielded us from his view.

Although I searched the bush for others, not a sign could I find and I turned again to study his position. At last I had an eland before me, but was it what I wanted? I suspected I saw the tip of the other horn, and slowly edged my body sidewise to locate the head, if possible. I saw a big ear swing into view and from its position figured he must be looking our way, yet I could see no part of the face and not until this ear changed its position did I dare to move. When the ear swung back, a tip of horn came into view and

ANOTHER FOOD PLANT OF THE ELAND

Infinite pains were taken by the expedition to secure photographs of exquisite detail so that every possible phase of an accessory was recorded for the future work of the preparators

TERMITE NESTS

A close-up of the "roofed" termite nests characteristic only of the open, grassy fields. Some of the species of southern and tropical Africa build great nests of clay twenty feet or more in height

from this I finally put together the puzzle of his head.

The patch we saw was part of his shoulder and from what I saw of the tip of the horn I figured it was undoubtedly a bull, but was too small for the Group. At one time I decided to let him go and try for a bigger one. Then I began to reflect npon the days I had trod the ground with never the sight of one, and here was my first chance, the only shot I had had presented in all the fifteen days of hunting. Finally I said to myself, "Don't be a fool. Here's a bull eland, and you may never see another. Take him!"

I could see the point of the elbow and a bit of the brisket and from these I judged the position of the heart. Cautiously I changed my glasses for my gun and slowly brought myself to a sitting position. Now I was ready to shoot.

With my mark spotted more by the bushes than by the now indistinct body, I took aim, but I was inwardly too excited, and the front sight would not settle down to quiet. I began shaking like a leaf. I was getting buckfever. I dared not risk the shot, so I took the gun from my shoulder.

It was with supreme effort that I re-collected my scattered nerves and calmed myself to steadiness. Then, holding my breath, I began to squeeze the trigger as I held the gun with braced elbows on my knees. It finally went off and at the report I saw the animal jump and a pair of heels fly into the air. Somehow I was confident, but rushed ahead to follow through.

When I neared the spot, I saw through the bush my eland lying motionless and, to my great surprise, there stood two more fine bulls but a few yards away. Startled by the ring of the shot and their comrade's fall, they stood and watched me. Hurriedly I looked them over. I had by sheer luck drawn the best.

During the few moments they stood, I took many rapid mental notes—the carriage of their heads, the conformation of

their fine bodies, the lines of their low-swinging dewlaps, all of which gave them so much style. I could have shot them both, but gladly let them pass from sight into the bush, which they quickly did.

Returning to my bull, I found him a really magnificent specimen. How thankful I was that I had not let him pass! My shot had hit its mark, passing through the heart, killing him instantly. How glad I was to see his fine horns and perfect skin, no one will ever know. Success had come at last, but only after 120 miles of hard foot-hunting had that element called "luck" finally favored me.

By two o'clock the skin was entirely salted and the skeleton and meat divided into loads. Our safari back to camp was a long line in mixed attire. Some of the personal boys, who had come out with the porters, were in long, white gowns, while others came half-dressed, as they were. The natives, for the most part naked except for a small loin cloth, carried the meat and bones, which dripped and smeared their bodies from head to foot. Little they seemed to care, when our eland and fresh meat were at last in camp, and they trudged along singing and happy in anticipation of a feast. There were another two and a half hours of hot, solid walking before we reached camp, and from then until late into the evening we worked on our precious skin, before we left it with a feeling of assurance.

Camp was a happy, buoyant place that evening, and our first success made the future look much brighter. Complete failure was now defeated and hopes for the cow seemed more promising.

By the next evening the skin was practically dry, so on the following day I was out again looking for the cow. As was expected, none was seen and another day of unfruitful endeavor made us decide to try for eland elsewhere. We felt that hunting over this ground for the past two weeks had probably forced the eland out and chances would be far better with some fresh herd.

A full week was wasted going and coming from other eland grounds a hundred miles farther west, where not a single eland was seen. We could not speculate further, time was too short, so I decided to make our last stand from Dry Camp where we got the bull. Hopeless though it seemed, we at least knew eland were there, and they had had a rest. So back we went, now with more hope and renewed spirit.

Much stuff was left at road camp for relaying to the boat while we went in very light. Our boat was to sail from Shambe on April 1st at 8 A.M. and we were about 125 miles away. This meant we had to break and leave eland camp early on the morning of the 30th of March (two days before) and if it did not rain and there were no breakdowns or bad roads, we would make that boat.

We had just six days of hunting left. Each and every morning Hope and I left camp long before daylight and did our usual seven or seven and one-half hours of hard hunting in this, our supreme endeavor.

Days passed as before—hot, toilsome, and discouraging, but never did we falter in our efforts.

It seemed, and actually was, slightly cooler now. Showers had cooled the air and the ground, and at the end of each day great rain clouds swept the sky and glorified the setting sun.

The evening of the 28th we were thoroughly discouraged. We had failed to get our Group. Our last day was now upon us. It seemed useless again to tread the ground at this eleventh hour in the hope of getting a cow, when already we had spent five weeks and hunted a total of 220 miles on foot and had not even seen one. Surely we could not expect success now. But we must try to the very end.

A GROUP OF DINKAS

The Dinkas brave the waters of the Nile and its many crocodiles in small "Ambak" canoes. These are made of a kind of reed which floats buoyantly. A somewhat similar reed boat is used by the Indians of South America on Lake Titicaca

Late that afternoon clouds gathered and filled the sky while continuous thunder and lightning burst forth and rent the air. Two heavy black clouds poured their fury over camp while on the west others glowed red and orange against bits of blue and turquoise.

It was a bad omen for us. The next day was our very last and I had hoped the rain would not defeat our last chance for hunting or prevent us from moving toward our boat. Food was about gone and other things were timed for this last day and no more.

After dark the storms subsided and the morning of the 29th broke behind a wall of gray clouds. An early start had again put us well along the trail on our eland grounds to the west. Dampened from the rains, the going was cool and quiet.

The gray, dull light was to our advantage, making us less conspicuous, while the overcast skies kept the morning air perfectly quiet. All tracks of the days before were now washed out and we knew that any we saw would be but a few hours old.

It was, in fact, an ideal morning for hunting. For at least two hours we hunted slowly and carefully, covering ground as fast as we could and still being duly cautious. Not a single track was seen and we began to lose heart, but methodically plodded on, hoping against hope

There was not the slightest indication of eland ahead. Suddenly my shikari stopped, clutched my arm and whispered, "Boga, Boga—Katel, Katel" (Eland, eland—many, many!)

Instantly my eyes swept the bush, but I could see nothing. He pointed, but all I could see was the usual wall of small trees. There was not a sign of an animal. Taking my glasses, I caught a glimpse of

RETURNING TO CAMP WITH THE FIRST SPECIMEN
The return to camp after a successful hunt is always a joyous time for the safari, and the boys trudge along singing and happy, bearing their precious loads

two or three rumps as they disappeared to the left, and farther on I saw some legs. They were perhaps seventy-five yards away, yet there was only a glimpse. Obviously they were feeding, moving steadily along.

My shikari took me by the arm and moved me to his position, while with the other hand he grabbed the guide by the back of the neck and without ceremony forcibly pushed his head to the ground with orders not to move.

From this point I caught glimpses of eland galore. What a break! At last, here we were, face to face with the whole herd and we had seen them first! What a piece of luck! That one chance in a thousand had at last come and on our very last day.

Never would I see them again. Now, of all times, no errors must be made.

Eland seemed to be everywhere, yet I could see but tiny patches. A few steps forward gave me a better position, but I was on open ground beneath a few scattered trees where they might easily see me.

To my great surprise they were feeding straight toward me and I slowly sank to my knees. Now I could see more of them —here a horn, there a face, and here a shoulder, still not enough of any one to tell me what it was. Constantly shifting, each time coming closer, now and then showing some of their bodies, yet still I could not pick.

I felt positive they would see me or get my scent and be off like a flash, for now they were only thirty or forty yards away. I dared not move. Would it be fate to have them bolt before I could pick the one to shoot? Just one shot would be possible and it must be a good cow, with typical horns, or our Group would not be complete.

Immediately in front of me two animals broke through some bush. They were partly blocked by the leaves. There were two bodies—one was a medium-sized male; the other, I could not tell what. All about me were moving eland. My eyes were flashing rapidly in all directions to guard against being trapped.

For weeks I had been trying to see

eland and now, at this moment, eland were so thick about me that I was actually hemmed in by them. These were indeed eventful seconds and my heart beat until it seemed they would hear it.

Then ahead came the two, straight for me, heads low, slowly stepping and pulling off leaves, first from one twig and then another. Still partly obscured, I felt now that all was up. They would be on me in a few more steps and, if not what I wanted, off they would go at my sight or scent, taking the whole herd with them.

Then one just in front of me slowly veered and showed the head.

"Thank the Lord, a fine cow!" I said to myself, and she swung behind some leaves.

But now I had my cow marked. Again luck played my way. Had it been any other, I should have been completely stumped.

I knew I had her if she would but show herself again, and I could hardly wait. Would she linger behind that bush not twenty yards away while others came ahead, or would Fate bring her out in time? Fate it must have been that turned her back into the open and presented her to me on clean, open ground. She carried her head low. I could see her eyes and I thought she looked at me.

My gun was now to my shoulder and I was ready to pull the trigger. She could not get away now. I had her. There was not a thing between us. I wanted to make a clean job of it, so, steadying my nerves, I waited as she came straight toward me. It was so close as to be dangerous. With one lunge she could have pinned me to the ground, even though I fired and hit.

A slight turn to the left presented her shoulder just as I wanted it and I pulled the trigger. Confusion reigned as eland broke in all directions. She wheeled and made a jump. Instantly I was up. She was still on her feet and another shot brought her down for good.

The rest of the herd, bewildered by the shot, still milled about in the near-by bush, but as soon as I showed myself, they were off.

She was a fine specimen, fully adult, with beautiful and typical horns. All was now set. Luck had accomplished the impossible and we could now make our boat, for we had found "the needles in the haystack."

Clouds Presaging the Coming Rainy Season

Morning Mists at the Edge of the Forest

DAY BY DAY AT LUKOLELA

Natural History Notes from the Congo River Gathered While Collecting Materials for a Bird Group

By JAMES P. CHAPIN

Associate Curator of Birds of the Eastern Hemisphere, American Museum

This article is a continuation of "Up the Congo to Lukolela," by Doctor Chapin, which appeared in the September-October issue of Natural History Magazine. —The Editors.

AMONG travelers on the Congo River steamers the "monotony" of the forest is proverbial. The wall of foliage, viewed from a distance, does seem lacking in variety as it slips past day after day, and the occasional clearings with their houses attract far more attention. But walk into the forest with a desire to see, and there is enough to keep you looking for years.

The little station at the Plaine awoke at 5:30 to the roll of a wooden drum such as serves the natives for a wireless telephone. Light had begun to break some ten or fifteen minutes earlier, and before that there often came from the forest the deep tooting of the large cuckoos known as coucals.

Perhaps a little before the reveille from the drum a pair of ibises (*Lampribis rara*) might have flown over on their way from the swamp where they had slept, to a feeding place in another inundated stretch of forest. Silent during the remainder of the day, they make up for lost opportunity as they go to and from their roosts. Almost every wing-beat is accompanied by a repetition of their raucous "k-hah!"

Now other birds would begin to call, and a few to sing: the common brown bulbul (*Pycnonotus tricolor*), the black-and-white wagtail (*Motacilla aguimp*), both village birds; a brown warbler (*Cisticola lateralis*), haunting the adjacent field of high grass; and a gray-and-rufous thrush (*Cichladusa ruficauda*), with the sweetest voice of all, as it awoke in the fan-palms. Gray parrots squawked and whistled as they flew over from their dormitory in a group of palms a half-mile distant.

The forest was so close that its bird voices also reached us distinctly. Among the earliest, a long-drawn whistle, curi-

ously low in pitch, came from a small brown "babbler" (*Illadopsis fulvescens*), which gives entirely different notes during the middle of the day. Others quickly joined the chorus, and one could sit with a pencil jotting down their names: doves, barbets, hornbills, cuckoos, bulbuls, and sometimes the toadlike croak of a brown broadbill (*Smithornis rufolateralis*).

If one stood at dawn beneath one of the towering *Borassus* palms close to the workmen's village, the black-headed weavers (*Textor cucullatus*) could be seen slipping out from the round doorways beneath their swinging nests. It would not be long before the males began to return with long green strips of grass trailing from their beaks, to resume their weaving where it had been left off. Although there were about 190 nests on this palm, the occupants may not have numbered more than 70 pairs of birds.

Females do little or no work on the outside of the nest, but apparently concern themselves with its lining. While the eggs are being incubated, the males continue to weave more nests, and accompany their labors with a loud, wheezy chattering. From time to time dozens of them beat their wings and wobble from side to side as they hang back-down beneath their nurseries.

Up in the top of the palm-crown lived a half-dozen pairs of another species of weaver (*Melanopteryx nigerrimus*), the males pure black with bright-yellow eyes. These were a trifle less demonstrative. Both kinds of weavers continued nesting from July to April, and probably kept on through the whole year.

With little fear of man, the weavers often prefer to nest close to villages. They have several winged enemies, especially a large gray hawk (*Gymnogenys*) that comes very frequently to pull out the young weavers. Even at night, while the weavers are asleep in their baskets, they are in

CATTLE HERONS WITH SHEEP AT LUKOLELA POST
The protection these birds receive by law is strengthened many fold by sentiment among Europeans in Africa

A BORASSUS PALM AT THE PLAINE
On this the weavers had built a large colony of nests. These hung from the extremities of the fan-shaped leaves, which were twelve feet long

danger of attack from the nocturnal hawk, *Machærhamphus*. A third more insidious enemy is the didric cuckoo (*Chrysococcyx caprius*) which manages to have its young reared by the weavers.

A stroll in the neighboring forest will perhaps prove disappointing until one learns the ways of the birds. High in the trees one may see—and more often hear—a fair number of birds: fruit pigeons, plantain-eaters, hornbills, barbets, and glossy starlings. The trees, however, are forty yards or more in height, and the foliage abundant. Down in the undergrowth birds prove scarce until one happens upon a mixed feeding party combing the boughs for insects. The party may include representatives of a dozen or more species, belonging to groups so diverse as woodpeckers, flycatchers, sunbirds, and weavers. Two species of greenish bulbuls (*Trichophorus calurus* and *Phyllastrephus icterinus*) are so regularly associated with them that the calls of these bulbuls, whenever heard, suggest the proximity of a bird-party. The birds keep moving along together as they feed, and often they are so shy that it is no easy task to learn just which ones are present.

The woods are full of termite colonies, some dwelling in structures of toadstool form, others in great mounds of tough clay, and still others in globular nests saddled in the trees. All send forth winged broods, especially at the beginning of the rainy season.

A flight of termites during the day is a signal for birds of most diversified habit to become flycatchers. Weavers mount to the tops of trees and palms, circling out from their perches to seize the slow-flying but succulent termites. At night bats and toads reap the harvest.

All such activities vary with the weather. During nine or ten months, each week has a few wet days. The rainy days are the only cool days, but a thermometer in the shade at Lukolela seldom goes above 95°. The heat would be more bearable if there were more breeze, or the air a little drier.

As the sun mounts higher, on a clear day, mosquitoes stop biting. But in the forest the tiny, stingless bees (*Trigona*),

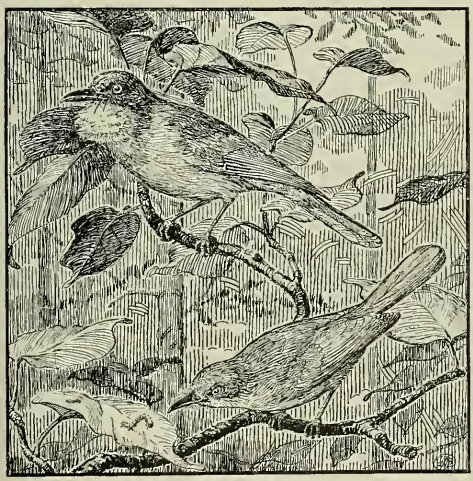
attracted by perspiration, alight on one's hands and neck, or hover before one's eyes. Even true honey-bees come, too, and beware how you brush them away.

Driver ants work day and night, avoiding only the glaring sun. Some of the popular tales about them are exaggerated, they are scarcely a menace to larger creatures like man. Several species of small, thrushlike birds (especially of the genera *Alethe* and *Neocossyphus*) are actually attracted by moving columns of driver ants, and steal the plunder they are carrying. Sometimes they go so far as to eat a few of the ants.

Throughout the Congo, when one hears of blackbirds, they are glossy starlings; or of toucans, they prove to be hornbills. At Lukolela hornbills come in many sizes, from the diminutive gray *Lophoceros hartlaubi* up to the great black *Ceratogymna atrata*. Those most commonly seen are two black-and-white species of *Bycanistes*. In early youth, reading one of Mayne-Reid's books, I learned of the way the female of an Indian hornbill remains closed up in her nest and is fed regularly by her mate. Little did I suspect then that I would some day be finding hornbill nests in Africa. These studies were continued at Lukolela.

WEAVER-BIRD HOMES
A leaf of a Borassus palm, draped with swaying nests of weaver-birds

One morning in December, as I stood near our house at the Plaine, a male *Bycanistes albotibialis* came flying along the edge of the forest. There was nothing unusual in such a sight, except that this bird carried something between the tips of his big mandibles. That made me keep looking. I noticed that he entered the forest, and soon stopped at a large tree scarcely more



Drawing by Dudley Blakely

SOCIABLE INSECT HUNTERS
The two commonest bulbuls of the mixed bird-parties in the forest: *Trichophorus*, with white beard, and *Phyllastrephus*, with plain yellowish underparts

than a hundred yards away, where he clung to the upper part of the trunk. Clearly he had a nest, but careful scrutiny through a glass was required to see the small hole into which he had passed the food. Off he went for more. Devoted husband!

For more than a month we watched him provisioning his family, busy all the day long, except for a little rest toward noon. I doubt if he had ever entered the nest. The small knothole through which his mate had wormed her way in would scarcely admit his great beak, and now it was closed up to a small slit.

In order to know just how often he came I sometimes placed a black boy on watch, with a sheet of paper marked with circles. On this, at each visit, Epoyo sketched the position of the hands of my alarm clock. On December 22 the father hornbill came eighteen times between 7:26 A.M. and 5:48 P.M. Even toward noon he did not skip an hour, and it is possible that we missed the first visit of the morning. On January 12 he came first at 6:10 A.M. and paid fourteen visits, the last at 4:57 P.M.

Fruit is the principal food of this species, and no doubt that was what he was bringing. He went off each time to a distance, usually many hundred yards, and seldom was anything visible in his beak as he returned. Clinging at the nest opening, he would turn his head to one side—most often the right—and then with short jerks of the neck bring up the provender in small helpings, to be passed into the nest. This seemingly uncomfortable behavior would be repeated several times, sometimes a dozen or more, before the hornbill took wing again.

I grew very fond of my hornbill, and he showed no great fear of me. But as weeks passed I realized that if I wanted to know the whole story, the nest tree would have to be cut down. How many young were there? Was the female molting her flight feathers rapidly in the nest, as many smaller hornbills do? How was her doorway walled up?

A CAPTIVE TICK-BIRD

Climbing on the clothing of a native boy. Its claws have exceptionally sharp points, which aid the bird greatly in keeping hold on the skins of its everyday hosts

Finally on January 14, with a feeling of shame, I had the tree felled. The pursuit of knowledge is often cruel. In the nest we found a single young hornbill, about three-quarters grown, with its mother. She was fully able to fly, for her wing-quills were being molted gradually, not all at once, as happens in other hornbills of smaller size like *Lophoceros* and *Tropicranus*. Her tail-feathers were dropping out more rapidly, so that if she had left the nest within the next couple of weeks the new quills would still have been growing.

Drawing by Dudley Blakely

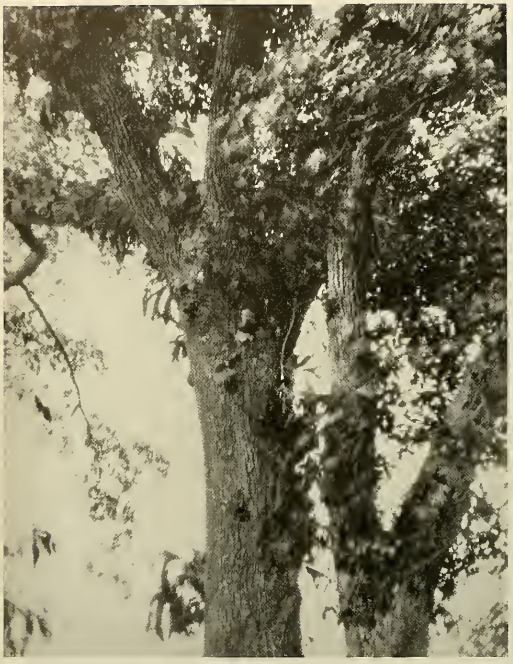
THE WEAVER-BIRD AT ITS NEST

A male weaver-bird as it flaps beneath the entrance to its nest, the interior of which is so constructed that the eggs do not fall out

As for the partition that narrows the nest entrance to a slit just wide enough for the male bird's beak, it proved to be composed entirely of dung ejected by the female, and molded naturally around the inside of the hole. The male had brought no clay to plaster on the outside, as has often been claimed.

The African native has no pity for hornbill families. Rather is he delighted at the prospect of eating them, for the female is usually fat during her voluntary confinement. It happened thus that I saw another nest of the same kind of hornbill after it was raided by the negroes. It likewise had contained only a single young bird. The larger African hornbills seem to lay but a single egg, whereas some small ones may have four of five. One African species which lays two eggs is *Tropicranus albocristatus*, often spoken of by natives of West Africa as the monkey-bird. It is said to roam the forest in company with bands of monkeys. One might assume that fruit would attract the hornbill to the same tree with the monkeys, if we did not know that *Tropicranus* feeds mainly on insects, and seldom touches fruit.

Among the seven kinds of monkeys more or less common about Lukolela the two *Colobus* monkeys eat tender leaves rather than fruit. Occasionally one sees bands including two or three species of monkeys, even fruit-eating guenons (*Cercopithecus*) with the red *Colobus tholloni*. The black *Colobus angolensis*, with white on the sides of face and neck, is familiarly known as the "magistrat," in allusion to judicial robes. Monkeys and squirrels



THE FAMILY PROVIDER

This male hornbill, with beak inserted in the door of the nest, is delivering food. He is clinging against the trunk, in the middle of the picture

are not welcomed on a cocoa plantation, for they bite into the fruit and destroy an appreciable part of the crop.

It was long thought that chimpanzees did not occur in forests on the left bank of the River Congo. But Doctor Schouteden succeeded in proving that there are chimpanzees in the large area of forest south of the upper Congo River. They are relatively numerous at Lukolela, occasionally coming to the edge of the plantation near the Plaine.

One of the natural checks on monkeys is the crowned eagle, *Stephanoaëtus coronatus*. Of course it must occur at Lukolela, but how common was it? Did it have a recognizable call? One day a shrill "kee-a-ree, kee-a-ree . . . . . " was heard repeated over and over from high above the forest. "Nkawli," said the boys, using a name that is applied to birds of prey in general. Later on they explained that this particular kind preyed largely on monkeys, and was called "Pongonyoli."

Knowing the cry, I continued to listen for it, and soon saw the eagles soaring high in the air, generally in the middle of the day. Frequently there was a pair, and before long the bird was identified as the crowned eagle. One eagle might indulge in graceful swoops which seemed to be a kind of display. A pair of these eagles would be expected to hold a territory two or three miles in diameter, and I was shown a nest, high in a silk-cotton tree, well known to natives. One of its owners perched regularly on a forest tree about a hundred yards away. Watching it with the field glass was fulfilling another old wish. Why bear ill-will toward such a noble bird, bloodthirsty though it be? Its rightful flocks and herds are the monkeys on the forest boughs.

At the edge of the Plantation, from time to time, the advance of civilization would be punctuated by the thunderous fall of some great tree, removed to make place for cocoa seedlings. As the last blows were dealt at its base and the upper boughs began to sway, the bystanders

broke into cheers and wild yells of joy. After the prolonged crash the yelling of the wood-choppers continued—savages exulting over the destruction of a glorious tree. Yet we who like cocoa are in the end responsible. The more civilized we are, the more we must regret many things that civilization demands.

The equatorial belt, of all parts of the earth, is least affected by seasons. Even there many plants exhibit a seasonal cycle. A beautiful amaryllid dotted the forest floor with its delicate red flower-clusters from November to January. The birds that nest in the forests of Equatorial Africa are not migratory, and many of them breed throughout a major portion of the year. But the region is visited by many refugees from the rigors of northern winter, and by certain African migrants that run no risk from cold. Drought seems to be the condition that drives them toward the well-watered equator. Many of the migrants from the Sudan stop at the northern margin of the Congo forest, yet certain of them cross the forest belt, and show themselves in clearings like those at Lukolela.

ALERT

The hornbill at the nest, as he withdrew his beak and looked around toward the camera. Photograph retouched to show the bird more clearly

A YOUNG HORNBILL

Behind the bird is the inner wall of its nest. The opening left in the doorway shows just above its head

Here I first saw the pennant-winged nightjar (*Cosmetornis vexillarius*) in July, 1909, and began the series of observations which proved it to be a migratory bird. In February, 1931, I saw it appear at Lukolela again in the course of its annual northward migration. Early in the same month a flock of some three hundred Abdim's storks tarried a little at the Plaine, on their long voyage from the southern half of the continent back to their nesting grounds in the Sudan. A Sudanese bee-eater, *Aerops albicollis*, spent its "winter" in flocks about Lukolela, from November to April.

Still more familiar were the cattle

A TRAVELING COLUMN OF DRIVER ANTS
With some large soldiers on guard beside it. Most of the species are dark reddish-brown

herons (*Bubulcus ibis*), which never nest in this part of Africa. A few examples seen at Lukolela in August and September may have been migrants from Southern Africa. It was only in November that the species rapidly became numerous. Their plain white plumage showed they had finished breeding, and it was clear that they could only have come from the north, where they nest in the Sudan during June and July.

Parties of cattle herons now appeared daily at certain spots near stations and villages, especially where sheep or goats were kept. At the Plaine their numbers gradually increased to 35 or 40. The herons eat grasshoppers, and love to walk about with the hoofed animals, snapping at insects all the while. They never slept at the Plaine, but arrived soon after 6 A.M., and departed toward the northwest or north a little before sunset. All the cattle herons of the vicinity gathered for the night on a small, wooded islet near the far bank of the river.

These "wintering" birds have their established roosts, and it seems not unlikely that the same birds return year after year, in company with younger generations. At Léopoldville, too, their sleeping quarters were well known. Some eight hundred cattle herons assembled here nightly in April in the palms and other trees directly in front of the residence of the Provincial Governor.

It is my belief that many river birds of Africa perform regular migrations to avoid the periods of high water. The scarcity of such birds when the rivers are in flood is very pronounced. When the rivers immediately north of the equator are ebbing, those just south of it are about to rise. Near Lukolela the sandbars of the Congo emerge twice a year, and at both seasons are frequented by pelicans,

CHIMPANZEE FROM LUKOLELA
On the southern bank of the Congo lives the recently described race, *Pan satyrus paniscus*, which is relatively small in size, unusually hairy on forehead and cheeks, and black-faced from birth

SMALL STINGLESS BEES

They gathered in numbers on Doctor Chapin's hand while he was at work in the forest. His neck and back were equally attractive to them, and his eyes even more so

skimmers, saddle-billed storks, and other birds which seem virtually absent when the river is high. Whether the skimmers, lapwings, and pratincoles nest on the bars twice a year, or only once, remains to be ascertained.

It seems probable that *Pseudochelidon eurystomina*, a swallow-like bird that nests in tunnels in the sandbars during February and March, is absent from the region between June and December. I have looked for it in vain during July and August; but like Doctor Schouteden, I found that they nest near Lukolela in February and March.

Besides its forest and the river, Lukolela offers another type of country, restricted in area, but quite distinct. Lying close to the southern edge of the forest belt, it has patches of natural grassland, as distinguished from mere clearings about villages.

The little Plaine was such an area. A few miles to the south were many more, some of larger size, and thickly dotted, with old *Borassus* palms. The birds of such savannas are sharply differentiated from those of the forest, as are also the antelopes and many other mammals. Buffaloes, however, wander from forest to savannas, for they find better grazing in the grasslands, better concealment and shade in the woods.

It was a surprise to hear that tick-birds (*Buphagus africanus*) were well known about Lukolela. As a rule they are not found in forested country. A clever native hunter, Bahoi, one day brought me a dead example. He had shot a buffalo, and in its fall a tick-bird was pinned underneath, still alive. Bahoi caught the bird and brought it in, but unfortunately it died on the way.

Some months later the same accident occurred to another tick-bird, and this time I received it alive. We put it on an

A SMALL BROWN TREE-FROG
Hyperolius perched at night on a stalk of one of the leaves where its eggs are laid

old antelope hide, with a stout thread attached to one foot. Off it flew to the ground, and then up to the back of the boy who was holding the thread. There it behaved as though at home on the flank of a buffalo, edging away to escape a hand just as it would have dodged the swish of the buffalo's tail.

Life in the forest shows no great change as the day advances, until late afternoon, when there is a lessening of many noises, and the insect musicians begin to make themselves heard. Orthopterous insects have oftimes reminded me, as I trudged along forest paths, that I had better hurry to get in before dark. The sun disappeared behind the forest a little before six. Franklin Edson, my companion, made a little sun-dial that facilitated regulation of our timepieces during the day.

Between 6:10 and 6:30 P. M., the ibises that squawked so frequently at daybreak were very apt to make another noisy crossing over or around the Plaine, two or three pairs assembling for the night in some large tree in a swamp. So little was known of the habits or voice of *Lampribis rara* that I felt highly favored by their frequency here, and took some pains to verify my identification.

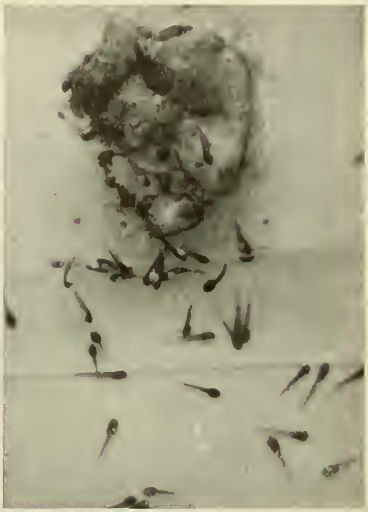
Right after six o'clock the large insectivorous bat, *Saccolaimus peli*, appears in the sky, and might almost be mistaken for a fruit bat, did it not make erratic swoops that show it to be chasing insects. Here and there a single fruit bat of indeterminate species may pass over with labored wing-flaps. Sometimes they appear in larger numbers. When one begins to see hundreds, it is safe to assume—in the Congo—that one is looking at *Eidolon helvum*, the common roussette, related to the flying foxes of the East.

Whether *Eidolon* can be called truly migratory is doubtful. It certainly

BUSH-BABY
The small nocturnal lemur (*Galagoides demidoffi*) so abundant in the Congo forest. It spends the day in a nest lined with green leaves

establishes roosts which may be frequented for some weeks or even months. Then the group moves off to another spot. At Lukolela, in brief, they had such a roost along the river from mid-August to October 20, and again—though the numbers were less—in early December. It was said to be on an island. At dusk these large bats flew out to feed, and for weeks at a time it seemed as though the majority came our way. We were able to ascertain that they flew on a front at least a mile wide, beginning to cross the Plaine close to 6:20 P.M., and from the duration of the flight and the number counted per minute crossing a short section of the road, we arrived at a grand total of 22,400 bats. I think we were conservative.

Going into the forest later, we could sometimes see them fluttering about the crowns of trees with fruit, snarling as they struggled to get their food, or we could "shine" their eyes as they hung lower down. The large forest goatsucker (*Caprimulgus batesi*) lives at Lukolela, but in small numbers. *Caprimulgus fossii*, of the savannas and clearings, was likewise scarce. Fortunately there were many other creatures to watch: lemurs, genets, palm-civets, flying squirrels, and elephant shrews. No leopard crossed our path.



FROTHY "NEST" OF *CHIROMANTIS*

This tree-frog's nest was kept on a glass plate until well-developed tadpoles began sliding out of it

JELLY "NEST" OF *HYPEROLIUS*

Adhering to a leaf over water in a swamp. The eggs of the tree-frog have already developed into tadpoles

I recalled that there should be a green-and-gray tree-frog which lays its eggs in a frothy mass on leaves and logs well above the water. For the time its name had completely escaped me; but I knew it by sight, and soon found it sitting on branches around the forest swamps. It gave a call like a few taps with the finger on an empty cardboard box, frequently varied or followed by a rasping sound. In the second half of October, after the rains had begun, I began to find its "froth-nests" here and there on fallen logs and

AFRICAN "WOOD-SWALLOWS"
They are resting on a sandbar where they breed. Though supposedly allied to the Oriental wood-swallows, *Pseudochelidon* is more like a bank swallow in nesting habits

large leaves in the swamps. Egg-laying is carried out only between 9 and 11 P.M., so it required some searching in places swarming with mosquitoes before I was able to put the flashlight on the frogs as they laid. The egg-mass becomes filled with bubbles of air, and its outer surface dries out and helps to support it while the eggs are developing into tadpoles. At the end of four or five days the interior of the "nest" becomes very liquid, breaks through the bottom, and the tadpoles tumble into the water. Usually they fall only a couple of feet, sometimes six or eight.

NEST-TUNNELS OF *Pseudochelidon*
Opening in the nearly level surface of the sand. They run down obliquely for three to six feet, the plain white eggs being laid at the far end

Several "nests" were taken to the house and kept on glass plates over a tray of water, so that when the tadpoles wriggled toward the water I was able to photograph them. Sometimes the adult frogs turn to a browner coloration, and this may be the explanation of their scientific name, *Chiromantis rufescens*.

Other small tree-frogs in the same swamps, belonging to the genus *Hyperolius*, were also laying their eggs on leaves out of the water. Their tadpoles developed in a clear mass of sticky jelly, and seemed not to fall into the water before a period of ten days. Rain was probably needed to free them from their elevated position.

Sometimes as I flashed the light about the woods a brilliant firefly caused a momentary surprise, but one night I noticed what seemed to be the steady lights of numerous glow-worms on the floor of the forest. Looking closer I found that there were no glow-worms, only tiny white mushrooms growing out of dead wood. Their slimy little stalks, but not their rounded caps, gave forth a greenish light similar to radium paint. A bunch of these twigs, held up by a black companion, was visible at night from a distance of forty yards.

On the way back to our house we frequently passed under the tall palm with its weaver colony. Silence reigned, unless one struck the base of the tree, when the birds would awake in their nests and indulge in a loud burst of chattering.

FROTHY "NEST" OF *Chiromantis*
On the lower side of a fallen tree, over stagnant water in a swamp

The gasoline lantern on our verandah proved a glowing attraction for hordes of tiny insects, and some large ones such as mantises, moths, and cicadas. Flights of termites were distracted by it, and occasionally littered our dinner table. Large termites are edible, but do not mix well with dessert or coffee.

As long as we could fight off the mosquitoes it was pleasant to sit and watch for new arrivals near the lantern, and listen to the sounds drifting in from the forest. Among the fruit-bats *Hypsig-*

FUNGI WITH LUMINOUS STALKS
Mushrooms of the genus *Marasmius* growing from dead sticks. The picture was taken by a six-hour exposure at night, supplemented by a few seconds' illumination with an electric flashlight

nathus and *Epomops* were frequently heard, as was the hooting of the common wood owl. Tree hyraxes repeated a seemingly endless succession of short cries in complaining tone.

Among normally diurnal birds the cuckoos are very apt to call at night. Four species did so rather frequently, their identification then being simpler by ear than with a field-glass by day. Especially on moonlit nights one or two gray parrots are apt to go flying over noisily, and once in a while a boulicoco (*Corythæola cristata*) awakes as if from a bad dream and coos lustily from the forest.

Early to bed is not always good advice for a naturalist, but he must go sometime. Often the mosquitoes drove me to turn out the lamp and jump under the mosquito net.

From the corner of my little room a dim, green glow might still be noticeable, where some of the luminous fungi were being cultivated on twigs in a tray of water. The rats from the thatched roof were now free to climb down and dance across the mosquito bar. We'll have to set some traps for them tomorrow.

FLASHLIGHT PHOTOGRAPH OF CATTLE HERONS IN THEIR SLEEPING QUARTERS AT LEOPOLDVILLE

Sunrise on the Tibetan Plateau

AMONG THE NOMADS OF TIBET

Wanderers on the Roof of the World—The Sturdy Inhabitants of the Vast Tibetan Plateau Who Live Behind the Great, Snow-Covered Wall of the Himalayas

By C. SUYDAM CUTTING
Trustee of the American Museum

IF there is any one race of people that shows an utter disregard for the elements of nature, it is the nomads of the great Tibetan plateau. Living the year around in tents in a high and windswept land, often well over fifteen thousand feet above the level of the sea, they appear to be completely happy and thoroughly comfortable.

It was during the summer of 1930 that I visited this bare and elevated land. Having obtained the permission of the Dalai Lama himself, I went to India, and thence traveled up over the steep and winding trails among the world's most mpressive mountain range to the southern borders of Tibet, which lie just to the north of Darjeeling, where that fascinating little city is situated within sight of Mt. Kinchinjunga and her greater sister, Mt. Everest.

Along the border of this country of nomads, one finds a few villages where agriculture is practised, and to one of these, Khampa Dzong, we made our way. Being on the frontier, it boasts quite a large fort which, for purposes of defense, is elevated about 600 feet above the plain. Angling steeply down to the foot of the hill on which the fort is erected, runs a heavy wall built to protect the defenders when they come down to get water.

Even so close to the giant Himalayas this portion of Tibet is largely level, and looking to the south one sees the glittering, snow-covered peaks beyond a great plain that, near Khampa Dzong, is dotted with the irregular fields tilled by the local Tibetans. A cluster of low, flat-roofed houses lies on the level ground below the fort. On a near-by hill a smaller fort stands, built as a secondary protection, while an old, and now disused execution tower stands deserted at the foot of a steeply sloping rock.

We were received with the utmost friendliness by the Dzong Pen, or governor of the town, and for two nights were put up in his home.

Away from these border villages one

THE FORT AT KHAMPA DZONG

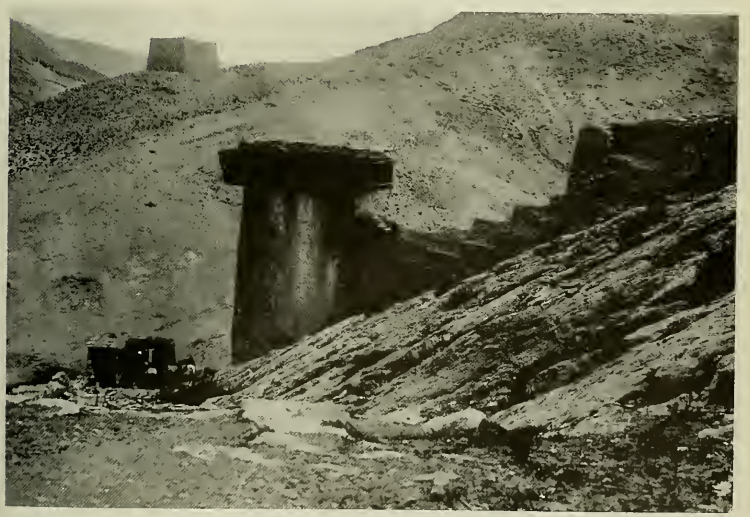
Built to guard the southern boundary of Tibet, this ancient fort stands high on a hill near the town on Khampa Dzong. The wall constructed on the hillside leads to the fort's water supply

INSIDE THE FORT AT KHAMPA DZONG

The small fort on the hilltop in the distance is for the purpose of preventing an enfilading attack. Neither fort, naturally, could withstand an attack by modern artillery

KHAMPA DZONG

The city wall is shown running steeply down the hillside, while a part of the village is visible at the foot of the hill. Khampa Dzong is one of the few places where agriculture is practised



THE EXECUTION TOWER

This ancient structure at Khampa Dzong is no longer in use. The size of the tower can be estimated from the horses that appear to the left of its base

LOOKING SOUTH FROM THE FORT AT KHAMPA DZONG

The irregular patches of fields are tilled by the local Tibetans. As one travels north from this village, the country rises, with the result that agriculture becomes impossible. The mountains shown in the distance are the Himalayas

finds conditions radically different. Dependent upon grass and moss for the sustenance of their herds, and uninterested in agriculture, the Tibetans wander here and there across the windy plateau, leading their hardy, nomadic lives.

Their herds are made up of sheep, goats, horses, and yaks, which, with the exception of the yaks, feed on the grass which is to be found in the stream bottoms. The yaks, however, indigenous as they are to the region, are permitted to wander about among the hills where they find the moss that is their favorite food.

The country is well adapted for long marches, and traveling with a caravan is easy, for the going is good and water is to be found readily. The coarse grass of the country is common although it disappears as one climbs the ridges, moss taking its place. The latter is, to a great extent, the food of the game of the country—the sheep, Ovis ammon, Bhurrel, gazelle, and wild ass.

Large lakes are common, but are often brackish. Springs are rare and are invariably thermal, very hot and impregnated with sulphur. The streams are of snow water, excellent to drink, and are very numerous. In the course of almost any march one is likely to pass one or more, some of which attain considerable size.

The nomads always camp near these streams, as along their banks a more luxuriant type of grass is to be found. It is here that one sees the sheep, the goats, and the horses, while the yaks wander off to the ridges, where they roam all night feeding. These beasts require an abnormally long time to feed, and must be allowed to wander at will, with the result that a good two hours must be spent in the early morning in collecting the yaks and loading them before a caravan can move.

It is true that the yak is ideally suited to the country. Nature has given him ample protection from the cold and the wind. He finds his food in the most unpromising districts, and can carry a pack

of considerable dimensions. His marches, however, should not greatly exceed ten miles a day, which makes rapid cross country travel impossible. On the other hand, with proper treatment the animal is indefatigable and can be used indefinitely. Furthermore, from the herds of yaks the natives obtain almost every necessity. Yak butter is a staple article of food. Their wool and their skins are used in the manufacture of clothes and tents, while yak dung supplies the most widely used fuel of the region.

Slowly—at no more than two miles an hour—the yak does his day's march, groaning constantly as he goes. And whether on smooth going or along precipitous and dangerous trails his pace never varies. Heavily laden, he will mount the most appalling slopes at very high altitudes and, despite the most uncertain footing, will maintain the same speed as on the level.

The people of this rugged land have literally conquered the elements. They are the survival of the fittest. Those who could not combat the severity of the elements of the higher sections of the Tibetan plateau have either moved elsewhere or died long ago.

The plateau has very little rainfall—about eight inches a year. On the ridges and peaks, however, the latter of which often rise to twenty thousand feet or more, there is much greater precipitation, and from these comes the plentiful water supply.

What a person unaccustomed to living in such a land will mind by far the most is the terrific wind. The higher the altitude, the greater is the wind's severity. In summer, at fifteen to sixteen thousand feet, it starts blowing between eleven and twelve o'clock noon, and blows violently all day until sunset, when it dies down to a dead calm. At higher elevations, it starts

THE GOVERNOR OF KHAMPA DZONG

With his three sons. The two figures in the background are servants who were eager to be photographed but were not permitted to take more prominent positions

A CARAVAN AT AN ALTITUDE OF 15,000 FEET

The country is excellent for travel with caravans. Though rain seldom falls, the country is well watered by streams formed by melting snow on the higher peaks. Grass grows along these streams

THE PRINCIPAL TIBETAN BEAST OF BURDEN

Yaks not only supply milk from which the nomads' important diet of butter is made, but these animals also are ridden, are used to carry heavy packs, and are able to find sustenance on the higher ridges

MR. CUTTING'S CAMP

Beside a lake at an elevation of 17,200 feet. Heavy winds constantly sweep this barren land, growing stronger as the altitude increases

LUNCH WITH THE GOVERNOR

On the roof of the "gubernatorial mansion." Signs of western influences are not lacking. The chairs are of the type once common in American soda "parlors"

A NOMAD VILLAGE

These tents were pitched at an altitude of 15,900 feet. They are securely and cleverly anchored by the use of heavy stones, and seem able to withstand even the most violent gales

earlier, and in winter it blows during all the daylight hours.

The tents of the nomads are perfectly adapted to the windy land in which they are almost the only shelter, and the natives have learned to perfection the art of anchoring them with stones, for tent pegs in such a land would prove useless. Taut ropes keep the tents from rattling and also keep that section of the tent that is to windward from blowing in. No matter how high the wind is, these tents rarely seem to move or rattle. Tiny and flea-ridden, with rarely a fire except for cooking, and only a slit in the top through which smoke can escape, these tents are yet perfectly acceptable as dwelling places to the Tibetans. It seems fortunate that these people are so comfortable and at ease out of doors, for during wind, snow, or rain, they must be out most of the time.

We often made our camp beside that of some Tibetan group, and were interested in many of their customs. A curious one is the milking of the sheep. Shortly before sundown every day, after the animals are brought in from grazing, they are all roped together. When properly aligned—and sometimes there are two or three dozen fastened together—milking is begun. Astonishingly little milk is collected, but it is carefully put away to be made into butter. Nor is the least care taken to keep the milk clean. Whatever filth may get into the containers is removed—if at all—without the least hurry.

The butter that they make is one of their most important articles of diet. Although they have plenty of excellent mutton—excellent, too, in its ability to keep well—they rarely eat it. It is on buttered tea that they seem principally to subsist. This strange concoction is sometimes mixed with millet, but is often prepared more simply. The butter is made from the milk of yaks, goats, or

sheep, and then is clarified. This latter process makes it keep very well although it is always somewhat rancid. The brew of buttered tea is a hot, thick liquid. The tea is the black type from China, imported into Tibet in brick form. It is inferior in quality, as it is merely the sweepings of poor tea.

This is put into a wooden churn and churned up when the liquid butter is poured over it. The liquid, if not too rancid, is palatable enough, especially if one is hungry and cold. As for the taste of the tea, there simply isn't any. All one tastes is the hot, rancid butter sometimes flavored with salt. When mixed with millet it is made into cakes called *tsamba*. The average Tibetan can consume vast amounts of this nourishment.

The economic and social world of the Tibetan nomads is interesting and in some characteristics almost unique. They have little need for money, as bartering is largely carried on among themselves. Their usual exports consist of sheep and goats, skins, and buttered tea packed in animal gut.

In marriage these people often practice polyandry, a wife sometimes having two or three husbands. This type of marriage seems to work out in eternal domestic felicity. Brothers are very apt to be the husbands of a girl and the peace and harmony resulting from this marriage regime seem to be the direct opposite of that of polygamy.

The women of this part of Tibet are far from beautiful to western eyes, but they are often cheery and friendly. Their costumes are somewhat voluminous and are rarely—perhaps never—clean. The outstanding characteristic of the Tibetan

A NOMAD CAMP

Though these tents are able to stand in the heaviest winds, they are not likely to appeal to any but nomads. They are small and overrun with fleas, while any fires built inside fill them to the choking point with smoke

NOMAD WOMEN
These women are carrying water to camp, and are wearing the typical nomad headdress, which is known as the Lhassa type

feminine costume is the headdress, which is of the so-called Lhassa type. The whole top hamper on the women's heads is held in place by being interlaced with many wisps of their hair. This interlacing is so complex that the hats are never taken off, except possibly at long intervals in order to be reset. These nomad women always wear their headdresses at night.

Babies, when they are born, are quite light in color. This color, however, does not last long owing to the presence of the soot from the dung fires. As they grow older they become darker and darker. Washing is quite out of the question. The water is too cold and there is no proper way of heating it in sufficient quantities for bathing.

Because of the average temperature and the dryness of the air, both being due to the extreme altitude, Tibet is a healthful country. To dwellers accustomed to lower altitudes, it is quite livable, provided they have normally strong hearts and do not go to Tibet at too advanced an age. It is, however, a common saying in Tibet that should Tibetans go to the plains of India, they would die. Of course, although the low altitudes of India would be oppressive to a race that has lived for generations at an altitude of more than 10,000 feet, it is the great heat of India that would wear them down.

Villages in Tibet, though they may be filthy, have no stenches such as one finds on the plains south of the Himalayas. In Tibet there are no pests of flies or crawling insects. The air seems always fresh and the water clean.

Tibetans all look, and are, healthy. Plague and cholera have never crossed the great divide and entered their land. Although they drink snow water, there is very little goitre. They have inherited a country that is cold and bare, with a season between frosts of barely four months. Yet they thrive. Virile and hardy to a great degree, they are kindly and happy. No famines ever visit Tibet, for food to their liking is abundant.

The hierarchy of priests, at the top of which is the Dalai Lama, who is the head

HERDED
FOR MILKING

The sheep are collected shortly before sundown each day and tied with their heads together as shown in this picture

MILKING SHEEP

This nomad matron, with her Lhassa type headdress, is engaged in milking her herd. All the milk is churned into butter, from which the staple dish of "buttered tea" is made

of the spiritual as well as the temporal government, wishes to keep foreigners out of the country, and to preserve the autonomy of Tibet. Foreigners, as a rule, should have no business in Tibet. It can never become a tourist route. Should the governing body of Tibet adhere to their present principles, it would be unreasonable for anyone to dispute them.

The Tibetan landscape is usually very impressive, due to the grandeur of the gigantic snow-covered peaks and the vast and almost level valleys. The term "Roof of the World" alone has its allure. If the scenery were to be analyzed, it would seem to be hardly more than slide rock and distance, yet no such statement is fair to the land. Shut off from the north by the vast distances of central Asia, and from the south by the glittering peaks of the Himalayas, among which Mounts Everest and Kinchinjunga stand supreme, this land is likely for generations yet to come to live as it has lived for generations past—almost untouched by the outside world—little affected by the problems, the advantages, and the handicaps of civilization.

THE HIMALAYAS
Rising above the plateau. The spot at which this picture was taken was 19,000 feet above sea level

Photograph by Elsie M. Kittredge

AMERICAN HOLLY

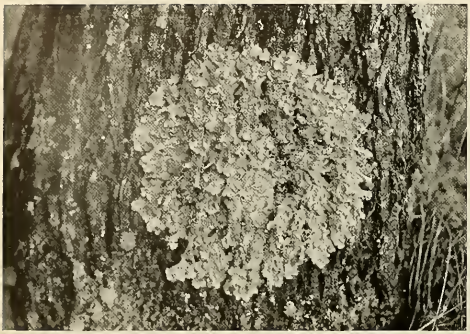
PLANT LIFE IN WINTER

A Variety of Hardy and Colorful Plants Enliven the Winter Woods After the Warmer Seasons of the Year Have Departed

BY OLIVER PERRY MEDSGER

CERTAIN forms of plant life are more noticeable in winter than they are at other times of the year, for during the cold season, their green colors make a fine contrast to the prevailing grays and browns of the forest. A walk in the woods is pleasing at all times to the real student of nature and loses none of its charms because the weather happens to be cold. Mosses, lichens, liverworts, club mosses, certain species of ferns, along with some of the higher types of plant life, show their forms and colors to best advantage when other plants seem lifeless.

I find the name "wintergreen" is applied to twenty different species of flowering plants in northeastern United States. The one best known is the true or aromatic wintergreen, *Gaultheria procumbens*, from which, by distillation, we get the wintergreen flavor. The essence of wintergreen is also procured by distilling the bark and twigs of the sweet or black birch, *Betula lenta*. The true wintergreen is an evergreen shrubby plant with slender, creeping stems. The glossy, dark green leaves are clustered at the ends of the branches. They are oval or oblong with sharp, saw-toothed edges. The nodding, five-toothed white flowers appear about July. These are followed by the bright-red berries formed by the fleshy calyx. Leaves, flowers, berries, all have the spicy wintergreen flavor. The berries hang on the plant for a year and may be gathered all through the winter and spring. They are generally most abundant in clearings. Birds, especially partridges, are very fond of them, and the plant is frequently called the partridge-berry. I recall a certain wooded hillside, sloping to the south, that I often visited as a boy in winter or early spring when the ground was free from snow. There I could hear the partridge whir, and could fill my pockets with the berries which are quite solid and do not crush readily. I find recorded twenty-five common names for this plant. In my



A PARMELIA EIGHT INCHES ACROSS

This very slow-growing common lichen (*P. caperata*) is perched against the bark of a hickory tree. When first photographed by Mr. Medsger on August 6, 1929, its diameter was eight inches

youthful days we always spoke of it as mountain-tea. The plant was much used by the early settlers as a substitute for tea and in places it is still used for that purpose.

Another common plant observed on winter walks is the partridge-vine, *Mitchella repens*. Many of the common names applied to the last species are also given to this one. It is a dainty little evergreen plant spreading flat upon the ground. The opposite, ovate or nearly round leaves are dark green and glossy. The bright-red berries are edible but rather tasteless. The tubular white flowers appear in twins with their ovaries united in such a way that it takes two blossoms to form one berry. Or, as John Burroughs puts it:

> Mitchella with her floral twins,
> Crimson fruit that partridge wins.

The winter rambler can scarcely miss seeing the pyrola or shinleaf, sometimes called wintergreen. There are several species, the most common of which is probably *Pyrola elliptica*. The leaves all come from the root, usually on margined petioles. The blade is about two inches long and two-thirds as wide, bright green and tough. The plant is one of the conspicuous evergreens of the woods, but the nodding flowers do not appear until mid-summer.

Besides the aromatic wintergreen and the shinleaf, there are many other members of the heath family (Ericaceæ) with leaves that are evergreen and that add cheer to the winter woods. Among these we may mention the rhododendron and mountain laurel, whose leaves are so much used and abused at Christmas time. Another is the trailing arbutus, probably the most beloved of all our wild flowers. It is fairly common in some places in the North, but near our

Photograph by Clyde Fisher

WITCH-HAZEL IN FLOWER

The latest wild flower of the autumn in the eastern United States. The flowers that bloom one autumn do not develop into fruit until the next autumn. When the fruit is ripe, the plant has the interesting habit of shooting its seeds into space

A PARMELIA'S GROWTH IN ONE YEAR

The same specimen of lichen as that shown on page 628, photographed by Mr. Medsger exactly one year later, August 6, 1930. Its diameter had increased less than one-quarter inch

large cities it has been collected so much as to become rare. I was recently grieved to see its stiff, leathery, evergreen leaves used in winter decorations.

In the North we find the bearberry (*Arctostaphylos*) spreading its numerous evergreen branches flat on the earth. Its bright-red berries (tempting to the human eye but proving insipid to the palate) are much eaten by birds and probably by animals, too. Another evergreen of our northern woods, whose creeping vines clingclose to the ground, is the creeping snowberry or ivory-plum. Both common names refer to its snow-white, oblong fruit, which has the spicy flavor of wintergreen. Personally I am very fond of these delicately flavored berries, but the birds usually find them first. The whole plant has the aromatic wintergreen flavor, and the Indians of Maine told Henry D. Thoreau that it made the best tea of any wild plant in the woods.

Photograph by Elsie M. Kittredge

ROUND-LEAVED AMERICAN WINTERGREEN

Pyrola americana, the leaves of which are conspicuous in winter, is more commonly known as shinleaf. Its flowers, which are delightfully fragrant, have a superficial resemblance to lilies-of-the-valley, but it belongs to the heath family

The wild cranberry, found in bogs, is another evergreen belonging to this family. So also is the spotted wintergreen (*Chimaphila maculata*), and the pipsissewa or prince's pine (*Chimaphila umbellata*). These plants are found in nearly every woods but rarely abundant. The mottled leaves of the former and the glossy leaves of the latter are always pleasing to the eye. They are conspicuous in the winter woods, but in summer we are apt to pass them by.

The nature rambler in winter finds many little things in the fields and woods that hint of spring and a growing season to follow. The leaves of such plants as the dandelion and evening primrose make rosettes upon the ground. The hepatica, one of the first wild flowers of spring, has fresh evergreen leaves that gradually take on a reddish or purplish hue—colors that absorb heat and thus give the plant an early start.

Photograph by Clyde Fisher

TRAILING ARBUTUS

One of our earliest spring flowers is the trailing arbutus whose evergreen leaves form beautiful patches of dark green in the winter woods. John Burroughs called it "the most poetic and the best loved of our wild flowers"

Photograph by Clyde Fisher

ROCK TRIPE

A rock-encrusting lichen (*Umbilicaria pustulata*) that is classed among the edible winter plants. Richardson and Franklin, the great northern explorers, lived on rock tripe for months. Its taste when properly prepared and cooked is somewhat like tapioca with a slight flavor of licorice

Photograph by Clyde Fisher

PARTRIDGE BERRY IN FRUIT

This is sometimes called twin-berry, because two flowers develop into one berry with one stem and two blossom-scars. Its glossy, green leaves with whitish streaks down the middle, and bright-red berries are seen at Christmas time in round glass bowls at the florists

Photograph by M. C. Dickerson

IN THE WINTER WOODS

A bit of the carpet of the forest floor in which may be seen several of the typical plants of the winter woods. Mosses, lichens, ferns, etc., show their forms and colors to best advantage when other plants seem lifeless

Photograph by Clyde Fisher

HERB-ROBERT IN BLOOM

This dainty, reddish-purple wild geranium blooms well into November in the latitude of New York City, as is evidenced by the above photograph which was made on November 28, 1925

Photograph by Clyde Fisher

SKUNK-CABBAGE IN FLOWER

Our earliest wild flower, which blooms often while snow is still on the ground. The flower-bearing spadix may be seen through the opening of the hood at the lower left of the picture

We will not mention the pines, hemlock, spruce, juniper, and other conifers that are so important to the winter landscape. The holly, which plays such a prominent part in our Christmas decorations, grows from Sandy Hook, New Jersey, to Florida. It is a slow-growing evergreen tree and now needs our protection.

The club mosses or ground pines (*Lycopodium*) form another group of evergreens that many people see only at Christmas time. They are now sent to the cities in great quantities. These plants are familiar to the wood lover and are most conspicuous in winter and early spring if the ground is free from snow. The most common species are the shining club-moss (*Lycopodium lucidulum*), the ground pine (*L. obscurum*), the running-pine (*L. clavatum*), and the trailing Christmas-green (*L. complanatum*). The last two grow in festoons often six or eight feet long.

Several species of ferns are evergreen and add cheer to the winter landscape. Among these we may mention the Christmas fern, the evergreen wood-fern (*Dryopteris marginalis*), and the common polypody. The last named species often covers rocks many feet square. Its thick, leathery leaves are unaffected by cold weather. The walking fern or walking leaf is also evergreen. It is not abundant and prefers limestone rocks, but we like to look for it on our winter walks.

Many mosses are at their best during the cold season or in early spring, so also are some of the lichens. The rock tripe (*Umbilicaria*) grows on dry rocks. Several species are found in eastern United States. Arctic explorers have lived on rock tripe weeks at a time. I have tried it out and find it is nutritious but it will never be considered a delicacy. The *Parmelias* are a genus of lichens that grow flat against the bark of trees or against rocks and stones. The one in the photographs on pages 628 and 629 is perched against a hickory tree. It is more than eight inches in diameter and in one year increased its diameter less than a quarter of an inch.

The plants that have been mentioned are only a few of those that a nature student or those interested may find on a winter ramble in the woods. Look for them, and you will see many others.

Photograph by Clyde Fisher

CLIMBING BITTERSWEET IN FRUIT
The scarlet fruit is more attractive in color than the inconspicuous greenish flowers

CANOE COUNTRY

As an Artist Sees the Primitive Wildernesses Still Existing Along the International Boundary Between Lake Superior and Lake of the Woods

By FRANCIS L. JAQUES
Assistant in Preparation, American Museum

CANOE country reaches from the arctic tundra of the barren grounds northwest of Hudson's Bay, southward to the International Boundary, between Lake Superior and Lake of the Woods, and dipping into Minnesota. These enormous areas in Canada, rich in lakes and water courses, have been reached only by the canoe and paddle, except for the recent flights of the airplane.

A true wilderness area, unmarred by civilization, still exists along the international boundary waters, contained within the area drained by the Rainy Lake. This Quetico-Superior region is particularly interesting not, only because of its rugged topography and its unmolested animal life, but also because it is within the range of the white and Norway pines and the white cedar, as well as trees of more northern latitudes, and because its borders are easily accessible.

When, in 1731, Sieur de la Verendrye and his sons first used the ancient canoe route of the Indians, beginning at the Grand Portage on Lake Superior, and established a fort far to the west on Lac la Pluie, or Rainy Lake, we have the first recorded use by the white man of what are now the international boundary waters. Verendrye carried his explorations far to the west, and claimed to have seen the summits of the Rockies from the plains.

With the founding of the Northwest Company in 1783, this waterway was used more and more until 1798, when a new route was found, north of the old, leaving Lake Superior at what is now Fort William. This was to avoid the necessity of using the Grand Portage to the Pigeon River, for throughout its entire course of nine miles, it lay in United States territory.

The new route joined the old at Rainy Lake, and it also passed through the country which is the subject of this article. Over these same portages, landing on the

very rocks used today, the hardy men of the Northwest Company maintained, by their canoes, the only communication with posts as far west as Saskatchewan and the Yellowstone, and explored the Mackenzie and Frazer rivers.

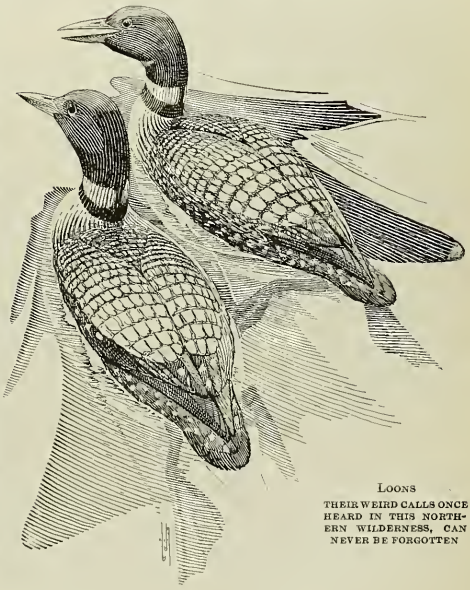
Finally, when the Webster-Ashburton treaty was passed in 1842, it stipulated that the route "as now actually used, shall be free and open to the use of the citizens and subjects of both countries." This treaty is still in effect. Of about forty portages between Lake Superior and Rainy Lake, only the Grand Portage has fallen into disuse. In at least one place, Bottle Portage, the International Boundary follows the portage trail. I have used it many times.

The Rainy Lake watershed drains this region, the water finding an outlet through the Lake of the Woods, the Winnipeg River, and eventually the Nelson River to Hudson's Bay. It is as large as Massachusetts, Connecticut, and Rhode Island, and no man will ever know how many lakes it contains until the region is mapped by airplane. The Superior National Forest, in Minnesota, and the Quetico Provincial Park, in Ontario, lie within the area, and in these latter fire-arms are not permitted.

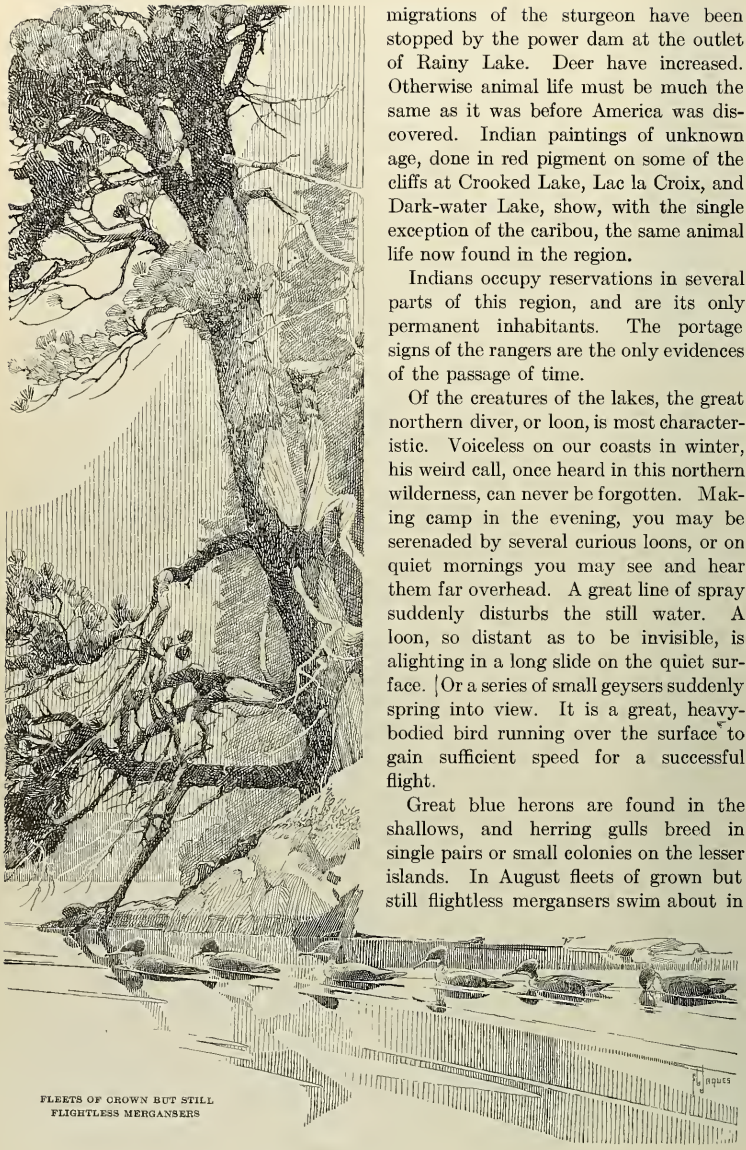
The entire region is of ancient granite, heavily scored in several directions by the former ice cap, resulting in numerous depressions filled with deep, cool lakes of clear water. Lakes away from the main watercourses sometimes are unbelievably clear, so that one has the weird impression that one's canoe is floating through the air.

Waterfalls and rapids are numerous, and beautiful bits of sandy beach hide along the heavily forested shore. Virgin stands of both Norway and white pine still exist. Little change can have taken place since Verendrye first set foot on these same portages two hundred years ago. The names of the lakes are a curious mixture of French, Scotch, and Indian,—Kahnipiminanikok, for example, Lac la Croix, McNiece Lake, and Poo Bah. Except for its forest products, which are of very slow growth due to the rocky nature of the surface, the region is only useful as a wilderness area,—a real museum of the past, a "university of the wilderness."

Never a region of teeming animal life, as were the plains, this primitive country is still inhabited by its savage creatures. Conditions are almost unchanged. Moose are much less abundant than they were fifteen years ago, but who can say that they were always numerous here? The caribou are no longer found, but they probably were never numerous. The



LOONS
THEIR WEIRD CALLS ONCE HEARD IN THIS NORTHERN WILDERNESS, CAN NEVER BE FORGOTTEN



FLEETS OF GROWN BUT STILL FLIGHTLESS MERGANSERS

migrations of the sturgeon have been stopped by the power dam at the outlet of Rainy Lake. Deer have increased. Otherwise animal life must be much the same as it was before America was discovered. Indian paintings of unknown age, done in red pigment on some of the cliffs at Crooked Lake, Lac la Croix, and Dark-water Lake, show, with the single exception of the caribou, the same animal life now found in the region.

Indians occupy reservations in several parts of this region, and are its only permanent inhabitants. The portage signs of the rangers are the only evidences of the passage of time.

Of the creatures of the lakes, the great northern diver, or loon, is most characteristic. Voiceless on our coasts in winter, his weird call, once heard in this northern wilderness, can never be forgotten. Making camp in the evening, you may be serenaded by several curious loons, or on quiet mornings you may see and hear them far overhead. A great line of spray suddenly disturbs the still water. A loon, so distant as to be invisible, is alighting in a long slide on the quiet surface. Or a series of small geysers suddenly spring into view. It is a great, heavy-bodied bird running over the surface to gain sufficient speed for a successful flight.

Great blue herons are found in the shallows, and herring gulls breed in single pairs or small colonies on the lesser islands. In August fleets of grown but still flightless mergansers swim about in

RARE DAYS WHEN THE WATER IS LIKE GLASS

long lines, or if alarmed, race toward the center of the lake in a shower of spray.

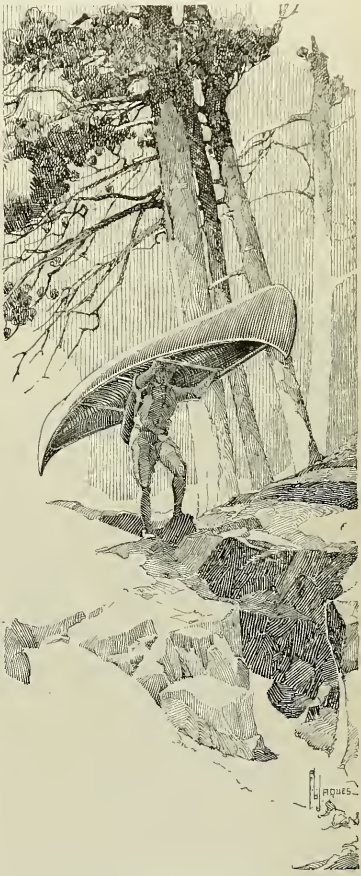
Bald eagles, and occasionally a golden eagle may be seen, and ospreys nest in the tall, dead pines, or you may find on the cliffs the nest of that greatest of feathered sportsmen, the duck hawk, a bird which kills swiftly and surely, but according to a definite set of rules.

The moose bird, or Canada jay, author of a number of strange and unassociated sounds, will visit your camp and steal anything he can get, though quite, as his big, friendly eyes will attest, without any knowledge that he is a robber. Ruffed grouse and Canada grouse may be seen in greatly varying numbers from year to year.

Beaver are numerous and have become quite a nuisance in places, flooding portage trails and throwing dams across watercourses. Have you ever tried to break a beaver dam? It's a tough structure! Once a beaver kept us awake an entire night by slapping his tail at regular intervals as a protest against the presence of the strange creatures in a white tent.

Bears are usually well behaved and dignified, as becomes a bear, though we saw one who, when he thought he was invisible to us, made a frightened speed that was amazing! If you are lucky you may hear the thrilling wail of the timber wolf. Deer are increasing in number, as I have said. But the greatest prize, not seen as frequently as in former years, is to find a great, slow-witted moose in the water.

The voracious great northern pike is



THE PORTAGE TRAIL
A TRUE WILDERNESS AREA, UNMARRED BY CIVILIZATION

MOOSE!
A THRILLING SIGHT TO THE CANOEIST

the most abundant fish, together with the wall-eyed pike perch. Large-mouthed black bass may be found in some of the smaller lakes and in certain bays of the larger ones, while lake trout, in summer, are deep down in the clear lakes, and require special tackle.

With these creatures you are, if you are on a canoe trip, almost one. The canoe offers, in the opinion of the writer, at once the most primitive, satisfying, and intimate way of living in touch with the wilderness and its denizens. In it you may travel as inexpensively, as safely, and as comfortably as you wish.

There are only a few simple rules that may be wisely observed in order to insure the maximum amount of safety; for instance, the canoe of the Indians was, and still is, the birch bark. While it was adopted by the early traders and used for many years, even the great birch bark canoe for use on Lake Superior, it has given way to the more practical canvas-covered canoe. The writer has one of the latter, weighing but slightly more than fifty pounds, yet it will carry two persons, a complete camp outfit, and food enough for a month.

Since canoe and outfit must be carried over many portages, the weight must be reduced to a minimum. One's outlook immediately changes, and one lives close to the source of things. In the bottom of the canoe there should be a compass and a map,—beyond lie hundreds of clear wilderness lakes through which to choose one's way in wandering. Truly, mild adventure offers no more alluring prospect!

Keep the load, including the personnel, low in the canoe. Stay in camp if the water is too rough, and don't take chances in the fast water. Portages have been provided in all doubtful places by the rangers. For comfort, keep dry. Waterproof clothing can be carried in the ends of the canoe, where it is instantly available, and a canoe which keeps water out from underneath will keep it out from above, if it is inverted and the duffle placed beneath it on the shore. Storms give sufficient warning so that you have time to reach land.

Be careful of fire. On a hot, windy day a fire can be started even a few hours after a heavy rain. Put your camp fires out thoroughly. Nothing disturbs your peace of mind so much on a dry and windy day as the thought that you may have left a burned-out camp fire undrenched that morning.

Weather, largely overlooked in the city, becomes of vital importance. The direc-

tion and velocity of the wind determine the route you take, or whether you travel at all. You scan the map anxiously for long reaches of open water, and try to avoid them. You come to feel a relationship between cloud shadows and gusts of wind. You treasure the rare days when the water is like glass, showing the inverted image of the sky, and the lakes seem full to overflowing,—truly a setting to inspire the lover of the outdoors.

The writer wishes that this article might end here. It is not pleasant to say that this wilderness is threatened. Commercial interests have proposed that at all the larger boundary lakes dams be constructed to permit the storage of water, ostensibly to help navigation, and for power purposes, at International Falls and Fort Francis and on the Winnipeg River. The proposal is to raise the water varying amounts from five to eighty-two feet with the resulting destruction of present shore lines, and a rise and fall of water which leaves an encircling fringe of dead trees, examples of which may be found in many places through the north.

A determined group of men, represented by the Quetico-Superior Council, 1218 Flour Exchange, Minneapolis, Minnesota, is working against odds to preserve this area in its original state. They have secured the passage by Congress of the Shipstead-Newton-Nolan act, restricting further alteration of water levels on the American side, but much still remains to be done. A treaty must be secured with Canada adequately to protect the region. Let us hope that the lakes of Verendrye and the first route to the Northwest may remain intact and unchanged for the people of the future!

A GREAT BLUE HERON

Photograph by Clyde Fisher

VIEWING THE COUNTRY-SIDE

TELLING THE BEAVER STORY

Experiences in Bringing to a Wide Public a First-Hand Knowledge of the Daily Life of an Industrious Beaver Family

By WILLIAM H. CARR

Assistant Curator, Department of Public Education, American Museum

Each year the Trailside Museum at Bear Mountain, operated by the Department of Public Education of the American Museum of Natural History, introduces a variety of wild animal guests to new human friends. The beaver in the confines of the Bear Mountain Harriman Section of the Palisades Interstate Park are now known to thousands of campers and tourists. Readers of NATURAL HISTORY *will recall Mr. Carr's "Indian Beaver Legends" which were published in the January-February issue.*—THE EDITORS

THE country telephone on the cabin wall rang "four shorts." Mr. Adolph, Park Forester, was calling:

"We have some beaver here in the greenhouse. Major Welch wants to send a pair to North Carolina. There are two more for you. The trouble is, we can't seem to decide which ones are Johnnies and which Jennies! Could you come up and help?"

We could and did. On the way, along a road that twists across the shoulders of Bear Mountain far above the gleaming Hudson River, we wondered how long the beaver had been confined in a glass-covered plant nursery. Somehow the presence of healthy, hungry beaver in a greenhouse compared very favorably with the proverbial bull in the china shop, with the exception that bulls do not include chinaware on their menu!

The plants were perfectly safe, however, for we found the broad-tailed animals confined in large wire baskets. Soon the pair for southern journeyings was selected and placed in a zinc-lined traveling box. Then, at the last minute, it was decided to postpone shipment for a few days.

"Why don't you take all of the beaver over to the Bear Mountain Trailside Museum?" asked Major Welch, who was an interested spectator. "You could keep them for awhile and make some photographs while waiting for cooler weather before starting the pair off on an express train."

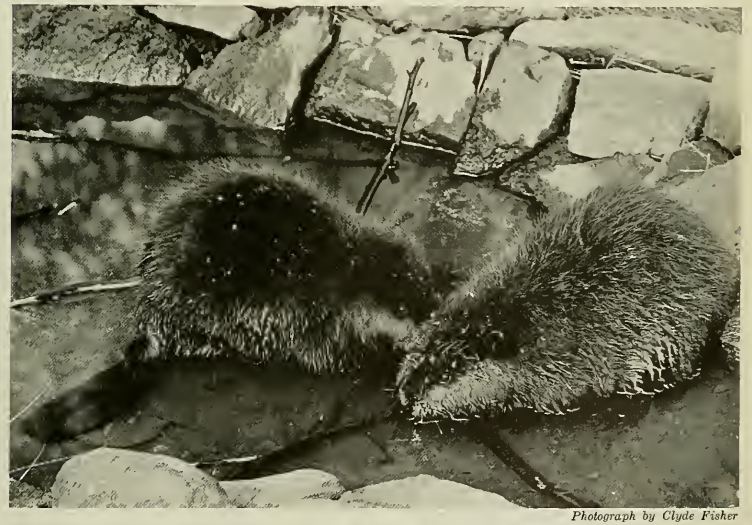
We followed the Major's suggestion and most of the pictures used in this article are the result.

There were three furry, round young beaver and one very large, shiny-coated

adult. They had been captured in the Bear Mountain-Harriman section of the Palisades Interstate Park in New York. For the past twelve years we have been patiently observing beaver in this area. In 1919 these large rodents were introduced into our section of the rolling Hudson Highlands and from the very first readily accepted the new environment. Today, there are at least thirty active colonies in the region. Not satisfied with merely occupying the fourteen thousand acres of the preserve, the animals have wandered far on every hand. They have crossed the Hudson and have strayed to the North, South, East, and West, following stream beds and river courses, gradually repopulating some of the territory that originally knew them as its own some 280 years ago.

Newspaper accounts, motion pictures, radio talks, roadside signs, exhibits in our Trailside Museum, numerous lectures and, best of all, the work of the animals themselves, have all served to acquaint thousands of men, women, and children with the story of the often mentioned "engineer of the animal world."

Several years ago a thriving beaver colony with dams, houses, and tree cuttings could be easily viewed from the state road that ran through the center of the Park. Many trees had been killed by flooding, for beaver destroy more timber in this way than by cutting for food. State Park authorities decided to chop down dead trees in an effort to improve the appearance of the country-side. The rodents were moved to a new location at the same time. Very shortly, complaints both verbal and written came pouring in. Indignant motorists, many of whom had journeyed for miles to watch the beaver, were strong in their protests against the removal of the woodland architects. Eventually public opinion won the contest,



Photograph by Clyde Fisher

DINING ON CHERRY BRANCHES

A variety of tree species is accepted by beaver as food. Their diet of bark and other plant food is not rigidly restricted

Photograph by Clyde Fisher

A GENTLEMAN OF THE OLD SCHOOL

Dignity is seldom lacking in the beaver's deliberate movements on land. Note the handlike forepaws

and once more beaver were encouraged at the spot. Now, at almost any hour of the day or night, automobiles may be seen parked near by!

From the outset there has been no question as to public approval of successful experimentation in the reëstablishment of beaver. This was clearly demonstrated by hundreds of visitors who examined the greenhouse beaver while they were in temporary quarters near the Bear Mountain Bridge. In some strange way the grapevine telegraph functioned, and from morning until night it was a case of "Where are the beaver!"

Beaver kittens and a sixty-seven pound grandfather were certainly attractive enough to draw crowds anywhere. The flat, paddle-shaped tails always fascinated onlookers.

"They use their tails as trowels to pat down the mud," said ninety-five per cent of the curious parents while initiating their wide-eyed children into the mysteries of nature lore. It seemed that the newspapers, the radio, and other vehicles of public information had failed, at least where accuracy was concerned. For this reason we had a large sign in the museum reading:

> BEAVER DO NOT USE THEIR TAILS AS TROWELS! THEY ARE NOT USED AS FERRIES FOR THE TRANSPORTATION OF MUD OR STONES, EITHER!

To answer the query, "What *are* their tails used for?" we had this label:

> THE MOST IMPORTANT USE OF THE BEAVER'S TAIL IS AS A SEAT FOR ITS OWNER! IT SERVES AS A PROP TO BRACE THE ANIMAL WHEN CUTTING DOWN TREES AND IS OFTEN EXTENDED FORWARD IN A MANNER ENABLING THE BEAVER TO ACTUALLY USE IT AS A PAD OR CUSHION WHEN RESTING. THE TAIL IS ALSO USED TO STRIKE OR "WHACK" THE WATER AS A SPLASH-WARNING SIGNAL TO OTHER BEAVER THAT DANGER IS NEAR. STILL ANOTHER USE IS THAT OF A RUDDER AND A "SCULLING OAR" IN SWIMMING, PARTICULARLY UNDER WATER.

We have learned that one way of arousing enthusiasm in natural history exposition is to provoke arguments. If onlookers can be informed that we do not agree with their established ideas about certain things, a stimulating talk often ensues.

Here are some signs, that, more than once, have had the desired effect.

TREES DO NOT NECESSARILY "FALL THE WAY BEAVER WANT THEM TO." IN FACT BEAVER ARE SOMETIMES UNABLE TO CAUSE TREES TO FALL IN ANY DIRECTION WHATSOEVER, EVEN THOUGH THE TRUNKS ARE SEVERED. FALLING TREES OFTEN LODGE AGAINST THEIR NEIGHBORS AND REMAIN IN A COMPARATIVELY UPRIGHT POSITION FOR MONTHS OR EVEN YEARS!

BEAVER DO NOT FEED UPON THE BARK OF POPLAR, WILLOW AND ALDER TREES, ALONE. HERE, IN THE PALISADES INTERSTATE PARK, THEY EAT CHERRIES, PINES, SPRUCES, OAKS, WALNUTS, ASHES AND MANY OTHER VARIETIES OF TREES. LARGE, TREE-EMBRACING POISON IVY VINES HAVE ALSO BEEN SEVERED!

FISH HAVE NO PLACE ON THE BEAVER'S BILL OF FARE. THE RODENTS SUBSIST UPON BARK, AQUATIC PLANTS, LEAVES AND GRASSES, THEY ARE STRICT VEGETARIANS!

BEAVER DO CARRY STONES. THE MONKEY-LIKE FOREPAWS AND THE CHIN ARE USED IN THIS OPERATION. OFTEN THE BEAVER MOVES STONES BY THE SIMPLE EXPEDIENT OF PUSHING THEM ALONG WITH ITS HEAD.

In our minds, people and beaver are closely associated. We have maintained beaver for the people and the people have responded with questions and other evidences of awakened interest almost too numerous to recall. The beaver and its habits and accomplishments as revealed to others and to ourselves has become a center and source of information about which revolve endless chains of closely interrelated and unforgettable experiences with both human and animal.

One of the most cherished incidents we ever had in this connection, one that will ever stay in our memory, occurred with a blind man in the Trailside Museum. It was a warm day and our Nature Trails were host to a perspiring multitude. The access to our museum is none too easy, even to persons possessing every faculty. The stony path winds up and down rocky prominences in a way discouraging to high-heeled shoes and uncertain feet in general. We were surprised and pleased, therefore, to see a blind man, led by a thoughtful boy, enter the doorway. As the two elbowed their way about, the boy would read labels aloud and describe various exhibit details to the best of his ability. His less fortunate companion made intelligent remarks about the snakes, fish, plants, and minerals on display. After a time the couple paused before our beaver exhibit.

Photograph by Wilfred A. Miller

A PAUSE BETWEEN CHEWS

The large beaver severed half-inch branches with two bites—no more, no less!

Photograph by M. Peter Keene

A LOG HALF CUT FOR TRANSPORTATION

When trees are too heavy to be moved to the pond, the beaver cuts them into convenient sections

Here a supporting stand had been made of timber actually cut and peeled by beaver. Tooth marks in the log sections were very plain. On the stand was a colored plaster-of-Paris model of a typical beaver colony. At one side was a mounted beaver skull and on the other a plaster impression of a large beaver track taken from the mud. Signs and pictures amplified the story.

We walked over in an endeavor to aid the boy in his task of explaining. It was then we learned that the man had been blessed with sight until he was fifteen years old. He had lived in the country and recalled, with an amazing show of cheerfulness, incidents with various birds and animals during his youth. We talked for awhile about the beaver and had begun reading some of the labels, when he said:

"Please take my hand and 'show' me what is here. Just guide my fingers to the various objects as you talk about them."

We did as he wished and noticed at once how sensitive were the fingers long used to the reading of Braille. First we directed him to the beaver skull.

"My what powerful teeth beaver have!" was his comment. "I can readily understand how the animals are able to fell trees. The teeth are curved, aren't they?"

And then, after a pause, during which the visitor handled the flat-domed skull and strong jaw connections, he asked the question so often forthcoming from people who are not denied vision.

"Why do beaver cut down trees, anyway?"

As our model was made partly to answer this question we next guided the inquisitive fingers downward to where the object rested. We indicated the pond house or lodge and the miniature bank house made of twigs glued together and placed half

on the bank and half in the water in the diagrammatic pond. We read a convenient label which said:

THE BEAVER HAS MANY REASONS FOR FELLING TREES. THE BARK ON TRUNKS, BRANCHES AND TWIGS IS EATEN, SO ARE MANY OF THE LEAVES. THE PRONE TREES ARE CUT INTO SECTIONS AVERAGING TWO AND A HALF FEET IN LENGTH AND LABORIOUSLY DRAGGED TO THE POND WHERE, STRIPPED OF BARK, THEY ARE FLOATED OUT AND USED EITHER IN HOUSE OR DAM CONSTRUCTION.

IN THE FALL SMALLER TREES ARE CUT DOWN, FERRIED WITH BARK INTACT TO A POSITION NEAR THE HOUSE AND THERE ANCHORED UNDER WATER NEAR THE LODGE ENTRANCE TO SERVE AS A WINTER FOOD SUPPLY. THE BEAVER DOES NOT HIBERNATE. IT MUST HAVE FOOD EVEN THOUGH ICE MAY PREVENT GOING ASHORE FOR WEEKS AT A TIME.

After our blind pupil had digested the contents of this label he asked another common question.

"Why do beaver go to all the trouble of making a pond? I should think that, like many other four-legged creatures, they could live on land in a den or hole and feed easily enough wherever there were forests!"

Once more a sign came to the fore:

THE BEAVER IS PERFECTLY AT HOME IN WATER. IT IS AN EXPERT SWIMMER AND DIVER. ON LAND, HOWEVER, IT FALLS AN EASY PREY TO CARNIVOROUS ANIMALS SUCH AS WOLVES, BEARS, FOXES AND OTHERS. THE HEAVY HINDQUARTERS, FLAT TAIL, AND WEBBED HIND FEET PREVENT RAPID LOCOMOTION. ONLY IN WATER IS THE BEAVER SAFE FROM NEARLY ALL MARAUDERS EXCEPT THE OTTER AND AN OCCASIONAL HAWK, EAGLE, OR OWL—AND OF COURSE THE HUMAN BEING.

IF NO POND OR LAKE IS AVAILABLE, THE BEAVER MAKES ITS OWN. WATER ALSO SERVES AS A MEDIUM FOR FLOATING BUILDING MATERIAL AND FOOD, AND PROVIDES, A PROTECTIVE MOAT TO THE UNDERWATER LODGE ENTRANCES. BEAVER KITTENS ARE SAFE, TOO, IN THE DEPTHS OF THEIR NATAL POND. SO DEPENDENT IS THE BEAVER UPON WATER THAT IT SOMETIMES LIVES IN HOLES ALONG STREAM BANKS.

The blind man remarked that the beaver house was about as high above water as

Photograph by Wilfred A. Miller

BEAVER SKULL MOUNTED FOR HANDLING

Whenever possible, all specimens of this type are presented to satisfy the tactile sense of Trailside Museum visitors

Photograph by Clyde Fisher

BEAVER IN THE BIRD BATH

The two infant beaver were content—for awhile—to accept strange and decidedly alien surroundings to facilitate photography

below, and we explained that although beaver could remain under water for several minutes at a time, they were by no means fish. Five minutes is an unusually long time for a beaver to be submerged, as we have observed. Others report they have known the creatures "to stay under for as long as eleven minutes." At any event, the beaver's sleeping chamber within the lodge and its home at the end of a bank hole are, of course, always above water level.

After an hour or so, our visitor had to go. We asked his name and he volunteered his occupation. We learned that he sold papers on a corner of Broadway in New York City, not far from the American Museum of Natural History. Without a doubt we had purchased papers from him many times during the winter! Furthermore, the man informed us that he visited the museum often, had listened to many lectures there and was acquainted with two of the curators. No wonder he braved the path to our small woodland museum!

We only wish now that the blind newsdealer had come during the time we were being entertained by the four beaver. We would have made it possible for him to touch and to listen to them as they fed unconcernedly before our eyes. How he would have appreciated it! Our enjoyment at pleasing him would have been as great as his in being pleased. We could not help but feel that the blind friend knew more of beaver ways after leaving our little museum than many another visitor who could see as well as feel.

At the place where the four beaver were held in temporary captivity, we worked out a scheme for making photographs. Dr. Clyde Fisher, of the American Museum, spent two days with us for this purpose. Earlier in the season we had constructed a bird bath,—small stones surrounding a natural saucer-shaped

depression in bed rock. An underground drain from a fish pond provided water. Goldfinches, catbirds, song sparrows, robins, and our tame crow delighted in the clear water on warm summer days; but we never thought that beaver would occupy our bird bath! However, after having exhausted all available sites for picture taking, the birds' pool appealed to us as the most logical spot.

Several dry-land portraits had been made, but the subjects showed a distressing tendency to wander. They simply would not stay "put." We persuaded them to explore the bird bath and there was no more difficulty. They settled down and soon were feeding on small branches of cherry. They performed very nicely while both still and motion-picture cameras recorded their actions. If the catbird had come by for a drink how outraged he would have been at the sight!

We have often been asked about beaver sounds. Yes, beaver do make noises—not only when feeding, either. Many times we have heard adults, disturbed upon shore, expel air through their nostrils with just the suggestion of a "snort." Snorting is by no means reserved for horses! The effect in the beaver's case is probably akin to messages of intimidation given by many animals in many ways. As a rule beaver we have observed, both in a wild and captive state, are anything but aggressive. Their very appearance expresses a docile, meek outlook on life. Our natural history literature contains but few references to beaver onslaughts upon human beings and, always, the human is in the rôle of initial attacker. We have twice been "rushed" by beaver—once by a kitten and again by a full-grown individual. In each instance we were about to grasp the animal by the tail. The beaver made a decisively rapid movement in our

Photograph by Wilfred A. Miller

A PLACID EXPRESSION

Beaver ashore have a resigned appearance suggestive of their actual helplessness away from the preferred watery habitat

Photograph by Wilfred A. Miller

A NEW USE FOR BIRD BATHS

Dr. Clyde Fisher making motion pictures of two beaver kittens. The Trailside Craftshop is in the background

direction. The intent was so unmistakable that we jumped back and approached the picking-up angle from the logical end.

Beaver young have a curious whine or grunt that has often been mentioned. Beaver of all sizes have the "tooth grinding" complex possessed by woodchucks, chipmunks, gray squirrels, and some other rodents. They rasp their teeth together, apparently to remind one that the chisel-like implements are there without a doubt!

Photograph by Wilfred A. Miller

The numerous lakes in the Palisades Interstate Park are used by campers for swimming. Beaver live in many of the same lakes. The question frequently arises as to whether there is any danger in the combination of beaver and bathers. We invariably answer, "Only to the beaver!"

Many of our guests were amused by the beaver's feeding habits. The kittens, especially, remind one of piccolo players in their expert use of handlike forepaws which hold the sticks and turn them as the teeth rapidly chew off succulent bark. The crisp, efficient sounds remind one of the vibrations caused by clapping one's hands rapidly, using only the finger tips in the process.

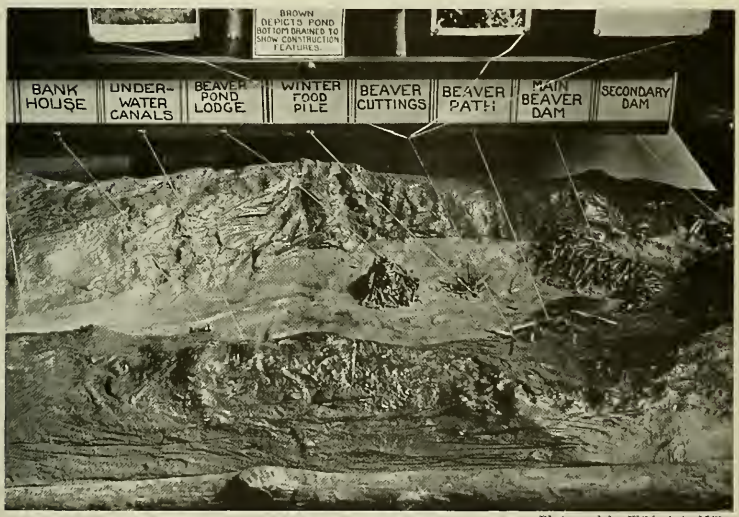
The first time we ever heard beaver chewing was at dusk, on a cool, spring evening. We were unable to catalogue the sound. Its repetitions were so rapid and its vibrant tone so uniform in volume that it seemed like the regular song of some insects related to the crickets.

Presently a tree fell and the wood hewer came swimming across the pond carrying its burden. In another moment a second pond occupant appeared to assist its mate in eating the bark, and then we definitely identified the sound to our complete satisfaction.

Photograph by Clyde Fisher

Our experience in sharing and in promoting beaver knowledge extends over a number of years. Many are the devices we have used to forward the study. Once we built a little tree house in the wide branches of a large maple tree on the edge of a beaver pond. One could climb the ladder and, lying on the platform some twenty feet above the water's surface, have an unobstructed view of all that transpired below. Many were the boys and men who used that platform. It was real sport to stay up there on bright moonlight nights and watch the shining ripples of the beaver's comings and goings, to hear the sleepy voices of birds, and to absorb in every pore the beauty of a tree-fringed pond at night.

Although not quite in keeping with the general esthetic spirit of the evening's program, we would sometimes play the mean trick of breaking the main beaver dam. The hole was usually about two feet wide and two deep. When a beaver discovered the leak, he would make repairs immediately. Often the breach would be invisible in the space of twenty minutes



Photograph by Wilfred A. Miller

MODEL OF A BEAVER POND

Detail of the beaver pond model in the Bear Mountain Trailside Museum. This simple exhibit tells its own story

or less time. Sticks, sod, and mud would fill the gap, and then the worker would go about his usual evening task.

Our tree-top perch enabled us to watch the beaver swimming under water in late afternoon. We could see to best advantage how swiftly the large, brown body could travel. As a rule not a ripple was in evidence, nor did bubbles mark the swimmer's progress; yet the animal seemed perfectly aware of surface disturbance near by. As he swam toward us, we would drop a small branch some ten feet ahead of him. Instantly his course would be altered. We found it possible to make the beaver swim in circles under water by dropping or throwing small stones in front of him. Each time he sensed the splash, he would change his swimming direction and move away from the source of disturbance. Night after night we devised schemes and systems of experiment until it is a wonder the beaver did not cut down our observatory and throw us into the pond!

Despite the annoyance we caused, we nevertheless learned many things, at first hand, that books had failed to tell us. We were exceedingly thankful in later years that we had spent these fruitful hours beside beaver ponds. When we lectured before groups, especially those of children, the questions that engulfed us caused us to call upon nearly all observations we had ever made. Furthermore, we only regretted that they were not more numerous. Children certainly do want to know the "Why, When, Where, and How" of things, and so do their elders. If the day ever comes when the sight of beaver or of beavers' creations fail to arouse interest in the minds of human observers—but why speak of the impossible?

Drawing by Merle Keith

Photograph by George Finlay Simmons

The "Blossom" Under Full Sail

UNDER SAIL TO THE CAPE VERDES

The Voyage of the "Blossom" on a Deep-sea Cruise for Oceanic Birds.—
The Cleveland Museum of Natural History Expedition to the
North and South Atlantic Collecting on the Islands
of the Cape Verde Archipelago

By ROBERT H. ROCKWELL

Other articles by Mr. Rockwell will appear in later numbers of Natural History *telling of further experiences on this voyage which covered 20,000 miles in thirty-one months of continuous exploration. The author of this article, now a member of the department of preparation of the American Museum, was a member of the scientific staff of the schooner "Blossom" for eighteen months.*—The Editors

IT seems strange, in this modern age of record-breaking speed, that anyone should select a sailing ship as a means of getting anywhere. Perhaps it is the very slowness of the thing that makes its most potent appeal. Anyway, when such a cruise was proposed to me it seemed to be a rare opportunity to depart from the high speed and tension of modern life and, at one swoop, take on a new existence. Looking back at it now from the proper perspective, this adventure seems like a brief sojourn on another planet. Perhaps it was the romance of manning our own ship, the lure attached to the sea, or the thought of landing on strange, desolate islands that led us to leave families and comfortable homes. Some of our friends assured us that we were not quite right in our minds, but our enthusiasm couldn't be dampened. It ran high and even the newspapers caught it to such an extent that they said we were going to look for the Lost Continent of Atlantis.

The plans of our journey were large but the object of the expedition was definite. We proposed to collect sea birds and sea mammals on the islands of the South Atlantic, as well as the huge, southern sea elephant from Kerguelin Island in the Indian Ocean. What we expected to do and what was done were quite different! But we sailed our ship for 20,000 miles. We visited that indefinite stretch of ocean known as the Sargosso Sea. We spent more than four months on the Cape Verde Islands and about the same amount of time in Senegal, at both places making large collections of birds and obtaining a few animals from the African interior, including a rare

Photograph by Robert H. Rockwell

THE LIGHTHOUSE AT SAINT VINCENT

Reinha Amelia Light stands on a bare and precipitous rock on the southwest side of the harbor of the principal port in the Cape Verdes Islands

species of lion. We visited South Trinidad Island, the Martin Vas Rocks, and then Rio de Janeiro; from here I returned home. The expedition later visited St. Helena, Ascension, Fernanda Naronha, and Rocas Reef before returning, finally, to the United States, and was able, after two and a half years, to deliver nearly 13,000 natural history specimens to the Cleveland Museum together with the written and photographic records of the voyage.

* * * *

One might naturally suppose that one of the very first requisites for such a prolonged voyage would be sailors—sailors of experience and ability—yet, when we cast off our lines at New London, Connecticut, on the 29th of October, 1923, and were towed to an anchorage in Gardiner's Bay, Long Island, sailors were not numerous on board. We were, except for Captain Gray, "Long John" DeLomba, the mate, and one or two others, a "lubberly" lot, without experience at sea, knowing little or nothing of halyards and sheets, and less, if possible, of port and starboard and all the rest of the specialized language of the sea.

Several times it has been announced in print that the schooner we sailed was only one third the size of Columbus' "Santa Maria." As a matter of fact, the "Santa Maria" was hardly more than one third the size of our schooner, but that did not make our "packet" large. She registered 250 tons, which means that the "Leviathan" is some 240 times as great. It is obvious, therefore, that with supplies for so extended a voyage as we were beginning, and with sixteen, all told, in the crew, there was somewhat less space on board then we could have utilized to good advantage.

Our ship had once been called the "Lucy R" and had been built several years before for the coasting trade. She was a three-masted schooner that, to my inexperienced eye, seemed husky and able and fairly well adapted to the task that faced her. She was overhauled and refitted—though, for some reason, the task was none too brilliantly accomplished—and was renamed the "Blossom," in honor of Mrs. Dudley S. Blossom, a trustee of the Cleveland Museum, whose very great generosity made the voyage possible.

When I joined the ship, as a member of the scientific party, she was lying at her

New London pier piled high with a mass of supplies such as no land lubber could possibly imagine. Her hold already seemed full to the bursting point, yet on deck was an accumulation of supplies that suggested the need of a secondary ship to carry it. Boxes, bales, barrels, and bags of every conceivable sort were piled high amidship, cluttering up the little ship's deck until it was difficult to clamber about. Scientific supplies, shotgun shells, tobacco, tins and cases and bales of food, spare parts, coils of line, and scores of other things lay helter skelter, while the men on board were busily endeavoring to sort it and stow it. The task looked almost impossible.

As a matter of fact, it took ten days from the time we dropped our anchor in Gardiner's Bay until we were finally ready for sea, and consequently it was the 10th of November before we set our canvas and headed E.N.E. on the starboard tack. At dusk that evening we rounded Montauk Point and headed out into the broad Atlantic with the Cape Verde Islands, off the coast of Africa, as our first port of call.

Crossing the Atlantic under sail appeals to many individuals as a romantic and altogether delightful experience, and it was with that point of view that most of us began our voyage on the "Blossom" but that was because of our inexperience and our lack of understanding of the discomforts that we were to find on the way.

A schooner of 250 tons is, as I have suggested, not a large craft. Nor was the "Blossom" an ideal vessel for the task in hand. She was not easy to handle. By no means could she be called fast, nor could she be prevailed upon to make headway "to windward." Furthermore, gales are not uncommon in the North Atlantic

Photograph by Robert H. Rockwell

THE MARKET PLACE AT SAINT VINCENT

The Cape Verdes Islands are, for the most part, dry and desolate. On some of them, however, the rains fall regularly enough, though on others rain may not fall for a year or more. Their produce is marketed at Saint Vincent, the principal port of the group

in the autumn. The result of all this was that no sooner had the weather changed for the worse—which it soon did—than our little ship began to go through the most amazing motions. Swept up to the crests of the great seas, she swept down again with the most sickening plunges. No express elevator ever dropped so rapidly away from under one's feet as did the deck of our vessel, as, with the passing of a heavy sea, yawning troughs appeared ahead. Spray swept constantly over her low rail. Solid water roared across her midship deck, ran forward and aft with the pitching of the ship, swept below far too often when some hatch was opened, and trickled constantly through the badly calked decks to soak our blankets and keep our bunks in a state of damp discomfort.

With every possible hatch battened down in order to keep out the water, the hull soon reeked with the foul odors of constantly sloshing bilge water, which, of all odors, is hardest on a land lubber's powers of resistance. Rolling and pitching, boarded constantly by green water and flying spray, the ship soon became a habitation scarcely fit for hardened sailors, and more than her crew of inexperienced men had bargained for.

It was impossible to eat a meal at the mess table for weeks. Instead, we must needs make our way forward through the rushing water, holding firmly to rigging and life lines, in order to reach the galley, there to seize a mug of coffee or a ponderous sandwich before wedging ourselves into some corner in the hope of wolfing our food before having it soaked or diluted with sea water.

Most of us were seasick for a few days, and, despite the humorous attitude that many observers have toward seasickness, it is not pleasant. After a short time, however, most of us got our sea legs and were

Photograph by Robert H. Rockwell

"THE BEACH" AT FURNA

The little town of Furna is on the island of Brava, about a hundred miles to the south of Saint Vincent. It was on this island that Mr. Rockwell spent three months collecting birds

Photograph by Robert H. Rockwell

THE "BLOSSOM" AT FURNA, ISLAND OF BRAVA

So nearly landlocked is this little harbor that it cannot be seen from sea until the approaching vessel has almost reached its entrance. Nevertheless, there is room within for many ships of the size of the "Blossom," and even for larger ones

able to take our meals. Mr. George F. Simmons, however, who, as curator of ornithology at the Cleveland Museum, was the leader of the expedition, was unable to stand for almost the entire forty-day voyage to the Cape Verdes. It speaks worlds for his determination that, after so severe an attack of *mal de mer*, he was either willing or able to continue the voyage, which he did to its very end, thirty-one months later.

It took us nearly six weeks to reach St. Vincent, the principal port of the Cape Verdes, and in that time we fortunately had other kinds of weather than received us during the first three weeks. Pleasant winds and calms, head winds and sudden squalls aided us or held us up or blew us off our course. Nor were we fortunate in obtaining more than a few specimens of birds while we were at sea.

In fine weather as we approached the Cape Verdes we often went swimming, especially when the ship was becalmed. We hooked dolphins, and harpooned an eleven-foot shark. We watched whales spout as we passed them, and even went out in the whaleboat with "Long John" DeLamba at the steering oar in a hopeless chase of some of these giants of the deep.

Furthermore, from necessity, and because our opportunities were frequent, we learned something of the sailors' tasks. We took in canvas or set it. We stood our "tricks" at the wheel, or stood watch in the bow, and before the mountain peaks of the Cape Verdes finally appeared above the horizon, we were a more capable, if a less romantically inclined, crew than had come aboard at New London.

And at last we anchored in the harbor of St. Vincent, eager to go ashore—to feel again the firm earth beneath our feet—to sleep in quiet, motionless beds, to eat fresh food, and to get away, for a time, from those with whom, perforce, we had

Photograph by Robert H. Rockwell

WOMEN PORTERS ON THE ISLAND OF BRAVA

The men do little heavy work, leaving to the women such chores as the carrying of burdens and pushing coal cars

lived so intimately and so uncomfortably for almost six weeks.

Furthermore, as is always the case with ships and as was especially true with ours, innumerable repairs had to be made. The result was that, while we collected birds ashore, the ship underwent an overhauling—which was sadly needed.

Photograph by Robert H. Rockwell

WOMEN PORTERS OF BRAVA

There are no horse-drawn vehicles on this little island, but one finds thoroughly sturdy women who can handle any load up to sixty pounds

For a month we remained at St. Vincent, collecting many of the birds of that precipitous and almost barren island. And, during this period, it was decided that, with John DeLamba, who was himself a native of the Cape Verdes, I was to go to his home island of Brava, there to collect birds during ten days, at the end of which the "Blossom" would call for us before continuing our search for the scientific specimens on the other islands of the group.

It was on a native sailing craft that we sailed the hundred miles or so from St. Vincent to Brava—a native craft laden with natives, with goats, and pigs, and chickens. Furthermore, we stopped at the island of St. Antone on the way while the negro crew and the Portuguese captain laboriously added several kicking, plunging mules to our cargo after these animals had been forced to swim out to our ship.

A hundred miles in two days and a half is not breathless speed, yet one must not measure time and distance in the Cape Verdes as we do in America. Nor must one ask for too much privacy on board such a vessel as we had taken.

There was but one cabin, and intending to turn in the first night out, I ventured below, only to find that I had to pick my way over five girls who lay alseep under their shawls on the floor. The second night I tried the cabin again, but sleep was impossible because of the odor of rum and cigarettes and other odors even less desirable. I grabbed my blankets and went on deck where I slept well enough only to awaken in the early morning to find that a dog and a goat lay curled up beside me and two chickens roosted close to my head.

The entrance to the harbor of Brava is strikingly beautiful. Rugged mountains standing high are tinged with green, and dotted here and there with tiny white houses almost to the summits six thousand feet above the sea. The little bay is protected by a cliff behind which one would hardly imagine a harbor could lie. Fairly good paved roads wander over the whole island, and lines of steeply terraced

Photograph by George Finlay Simmons

A STREET IN BRAVA

The houses are sparsely scattered over the island from the beach almost to the peaks of the bare mountains. The roads are surprisingly good

Photograph by Robert H. Rockwell

JOHN DE LAMBA AND HIS FAMILY

With a part of his family and many of his friends, John, like other natives of Brava, had gone to America to earn his fortune. He became mate of a whaler and finally mate of the "Blossom." At the completion of the expedition, he bought the "Blossom"

A BOOBY COLONY
An outlying island of the Cape Verdes group where brown boobies breed and rear their young among the rocks

Photograph by George Finlay Simmons

gardens spread over many of the hills and narrow valleys.

It is a difficult spot on which to earn a livelihood, and were it not for the fact that many of the native sons have gone to the New England fishing ports to earn the better pay that America affords, it is difficult to see how the people, miserably poor as they are, can live at all. With the small amounts sent to them, however, by their voyaging relatives, they manage to exist.

With only ten days to spend upon the island I had brought but little in the way of supplies, and had little enough time to collect the birds that were to be found there. Furthermore, as an American—a real citizen from that golden land of opportunity—I attracted endless attention. I worked with native boys and girls and men and women constantly looking on. If I went out with DeLamba to hunt, we were followed by bands of boys, eager to help, but often hindering us. Our supplies were carried by the women, who, with sixty-pound burdens balanced on their heads, seemed always capable of endlessly trudging up the steep grades. I often felt ashamed of my inability to climb those hills without puffing

MR. ROCKWELL AND A BOOBY
This old bird angrily pecked at pebbles that were tossed at her, and refused to move off the nest

Photograph by George Finlay Simmons

LITTLE JOE
A lonely islet four miles off the shore of Brava, where thousands of white-faced and other petrels make their nests

Photograph by Robert H. Rockwell

and blowing like a porpoise when, ahead of me, one of these barefooted Cape Verde Amazons was plodding tirelessly along with my often weighty belongings balanced on her head, and sometimes smoking a pipe as she did so.

With DeLamba as my very able assistant, I collected scores of the islands' birds—boobies, tropic birds, duck hawks, Egyptian vultures, fish hawks, kestrels, brown-necked ravens, kingfishers, finches, and others. Nor was our task an easy one. Often we were forced to cross the faces of the most fearsome and precipitous cliffs on our way to the nesting grounds of the birds, and on one occasion I lost my footing on a steep shale cliffside several hundred feet above the roaring surf that pounded in from the sea below me. I fell flat on my face, reaching wide with arms and legs, and felt myself sliding slowly down, the loose stone slipping gradually beneath me.

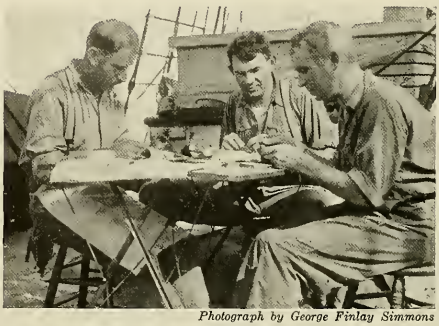
For several feet I slid, slowly approaching the sheer drop that lay only a little way below me—a spot from which, should I reach it, I could not do otherwise than fall abruptly into the surf so far below. I shut my eyes and searched with my toes and fingers for a hold, and finally found

A TRAIL ON SAINT VINCENT
The bird collector sometimes finds himself in ticklish positions trying to reach the nesting places of the birds

Photograph by Robert H. Rockwell

one. I had no idea whether or not it would hold me, but lay there tensely, wondering.

And now De Lamba, who had gone ahead of me across the more dangerous spot, turned about and saw me. Just how he managed to crawl back and help me up I do not know, but with his help I reached safety and viewed the depth of the plunge that I had barely escaped.



Photograph by George Finlay Simmons

PREPARING BIRD SKINS ON DECK

Allan Moses, Kenneth W. Cuyler and Mr. Rockwell, engaged at their work while at sea between the Cape Verdes Islands and the African coast. Only in ideal weather, of course, could such work be done on deck

On another occasion, and in a place almost as steep, John managed to pull a tropic bird alive from its hole in the hillside, but having secured it, he did not know how to kill it without ruining it as a specimen. Not being able to gather much from my directions, he wrapped the bird up in his flimsy sweater and sent it rolling and tumbling down to me where I stood below him. But as I watched it come, I saw the head and neck of the bird appear from the folds of the sweater. Next she pulled her wings free, and suddenly I saw the bird flap furiously, saw her rise from the steep hillside, and in a moment, with the sweater still dangling from her back, saw her go sailing off, while the light sweater swayed and flapped in the air to signal her departure. Where the bird went with her prize, I never learned, but the last I saw of her she was flying bravely out over the deep Atlantic, with the sweater still waving behind.

Brava boasts almost no trees, but for all that the island is inhabited by a race of very agile monkeys which, living among the rocks, are wont to raid the limited garden patches of the natives.

Thinking to add a few of these to my collection, I started out to hunt them, and my decision cost me many a weary hour of hard labor. Why they should be so very fearful of my approach when they sometimes raided the garden patches almost under the very noses of the natives, I do not know, but while I often saw them among the distant rocks, I seldom was able to come close to any of them. And, many times, after my most careful stalks, I peered forth to find that I had been under observation all the time and that my quarry was safely away, perched on some rock that was, for me, utterly insurmountable.

I did manage, after endless trouble, to get three of the yellowish-brown creatures, and spent more than a little care on the proper preparation of their skins. These were to me prize specimens, the only wild animal found on the Cape Verdes. I spread the skins high on a wall to dry, and went about my other duties. When I returned, however, the skins were gone, and when, at last, I found them, it was to learn that some marauding cat had been the robber, and, furthermore, had eaten portions of my valued specimens.

With the passing of the ten days during which I was to complete my work, I naturally began to look for the arrival of the "Blossom." Still, I knew that sailing ships sometimes have difficulty in

keeping to schedules, so I did not stop my work nor move my belongings down to the cove. I was living with John DeLamba's family, and while the food that was available on the island was not all that could be desired, I felt no great hardships.

When two weeks had passed, however, I began to wonder. When three weeks had passed, my limited supplies began to run low. When four weeks had passed my shoes, of which I had only one pair with me, began to show the signs of wear, what with clambering over the rocks and searching along the shore.

I began to get a little worked up, and went to the highly inefficient radio station on the island with a message to the "Blossom." I was told the message was sent, but no reply came. More weeks went past. My only suit of clothes began to give way at important points. My ammunition ran out, and I borrowed an ancient muzzle loader that was out of repair. This I fixed by heating it in the fire and removing the breech plugs, taking out several rusty rags with which the barrel was choked. Later I managed to find a little powder and shot. Two months passed, and still no word came from the ship that was to call for me. I did not know but what she had gone down with all hands. My clothes, by now, were utterly disreputable—my shoes were all but torn to bits. John and I were forced ultimately to use snares to catch our birds. I tried to buy some canned food, but the only thing the island store afforded was two cans of condensed milk, which had been on the shelves from sometime far earlier in the islands' history. I opened the cans eagerly, and found the contents useless, resembling half-hardened plaster of Paris.

More weeks went by, and I wondered whether I should feel sorry for my shipmates at the bottom of the sea, if so great

Photograph by George Finlay Simmons

MR. ROCKWELL ON THE BEACH OF BRAVA

For almost three months the author of this article collected birds on this barren little island, finally continuing on the "Blossom" to the African coast and to other islands in the South Atlantic

Birds Collected on the Island of Brava and Outlying Rocks Four Miles Off Shore

White-faced petrel *Pelagodroma marina hypoleuca*
White-rumped petrel *Oceanodroma castro castra*
Bulwers petrel *Bulweria bulweri bulweri*
Small shearwater *Puffinus l'herminieri boydi*
Large shearwater *Calonectris kuhli edwardsi*
Brown booby *Sula leucogaster leucogaster*
Red-billed tropic bird *Phæthon æthereus*
Large brown hawk *Buteo buteo bannermani*
Kestrel *Cerchneis tinnuncula neglecta*
Fish hawk *Pandion haliætus haliætus*
Quail *Coturnix coturnix inopinata*
Turnstone plover *Arenaria interpres interpres*
Rock pigeon *Columba livia* subsp.
Darwin's kingfisher *Halcyon leucocephala acteon*
Barn owl *Tyto alba detorta*
Swift *Micropus unicolor alexandri*
Black cap *Sylvia atricapilla atricapilla*
Raven *Carvus ruficollis ruficollis*
Weaver bird *Estrilda astrild* subsp.
Cape Verde sparrow *Passer jagoensis*
Spanish sparrow *Passer hispaniolensis hispaniolensis*
Pharaoh's chicken *Neophron percnopterus percnopterus*
Perigrene falcon *Falco peregrinus*

a misfortune had befallen them, or whether to boil up and demand abject apology when they showed up.

By now, I found myself troubled by fleas and jiggers as were the natives about me. I had been forced, because of lack of ammunition, to give up all but the simplest collecting, gathering only birds that were tame enough to catch by hand.

And finally, when I was fit to be tied, a radio message came. In two weeks the "Blossom" would come. But two weeks passed and two weeks more went by before, finally, I saw her three topsails appear upon the horizon. With a company of native women bearing my collections, I marched sternly down the steep hills to the cove. The ship came in and I heard her cable roar as the anchor was let go. Still stern—still angry—I went aboard. What I had planned to say I do not know, but whatever it was I never said it, even when I learned that the expedition had changed its plans and visited almost every other island of the group before coming to Brava for me. For, probably recognizing that I had a cause for complaint, Mr. Simmons, our amiable leader, met me as I reached the deck. He put his arm on my shoulder and before I had an opportunity to burst forth, announced that the expedition was all but ready to sail for the African coast where I (as a reward, perhaps, though he did not say so) was to be sent into the interior after other things than island birds—after mammals—perhaps after lions. And I, keen to have so great an adventure, swallowed my wrath, or forgot it, in the prospect of hunting big game in the jungle.

Photograph by George Finlay Simmons

The "Blossom" in the Harbor of Saint Vincent

"JIMMY"

A Snowy Owl's Sojourn in a Great Metropolis

By T. DONALD CARTER
Department of Mammals, American Museum

THERE is no doubt that the snowy owl is one of our most distinguished looking birds, and observing one in the field is an experience long to be remembered by the bird student. Near New York City it is a rare winter visitant, although hardly a season passes that at least one is not discovered along the near-by beaches. The winter of 1926–27 will long be remembered by the local ornithologists as quite unusual, for large numbers of rare visitors from the north moved southward into the more settled sections of the country, thus giving opportunity to observe for the first time these unfamiliar feathered folk. The most noteworthy of these was the large flight of goshawks and snowy owls. The latter appeared in such abundance that their presence was frequently recorded in the news columns. This flight extended throughout the northeastern part of the United States, birds being reported as far south as North Carolina. In *The Auk*, Vol. XLIV, page 479, Mr. Alfred O. Gross gives a very full account of this flight. The first bird that came to my attention was on November 6, 1926, when a friend of mine showed me a snowy owl that had been killed the day before near Nyack, New York.

We cannot boast that we were very hospitable hosts to our snowy visitors, for the greater number of these birds were shot as soon as they were discovered. Very few appear to have survived their southern excursion. They were condemned wherever seen. Although on occasion they destroy poultry and game, the stomach contents of specimens I have had the opportunity to examine and those inspected by friends of mine, prove that the snowy owl, especially around New York City, is a very beneficial bird. One man claimed that the owls were killing off the meadow larks in a certain section of Long Island. To prove this claim he brought in three birds that he had shot. Upon examination it was found that the stomachs of two of the owls contained nothing but rat remains and the third stomach was empty.

"Jimmy" was a member of this southern flight. She fared well until she

ON HER FAVORITE PERCH

Although Jimmy had many visitors she never would trust strangers and had no difficulty in distinguishing them from members of the family

reached Steuben County, New York. There, alighting too near a farmer's chickens, she nearly met the fate of so great a number of her kin. She was more fortunate than many, however, suffering only a broken wing.

The first I heard of Jimmy was in a letter from a friend. He said he was sending me a live white owl and would like to have it stuffed. The next day Jimmy arrived. With much snapping of her bill she was taken from the shipping box. Her great beauty at once impressed us. Then and there we knew that she never would be "stuffed," if we could help it. We made up our minds to keep her—friend or no friend. Although the bird had been christened "Jimmy," we soon decided that this name belied her sex. The females of these owls are apt to be larger and darker than the males and she was one of the largest and darkest I had ever seen.

We found Jimmy to be in fine condition with the exception of a broken bone in the wing. That night I took her home with me to my New York City apartment and liberated her in the kitchen. She appeared to be unusually tame and after a great deal of coaxing ate most of a chicken's head.

As the days went by we became better and better acquainted, and she even allowed us to stroke her and soon began taking food from our hands. We placed a box near the window so that Jimmy could look out, and she spent most of her time gazing at the passers-by, four stories below. It was not long before she attracted their attention and at times a goodly number of people would collect and exclaim about the "odd parrot" staring at them.

The box, which was a pasteboard carton, afforded Jimmy no end of fun. She began by tearing a small hole in the side. This hole finally grew until the box collapsed. The wreckage she would

take by one corner and drag around the kitchen floor.

In a week she was able to reach the top of the wash tubs and for some time these became her favorite roosting quarters. We left a pan of water in the sink where she went regularly to drink. In three weeks the injured wing appeared able to hold her weight, so she changed her roosting place to the top of the bread box on the gas oven. This was undoubtedly the hottest place in the room, but she seemed to prefer it, although she must have felt the heat greatly.

Although we left the kitchen door open most of the time, Jimmy offered to come out of the kitchen only once. I was seated on the sofa fixing a camera, while Mrs. Carter was busily writing at her desk across the room from me. A patter of feet across the hardwood floor and there was Jimmy on the sofa beside me. After surveying the camera for a moment, she flew across the room, landing on the back of Mrs. Carter's chair. Here she remained for a few minutes. Just as she had about decided to explore the top of the bookcases, the remaining occupants of the room had unanimously decided that the place for snowy owls was in the kitchen away from breakable crockery and knickknacks.

One evening, while the family were sitting in the front room, a strange noise was heard coming from the kitchen. There was a sharp, metallic bang followed in just a few seconds by another and then another. Wondering what the queer noise might be, I proceeded into the kitchen and turned on the light. There sat Jimmy in her accustomed place on the bread box as unconcerned as could be. I

FROM THE COUNTRY OF THE ESKIMO

This owl was undoubtedly a female, as is shown by her large size and heavy barring. The adult male is smaller and much whiter

FRIENDLY ADVANCES
Jimmy soon became tame enough to be handled with discretion and appeared to enjoy being stroked or having her head scratched

returned to the front room, after turning out the light. In a few moments the banging was repeated. Again I investigated but, upon turning on the light, I found Jimmy as before. This time, however, I left the light turned on and seated myself where I could watch. In a few moments Jimmy reached down and grasped the handle of the roll-top bread box in her beak and, lifting it for about three inches, let go. Down came the cover with a bang. This was repeated again and again. Jimmy had discovered a new game and was enjoying it to the full.

On another evening Jimmy was responsible for our having fried eggs instead of lamb chops for supper. I was late arriving home. Supper was all ready with the exception of frying the chops. These were placed in the frying pan and covered over. Upon our entering the kitchen preparatory to frying the chops, we found only the empty frying pan. Jimmy had in some way discovered the meat and made the best use of it as far as snowy owls were concerned.

The more pranks Jimmy played the better we liked her. On another occasion, when we were eating a hurried supper in the kitchen, Jimmy flopped on the bread plate in the center of the table and, grabbing slices of bread, shook them as a terrier would shake a rat so that chunks of bread flew all over the room.

On another day Mrs. Carter was preparing to wash some clothes and had the boiler on the stove. The water was just coming to a boil when—plop—came Jimmy into the middle of everything. There stood the bird, her great white feet with their black toe nails planted on the bulging, floating island of wet clothes, her big, round eyes blinking calmly. Perhaps she mistook the clothes for a cake of ice. Everything went well until the clothes island began to sink under the weight of the heavy bird. As the boiling hot water reached her feet she felt the great discomfort but was unable to understand it, and simply danced clumsily around in a circle. It was not until Mrs. Carter dashed a pan of cold water over our pet, that she flew to the tubs.

Jimmy's wing being now healed, no part of the kitchen was left unexplored. The top shelf always had been filled with kitchen utensils, including an aluminum nester set. This shelf Jimmy soon adopted for her own and not even the aluminum set was allowed to share the

shelf with her. After two or three experiences of picking up the pots and pans from the kitchen floor, we granted Jimmy her squatter's rights, and as long as she remained with us this shelf was her roost.

Perhaps Jimmy was not as friendly as she might have been to some strangers. If they approached too closely she would snap her beak in quite a violent manner. One morning the gas man arrived to read our meter. Jimmy was on the tubs hidden behind some towels. The gas meter was over her head but high on the wall and the man had to lean over the tubs to read. I thought that he saw the half-hidden bird and I made the remark that she was perfectly safe. But the man had not discovered the owl for, as he was looking intently at the meter, Jimmy, evidently thinking the man too close, stuck her head out from among the towels and clapped her bill four or five times. The next thing we knew the man was seated on the gas stove across the kitchen.

Shortly after this we heard from the landlord. Although it was hard to believe, he said that he was ready to have the apartment repainted for us. This placed us in a quandary. How could a painter and an Arctic owl occupy a city apartment at the same time? We hated to think of parting with Jimmy since we had become such good friends and her comical ways had made for her many admirers outside of our household, people who came in daily to see her. Yet we did want to see that paint go on our walls.

At last our problem was solved. A friend living out in the open stretches of Long Island offered to take her and keep her safely until the approach of spring, when her enemies would be more apt to have put away their guns. On one of her legs we placed an aluminum ring with a number upon it—20063—which will serve to identify her if she is ever caught again. Later she was to be turned loose, once more to have the freedom of all outdoors. Did Jimmy ever find her way back to the far northland? We certainly hope so. But wherever she may wander, this great bird that came from the country of the Eskimo will be followed by the best wishes of a host of loyal friends.

ASIDE FROM HER BILL CLAPPING AND A LOW HISS, THE ONLY SOUND JIMMY EVER UTTERED WAS A WHISPERED WHINNY

AMERICAN MUSEUM EXPEDITIONS AND NOTES

EDITED BY A. KATHERINE BERGER

It is the purpose of this department to keep readers of NATURAL HISTORY *informed as to the latest news of the Museum expeditions in the field at the time the magazine goes to press. In many instances, however, the sources of information are so distant that it is not possible to include up-to-date data*

CENTRAL ASIATIC EXPEDITION.—Dr. Roy Chapman Andrews has recently returned to the American Museum from Peking where he spent the summer vainly attempting to make arrangements with the Chinese Commission for the Preservation of Antiquities, to allow the Central Asiatic Expedition to continue work in Mongolia during 1932. Last year the Commission was responsible for driving out of Chinese Turkestan Sir Aurel Stein, the famous British anthropologist, and has made such difficulties for the French Citroen-Hardt Expedition that at last reports, the members of this party were being escorted out of China by armed guards. The opposition to foreign scientific work can only be construed as being a definite anti-foreign move by this society, which has no constructive work to its credit.

The Central Asiatic Expedition has by no means abandoned hope of continuing its work in the future, however, and still maintains its headquarters in Peking. It is hardly conceivable that the obstructionist attitude of the Chinese can continue indefinitely, and it is felt that the Expedition is only temporarily suspended.

Doctor Andrews completed the manuscript of Volume I of the Central Asiatic Reports during the summer spent in Peking.

CHILDS FRICK'S EXPLORATIONS FOR 1931.—Explorations in search for further knowledge as to the extinct mammalian faunas of America have been conducted in seven widely separated areas—five in the Late Tertiary and two in the Quaternary. The former include the continuation of the explorations carried on for years past in the Mio-Pliocene horizons in the vicinity of Barstow, California, Santa Fé, New Mexico, and Ainsworth, Nebraska, and the added investigation of the Pawnee Creek of Colorado. A fifth exploration for the purpose of securing more ample knowledge of the immediate predecessors of these above faunas, was undertaken in the Lower Miocene of northeastern Wyoming. The two Quaternary operations include a reconnaissance carried on in the early winter in Ecuador, and the continuation of collecting for the third summer season, in coöperation with Alaska College, in the Quaternary of that area. Shipments from the field since June 1, exclusive of some forty cases coming from Alaska, total 125 cases. Exclusive of many larger trophies there are sufficient moderate to smaller specimens to fill 450 trays. The laboratory force, Messrs. Charles Hoffman, Joseph Rooney, Floyd Blair, and Haakon Dehlin, will be occupied for many months in the preparation of this material. A preliminary and rapid survey of the so far received finds indicates, in the presence of a wealth of rare data as to the respective faunas, the good fortune that again has attended the different field parties. New remains of camels, antelope, horses, rhinoceroses and of occasional carnivora will afford much additional information for the detailed studies in progress on these groups. During the summer the writer and his family had the pleasure of a four weeks' safari from the Black Hills of South Dakota southward across the great fossil fields lying to the east of the Rockies, from the Mauvaises Terres of the White River Oligocene to the Santa Fé marls of New Mexico, en route consorting and consulting with the several field parties, digging a few bones on their own, viewing again the famous Agate quarries in the Lower Miocene of Captain Cook's ranch, and for a first time, the embryo quarries in the underlying Oligocene at Torrington, Wyoming, of the Colorado Museum of Natural History and Harvard University, and finally winding up with a three-day pack trip across the volcanic tuffs of the high and lovely Jemez range. It was the cause of general regret that the writer's old friend and chief field lieutenant, Mr. Joseph Rak, to whose ability and energy the sum of data about

mammals of the Late Tertiary has been so largely increased, through continued disability was prevented from being of the party.

The seven different investigations of the present year may be briefly summarized:

(1) Barstow, Mohave Desert, California. Party under Mr. Jack Wilson, substituting for a second year for Mr. Joseph Rak, continued the collecting for the ninth winter. A considerable area in the upper horizon was painstakingly stripped and additional specimens secured from all three horizons.

(2) Santa Fé, New Mexico. Party with Mr. Jack Wilson, for the seventh May to October season, continued the investigation of this area. While certain useful associated remains of camel, horse, carnivora, mastodon and rhinoceros were obtained, the return, on account of the lack of rainfall and attendant erosion over the two last years, was relatively small.

(3) Ainsworth, Nebraska. Work was continued in this area for a fifth June to September season by Mr. Morris F. Skinner. The results were particularly gratifying, the party obtaining, in addition to other remains, a number of fine camel, horse and rhinoceros crania, skull and jaws of a trilophodon-mastodon, another skull of *Mylagaulus*, a largely complete skull of *Arlurodon*, and the jaws of tapir and machaerodont forms.

(4) Pawnee Creek, Colorado. The present summer the writer's friend, Mr. John C. Blick, undertook an examination of the classic Pawnee Creek horizon, and has been most fortunate in bringing together a very useful collection from this often worked-over area. He was assisted in part by Mr. Haaken Dehlin of the Museum force. Amongst the more interesting trophies are remains of an *Amphicyon* of the largest size, of *Tomarctus brevirostris* Cope, of *Pseudæluras*, of Teleoceine rhinoceroses, and of ever present horses and camels. By far the most spectacular occurrence of the entire season was the locating in place, through the inquisitiveness of a little daughter of the writer, thirty feet beneath the summit of the taller and more eastern of the two historic Pawnee Buttes, of the skull, mandible and two associated limb bones of a moderate sized camel.

(5) Lusk, Wyoming. Mr. Charles Falkenbach, thanks to the hearty assistance of his many friends in the vicinity of Lusk and following up a hurried reconnaissance of the previous season, has brought together a magnificent collection from the Lower Miocene beds of northeastern Wyoming. A few carnivora specimens and a fine series of oxydactylid, parahyppid and rhinoceroine forms add greatly to the heretofore known data as to the mammals of this period. Magnificent specimens include the skull of a large Diceratherine, apparently new to science, fine remains of *Dinohyus hollandi* and a massive block with a group of three closely associated skulls, jaws and skeletons of the great Oreodon, *Promerychochœrus carrikeri*, matching Mr. O. A. Peterson's fine group in the Carnegie Museum of Pittsburgh.

(6) Punin, Ecuador. Mr. John C. Blick for a second time extended our investigations to deposits to the south of Mexico, he and Mr. Charles Falkenbach, with the generous coöperation of the local authorities, returning from Ecuador in late February with a fine collection from the Quaternary deposits in the vicinity of Punin and Salinas, the same including a beautiful skull of *Megatherium* and series of horse, deer, camel and other remains.

(7) Fairbanks, Alaska. In coöperation with President Bunnel of Alaska College, and through the courtesy of Mr. Neil W. Rice and the staff of the U. S. Smelting, Refining and Mining Company, Professor Albert S. Wilkerson, of the Alaska College Department of Geology, continued the collecting carried on the two previous seasons by Mr. Peter Kaisen, of the Museum's laboratory, and reports securing some forty additional cases of bones and important data as to their occurrence, which latter he plans to publish at an early date. An unusual find has been the frozen and mummified posterior half of the body of a ground squirrel associated with nest and plant remains.

At the present writing Mr. Jack Wilson has has returned to Barstow, California, for the winter season, and Mr. Charles Falkenbach is making a reconnaissance of certain of the fossil areas of northern Texas.—Childs Frick.

Scarritt–Patagonian Expedition.—The American Museum was glad to welcome home Dr. George Gaylord Simpson who returned to New York November 1. As the leader of the Scarritt-Patagonian Expedition, he has been nearly a year and a half in South America. For the past six months he has been engaged in the revision and study of the unique Ameghino collection of Patagonian fossils at the Museo Nacional in Buenos Aires, and the Roth collection at La Plata. Doctor Simpson enjoyed the privilege of being the first scientist to study the Ameghino material since its recent acquisition by the Argentine nation made it available. With the data thus obtained, he is now beginning work on the cataloging and description of the expedition's fossil mammals, and preliminary publications are expected shortly.

Mr. Coleman S. Williams, scientific assistant of the expedition has been speeding the preparation of the collection, and about three fourths of the smaller specimens are now ready for study. The preparation has well confirmed field predictions of the wonderful variety and quality of the material. Among other specimens, a lower jaw of the strange, problematic pseudo-proboscidian *Pyrotherium* has been restored, and is now on temporary exhibition.

A note of appreciation should here be added to the Argentine authorities with whom the expedition came in contact. Dr. Martin Doello-Jurado, the director of the Museo Nacional of Buenos Aires, was most friendly and helpful. He it was who put the Ameghino collection at the expedition's disposal, and it was indeed fortunate to get the services of so eminent a conchologist to study its collection of fossil mollusca. Doctors Tours and Cabrera of the Museo de la Plata were also most helpful, both in matters scientific and in cutting the Gordian knot of red tape that surrounded the export of the expedition's material. Finally, great thanks are due to the geologic staff of the Yacimientos Petroliferos Fiscales (the government oil fields) for giving the expedition the benefit of its explorations with secret maps and personally conducted tours of interesting localities, as well as such material aid as cheap motor fuel and transport.

The Museum was privileged in having as its guest for luncheon on November 2, Horace S. Scarritt, the patron of the expedition. The luncheon was a homecoming welcome to Doctor Simpson, and the guests were afterward entertained with a premiere showing of the cinema pictures taken on the expedition.—C. S. W.

The Naumburg-Kaempfer Expedition.—Collections of birds continue to arrive from Mr. Emil Kaempfer, in the employ of Mrs. Elsie M. B. Naumburg, and now stationed at the border line of Brazil and Uruguay. Mr. Kaempfer, who

has been collecting for Mrs. Naumburg for the past six years, is expected to complete his labors on December 1. His material representing the bird life of entire eastern Brazil, from the vicinity of Pará to Uruguay and Paraguay, numbers approximately 12,802 specimens, and forms, doubtless, the most exhaustive collection existing of birds from this area. Through Mrs. Naumburg's generosity, it has been presented to the bird department of the American Museum which before contained almost no material from this vast region.

ARCHÆOLOGICAL RESEARCH IN MEXICO. —Dr. George C. Vaillant left New York on October 31 for Mexico, where he will conduct the fifth season of stratigraphical research in the Valley of Mexico, at the pyramid site of San Juan Teotihuacan. The objectives of this work are the establishment of a sequential dating of the site based on pottery, an attempt to establish the origin of the Teotihuacan civilization as indigenous or foreign to the Valley, and to try to form a collection of dated skeletal material for research in the races of Mexico.

NOTES

THE THEODORE ROOSEVELT MEMORIAL

ON October 27th, at 2:30 P.M., the corner stone of The Theodore Roosevelt Memorial was laid by His Excellency, Governor Franklin D. Roosevelt. Among the speakers were ex-Governor Smith, Aldermanic President Joseph V. McKee, representing Mayor Walker, and Chairman Henry Fairfield Osborn. About fifty guests were entertained at luncheon by Chairman Osborn at one o'clock. Among these were Rear Admiral William B. Franklin, Major General William N. Haskell, Col. Paul Loeser, Col. Frederick Stuart Greene, superintendent of public works, in charge of the construction of the Memorial, John Russell Pope, the architect, James E. Fraser, the sculptor of the equestrian statue which will stand in front of the Memorial, Mr. Felix M. Warburg, Mr. Clarence L. Hay, Dr. Roy Chapman Andrews, Mr. A. Perry Osborn, Dr. George H. Sherwood, Mrs. Douglas Robinson, sister of Colonel Roosevelt, Mrs. Franklin Roosevelt, the Trustees of the Memorial, and others.

From 2:00 until 2:30 P.M. a concert was given by the New York City Police Band of seventy pieces under the able direction of Capt. Fritz Forsch. A most pleasing feature of the concert was the solos rendered by Mr. Theodore Alban, tenor.

A colorful note was added to the occasion by the presence of a guard of honor consisting of a unit from the 258th Field Artillery, Theodore Roosevelt's old regiment, known as the "Washington Grays," Col. Paul Loeser, commanding officer, and a unit from the First Battalion of the New York Naval Militia, fittingly chosen because of Roosevelt's interest in naval affairs.

The entire ceremony was carried to a nation-wide audience through the National Broadcasting Company and the Columbia Broadcasting System.

After the invocation by Dr. F. Christian Reisner, formerly a close friend of Roosevelt, Col. Frederick Stuart Greene, who presided, introduced ex-Governor Smith. The bill authorizing the erection of the Memorial was signed by Mr. Smith and he made especial note of the pleasure it was to see the building actually going forward to completion. Mr. McKee following Mr. Smith recalled that Roosevelt stood for the "awakening of the American spirit." He also stated that the city intended to see that a proper approach from Central Park should be made.

In his brief address Chairman Osborn stressed Roosevelt's "backbone" and our pressing need of it today. He stated that Roosevelt "combined in rare measure the qualities of head and of heart, guided and controlled by intelligence motivated by an erect and energetic spinal column, and defended when necessary by a pair of stout arms and ready fists."

Governor Roosevelt pointed out Theodore Roosevelt's appeal to young people, adding—"Fundamentally he was entirely right in his emphasis that the future of the state, of the nation, and of the race depended on straight thinking and right acting upon the part of the rising generation."

Just after Chairman Osborn presented the silver trowel to Governor Roosevelt, Mrs. Douglas Robinson, sister of Theodore Roosevelt, raised the American flag which had covered the cornerstone. Then the top of the copper box which rests in the corner stone was soldered. It contained copies of the *New York Times* and other morning and evening papers of that date, copper and silver coins, the Legislative Red Book of 1931, copies of the reports of the Roosevelt Memorial Commission and photographs of Henry Fairfield Osborn, Governor Roosevelt, ex-Governor Smith, Mayor Walker, John Russel Pope, architect, George N. Pindar, secretary, and J. Harry McNally, builder.

The entire plaza was decorated with the national colors, and seats for visitors were

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CEREMONIES AT THE LAYING OF THE CORNER STONE OF THE THEODORE ROOSEVELT MEMORIAL
Among the distinguished participants on this occasion were Gov. Franklin D. Roosevelt, Alfred E. Smith, Henry Fairfield Osborn, chairman of the board of trustees of The Roosevelt Memorial, and George N. Pindar, secretary of the board

arranged across it in front of the speakers' platform. Because of the position of the cornerstone, at the left of the wide flight of steps at the main entrance, the platform was built over the steps and was raised to a height of about ten feet. However, the excellent placing of amplifiers rendered the addresses perfectly distinct.

The Trustees hope to be able to dedicate the building on October 27, 1932. The State is making every effort to complete it as soon as possible in order that it may function as one of the great educational features of the State. With the completion of the building it is planned to build an approach from the West Drive in the Park which, from a distance of about 400 feet will give a splendid view of the Memorial, flanked by Museum buildings.

ASTRONOMY

THE large attendance at the fall meetings of the Amateur Astronomers Association indicates that the popular interest in Astronomy is continued. The officers of the society announce the following lectures:

DECEMBER 2—Mr. O. H. Caldwell, former United States Radio Commissioner, and editor of *Electronics* and *Radio Retailing*, will speak on "The Electric Eye in Modern Astronomy."

DECEMBER 16—Mr. David B. Pickering will talk on "Observatories on the Pacific Coast and in Japan."

JANUARY 6—Dr. Jan Schilt, head of the department of astronomy, Columbia University, on "Star Counts."

JANUARY 20—Mr. Stansbury Hagar, ethnoastronomer, "Astronomical Temples of the Maya and the Mound Builders."

These meetings are held in the large auditorium of the American Museum of Natural History at 8:15 P.M., and the public is cordially invited.

BIRDS

BIRD LIFE OF THE EAST AFRICAN PLAINS.—The fifth of the series of twelve faunal groups of the birds of the world which are being planned for the American Museum, was formally opened to the public on November 9. The group, which is the gift of Henry W. Sage, is one of the fruits of the Ruwenzori-Kivu Expedition of 1926–27, and dipicts a scene in the Kidong Valley, forty miles northwest of Nairobi, Kenya Colony.

The Kidong Valley, named from the small

stream flowing through it, is merely one short section of a long trough which can be traced from Southern Palestine through the Red Sea, Southern Abyssinia, and Kenya Colony to Northern Tanganyika Territory. This lengthy depression in the earth's crust is known as the Great Rift Valley. On both sides of the Kidong, separated by twenty-five miles of level plain, rise bold escarpments, which are pictured at the extreme left and right of the background of the group. The floor of the valley, here and there, is interrupted by elevated strips due to former volcanic activity, where boiling springs are stilll numerous. One such strip extends across the distant background, culminating in Mount Longonot (altitude 9110 feet) at the right.

The birds of a plain like the Kidong—although it is 5300 feet above sea level—are characteristic of the savanna or grassland fauna which extends over a vast area of the African continent, from Senegal across the Sudan to Abyssinia, and thence south through East Africa to the major part of South Africa.

Field studies and collections for this group were made by James P. Chapin, DeWitt L. Sage, and Frank P. Mathews. The background was painted by Arthur A. Jansson from his own field sketches made during the same year. The birds were mounted by Raymond B. Potter, and the accessories prepared under the direction of Albert E. Butler, of the Museum's department of preparation, James L. Clark in charge.

CONSERVATION

PURCHASE OF BULL CREEK AND DYERVILLE FLAT REDWOOD GROVES.—An important event in the history of forest conservation took place Sunday, September 13, 1931, at Dyerville on the south fork of the Eel River, Humbolt County, California. On that day the State Board of Parks and the Save-the-Redwoods League completed the purchase of Bull Creek and Dyerville Flat groves, containing the finest Redwood trees in existence,—perhaps the finest that ever existed. These two groves of Redwoods amounted together to about 10,000 acres and were purchased from the Pacific Lumber Company for more than three and one-half million dollars. This makes the total acreage preserved to date by the Redwoods League over 24,000 acres, including 3000 acres of the Calaveras Grove of Big Trees in the Sierras.

On this occasion the Tallest Tree in the World, 365 feet, was formally dedicated by the state of California to the Founders of the Redwoods League, Madison Grant, John C. Merriam and Henry Fairfield Osborn, in recognition of their having originated the movement which led to the preservation of these trees. The tree in question was ascertained to be the tallest living tree after prolonged study and accurate measuring. Many other trees were claimed by their owners to be higher, but proved on investigation not to be.

Major Burnham made the following address at the dedication of the Tree:

Friends from beyond the mountains and those from across the seas, Welcome! We are glad to have you with us today on this joyous occasion. We Californians are flooded by two streams of emotions—one of thankfulness that we have averted the tragedy of destroying these forests, and the other of joy in knowing they are saved for the pleasure of all our friends and descendants forever.

It is an ancient and racial urge that has brought us together today in the shade of this far western forest. Like the druids of old, we feel we here are sheltered from the storm and have closer communion with the Divine Presence. It is no wonder we love the forests. The first cradle ever made was woven by some fond mother in the bough of a tree and, gently swayed by her hand, the infant was lulled to slumber by her lullaby, just as you see today in the wilds of Mexico and other primitive lands.

But, alas! we Californians, pioneering a great continent, were so busy tunneling our mountains, dredging out our harbors and building our cities, that for a time we forgot our friends, the trees. With swift-moving hands of jagged steel, driven by thunderbolts and aided by fire, we slashed and destroyed these mighty giants. We were fast turning our beautiful California into a land accursed. Yet, in fairness, it should be remembered that, through all these pioneer years, there were great voices raised that made many of our good citizens uneasy in their minds at this progressive slaughter and endless forest fires. To show you this is true, let me for just a moment read you a paragraph taken from *California the Wonderful*, a book long out of print, by Edwin Markham.

"Let us be reverent a little as we stand here in the hush of these leafy sanctuaries—be reverent a little if reverence in this age is possible. These great trees belong to the silences and the millennium. Many of them have seen more than a hundred of our human generations rise, and give out their little clamors and perish. They chide our pettiness, they rebuke our impiety. They seem indeed, to be forms of immortality standing here among the transitory shapes of time."

So, when the three great druids, Grant, Merriam, and Osborn, called us again to the ancient groves to worship and to save them from the ax, it fired our hearts. The dull embers leaped to flame and the Save-the-Redwoods League was formed. You all know its remarkable history, its years of struggle.

I have in my hands a telegram from Madison Grant that I should like to read to you. You have heard the eloquent words of Doctor Merriam that so touched our hearts.

"Greatly regret my inability to be present at the dedication of the Bull Creek and Dyerville Groves. Please present my congratulations to the Park Board and the officers of the Save-the-Redwoods League on the preservation of these superb forests and express my heartfelt appreciation for the greatest of honors conferred on my associates and myself by the dedication of the world's tallest tree.

(Sgd.) MADISON GRANT"

Had it not been for our Eastern friends I am afraid we Californians would not have waked from our trance until the last great Redwood had fallen. But, finally, our voice was heard in the halls of Sacramento. We voted a few million to make a start, six millions to be exact, to save what wilderness beauty we could. This was entrusted to your Commission and the sums have been matched by many kind-hearted citizens and very bountifully by our Eastern friends. We of California should never forget them. They have started us on a great work. The first step is accomplished as you see today, and it shall go on to a triumphal finish. So it is appropriate that we today symbolize the gratitude in our hearts by dedicating this tallest of trees to the Founders of the Redwoods League, Madison Grant, Dr. Henry Fairfield Osborn, and Dr. John Campbell Merriam. It shall be called from this time forever "The Founders' Tree."

The history of the founding of the Redwoods League follows:

In August, 1917, Professor Henry Fairfield Osborn, Madison Grant, and Dr. John C. Merriam were at Bull Creek Flat and, appreciating

the danger of the destruction of this magnificent grove, wrote to Governor Stevens of California, who was at that time contemplating a visit to Humbolt County. The following year, 1918, Madison Grant returned to the Redwoods country with Mr. Stephen T. Mather and held a public meeting at Eureka to protest against the proposed destruction of this great grove. They were greatly assisted by Judge Sawyer and Mr. Arthur E. Connick and the Save-the-Redwoods League was started then and there.

The following winter, in 1919, Messrs. Grant and Mather persuaded Dr. John C. Merriam to accept the presidency and Mr. Joseph D. Grant became identified with the chairmanship of the Board. Mr. Newton B. Drury was secured as secretary, and from that time on the success of the League was assured. It has progressed steadily, thanks to the devotion of those interested in the project, until now it is a model organization and able to record this great triumph.

A tablet of bronze will be erected upon a granite bowlder at the base of the Tallest Tree with an inscription as follows:

> This Tallest Tree in the World, height 365 Feet, is dedicated by the state of California to Madison Grant, John C. Merriam, Henry Fairfield Osborn, as Founders of the Save-the-Redwoods League

ALASKA Brown Bear Protection.—Of interest to all lovers of wild life and its protection is the appointment by the Executive Committee of the New York Zoological Society of a Special Committee to work for legislation for the protection of the Alaska brown and grizzly bears which are threatened with extermination under the present inadequate laws.

Two years ago, under the pressure of a small group of livestock growers in Alaska, practically all protection for these magnificent animals was withdrawn.

At its thirty-sixth annual meeting in 1930 the Society passed resolutions urging the proper governmental authorities to set aside two or more suitable islands in the Alaska territory as inviolate sanctuaries for these bears, in order that they might be protected and preserved.

The Zoological Society, together with other important conservation bodies, are now working to have the former protective laws reinstated and also to have Admiralty Island and Chichagof Island made permanent sanctuaries and preserves. The support of all lovers of wild life is being enlisted in this effort.

An interesting booklet entitled "The Brown and Grizzly Bears of Alaska At Home" and descriptive of the proposed reserves and depicting the true nature of these magnificent animals, will be sent upon receipt of ten cents in stamps to cover postage and printing. In this booklet will be given full information as to the proper officials to write to urging the reinstatement of protective laws and the establishment of sanctuaries. Address request for this booklet to John M. Holzworth, Chairman of the N. Y. Zoological Society Committee for Protection of the Alaska Brown and Grizzly Bears, Room 3653, 120 Broadway, New York City.

EDUCATION

BUREAU OF EDUCATION.—For the accommodation of the numerous public school classes that visit the American Museum during the winter months a bureau of education has been established. It office is at the left of the main entrance to the Museum, where all visiting classes will register. A teacher in charge will meet the children and their instructors to give them information and direct them to lecture halls or class rooms. Information concerning forthcoming lectures will also be given out from this bureau.

MR. WILLIAM H. CARR reports that the Bear Mountain Nature Trail, Trailside Museum, Craftshop and Zoo ended the fifth season of operation on October 1st, 1931. More than 280,000 persons visited the area during the period of May to October.

Several new features were added this year, including an out-of-door snake and turtle exhibit, a new fernery, a botany pond, and craftshop exhibit. A new cabin was erected to house the staff.

The Trailside Museum is controlled jointly by the department of public education of the American Museum of Natural History and the Commissioners of the Palisades Interstate Park.

CAFETERIA Service for the Schools.—There has recently been installed in the School Service Building of the American Museum a cafeteria especially for the convenience of school children and their teachers. Soup, several kinds of sandwiches, milk and desserts will be offered at reasonable prices.

MAMMALS

SMALL Mammals from Alberta.—This summer Mr. Alfred Ely set a splendid example for sportsmen when he devoted a considerable amount of time and care to collecting small mammals in Alberta for the American Museum. This was Mr. Ely's first attempt at

preparing specimens for study, and he apparently found it interesting, as he expressed his intentions of carrying on this work next year. Mr. Ely's material has proved to be a valuable contribution to the Museum collections, and consists of fifty-three specimens, including a fine series of flying squirrels, ground squirrels, wood-rats, small rodents, and shrews.

REPTILES AND AMPHIBIANS

MR. Tze Tuan Chen of the University of Pennsylvania spent several weeks this summer in the department of herpetology of the American Museum, securing material for the study of protozoan parasites of Chinese frogs of the Central Asiatic Expedition's large collection. This work has direct bearing on problems of amphibian evolution and distribution, so Mr. Chen's report will be awaited with great interest. Mr. Chen is an instructor in the department of zoölogy of the University of Pennsylvania.

CORA SENNER WINKIN

THE department of herpetology and experimental biology in the American Museum has suffered a great loss in the death, on September 25, of Dr. Cora Senner Winkin. After receiving the degree of doctor of philosophy at the College of Physicians and Surgeons in 1922, Doctor Winkin helped to advance the research program of the Museum in several departments. Her plan was to trace out a phylogeny of the physiological processes in vertebrate animals. For some years she worked as a volunteer assistant with this end in view. In 1929 she was appointed a research assistant in experimental biology. She carried on with distinction investigations on the molt mechanism and water regulation in vertebrates. Her wide knowledge of biological problems and her extraordinary command of foreign languages won for her a high place in the research activity of the Museum. As an instructor in physiology at the College of Physicians and Surgeons she broadened the influence of the Museum by bringing medical students in direct contact with Museum research and exhibition. Doctor Winkin died in her thirty-eighth year at the very beginning of the work she had been preparing for in many ways. The memory of her high ideals and cheerful personality remain a source of inspiration to her associates.

SCIENCE OF MAN

THE Hall of South American Archæology and Ethnology, which has been moved from the third floor of the American Museum to its new location in the west wing of the second floor has just been officially opened.

A major part of this hall is devoted to the excellent Peruvian collections. The principal archæological sites of the Andean region are represented. Though the collections consist largely of pottery, there is also exemplified stone, copper, wood, bone and gourd work. The gold and silver specimens are on special display and contain many unique pieces.

The Peruvian textile collection is one of the finest in the world and is of interest to art students and textile experts as well as anthropologists. Good examples of weaving techniques and designs do full justice to the excellent Peruvian art.

The archæological regions of all of the South American continent are represented in the hall. Furthermore, a number of cases are devoted to the display of the work of living Indians from the principal ethnological culture areas of South America.

Such variety as mummies, "shrunken heads," delicately painted Chimu jars, and elaborately embroidered textiles, are intended to appeal to every one interested in art and culture.

GIFT OF ARCHÆOLOGICAL MATERIALS FROM ILLINOIS.—The anthropology department of the American Museum recently received a valuable gift of specimens from Mr. Harold D. Flautt, of Casper, Wyoming, a member of the Museum. This gift included about one thousand typical archæological specimens of chipped and ground stone implements, mostly from Jersey and Calhoun counties, located at the confluence of the Illinois and Mississippi rivers in the state of Illinois; one fine Arapaho war bonnet, obtained from Chief Goes-in-Lodge, the last survivor of the Custer Massacre, who died on August 2 of this year after he had participated in the annual Arapaho sun dance; a clay pipe and some spear and arrow points of iron from New Mexico; a mealing stone from Wyoming; and about thirty invertebrate fossils from Wyoming and other places. The archæological material is especially welcome, as it fills important gaps in the Museum's Illinois collections.

MUSEUM ACCESSIONS

THE LIBRARY of the American Museum announces that it is the fortunate recipient of Doubleday, Doran's eight-volume edition of Ernest Thompson Seton's *Lives of Game Animals*. Miss Emma F. Randolph by this gift has given concrete expression of her friendship for the Museum and of her interest in its aims and activities.

MEETINGS OF SOCIETIES

AT the recent meeting of the AMERICAN ORNITHOLOGISTS' UNION in Detroit, Dr.

Ernst Mayr, of the department of ornithology, American Museum, was elected a corresponding fellow of the Union. Papers were presented at the scientific sessions of the Union by Doctor Mayr and Doctor Chapman, and Mr. Albert R. Brand of the department of birds presented an exceedingly interesting preliminary demonstration of the results obtained by him in recording the songs of birds on film; a synchronized film, showing the home life of the pied-billed grebe, together with the remarkable sonorous calls of this species, was particularly successful.

CENTENARY MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

At the Centenary Meeting of the British Association for the Advancement of Science, held in London, September 23–30, 1931, the American Museum was represented by Prof. Henry Fairfield Osborn and Dr. William K. Gregory.

The evening address by General Smuts, president of the Association, was a notable review of the present scientific picture of the universe by a leader of men and great thinker of unusual sweep and penetration. The speaker traced the influence of the newer concepts of physics and astronomy upon the interpretation of biologic phenomena, including evolution, following the lines of his book on "Holism." He concluded that "the essential character of the universe does not preclude new creation, that there are indications of a certain measure of free movement and creativeness throughout the world, which increases in life and mind, and in the emergence of new values. Within the deterministic limits of the universe the human spirit may thus have an assured status and a certain measure of creative free play." Such conclusions contradict the once fashionable philosophy of mechanistic determinism, according to which Free Will is a complete myth and every action of every object has been foreordained from the beginning of time. They are also in accord with Professor Osborn's well known views on "Creative Evolution," based on palæontological evidence.

The proceedings of the Section of Zoology opened with Prof. E. B. Poulton's address, "A Hundred Years of Evolution." Professor Poulton is undoubtedly one of the most eminent living exponents of what is known as "pure Darwinism," or the doctrine that, given the tendency to variability, Natural Selection and Heredity alone are sufficient to produce the observed differentiation of species that have descended from a common ancestor. Professor Poulton could speak with special authority in this field, in which he has played a conspicuous and continuous part since the early days of the controversy that arose over Darwin's work. After a lively retrospect of the great debates on this subject in early meetings of the Association, in which he had taken part, he proceeded to exhibit lantern views of some exceptionally arresting cases of mimicry between different species of moths and of butterflies. He cited much evidence gathered in the field and in the laboratory tending to show that the species with conspicuous coloration do have a disagreeable taste or some other defense against being eaten by sharp-sighted enemies, and that the species which mimic them do profit in the long run from their resemblance to these bad-tasting species.

Prof. Julian S. Huxley then spoke on development and evolution. He gave some illustrations of the growth of the enlarged chelæ of fiddler crabs, of the antlers of deer, of the bony horns of the titanotheres, etc., showing that the increasing dimensions of the part as compared with the whole animal could be expressed in a simple logarithmic curve. He suggested that the independent increase of the bony horn swellings in different hereditary lines of titanotheres could be interpreted as a mathematical result of the general principles of growth rather than as an example of orthogenesis.

Professor Osborn then presented his paper on "New Principles of Evolution Revealed by Palæontology."

"In honour of Darwin our first thought is that natural selection is the sole survivor of the age-long theories and hypotheses clustering about evolution. Selection alone has stood the test of survival of the fittest, yet we must severely limit the powers of selection as Darwin imagined them in his earlier and more sanguine frame of mind, and glean the elements of truth pervading all the other hypotheses and theories.

"When we consider the youthful zoölogy and the infantile palæontology of Darwin's time (1809–1882), our admiration for his genius and marvellous powers of generalization constantly increases. What would his generalizations have risen to with our present knowledge? He foresaw the promised land of palæontology, but did not live to enter it. The ratio of the 8,767 vertebrate species known in his time to the 65,939 species known in 1925, nearly 8 to 1, is about the measure of the biological progress of the first century of evolution."

The speaker then alluded to the fact that when Darwin sailed on the "Beagle" on December 27, 1831, there were only two species of fossil elephants known to science, the Mammoth and

the Mastodon. Now, there are 395 known species, clearly arranged along twenty-five different lines of evolutionary ascent. From this and similar hundredfold expansion of our knowledge of the actual processes of evolution may be deduced no less than nine new and fundamental principles as to the origins of new characters in what may be called biomechanical adaptation alone, for this is all that is revealed in the hard parts of animals and plants which may be preserved fossil.

Professor Osborn then gave a striking illustration of the rise of biomechanical adaptations in a certain phylum of proboscideans which culminated in the great extinct "shovel-tusk" mastodon, discovered by an American Museum expedition under Roy Chapman Andrews in Mongolia. He also gave illustrations of some of the other new principles of evolution which had become evident during his studies on the evolution of the titanotheres and the Proboscidea, especially the principles of predetermination and potentiality, of rectigradation and aristogenesis. "Rectigradation" he defined as the observed origin and rise of biocharacters from almost invisible beginnings to an advanced stage of evolution in a single direction, without deviation to one side or another. The term "aristogenesis" was provisionally used to describe the origin of the best adaptive characters, directly from the germ and without experiment.

The speaker's more general conclusion was as follows:

"We can affirm that it is the essential living principle of biomechanical reaction which calls forth the adaptative biomechanical response, whether in development or in evolution. While we know infinitely more about the principles of evolution than did Charles Darwin, and while we can demonstrate beyond refutation the prevailing twenty principles of biomechanical adaptation discovered in ontogeny and phylogeny, *we are more at a loss than ever before to understand the causes of evolution.* One after another the Buffonian, Lamarckian, Darwinian, Weissmannian and De Vriesian theories of causation have collapsed; each, however, contains elements of truth. All that we can say at present is that Nature does not waste time or effort with chance or fortuity or experiment, but that she proceeds directly and creatively to her marvellous adaptive ends of biomechanism."

While especially desirous not to say a single word which could be interpreted as dissent from Darwin's main principles, the speaker felt compelled by the synthesis of the wholly unexpected principles revealed by Palæontology since 1869 to oppose absolutely Darwin's central hypothesis that the adaptive can arise out of the fortuitous. He substituted the essentially new concept of the direct rise of the adaptive out of the germ, not in an experimental manner, but as a secular process observable only in very prolonged periods of geologic time. His address throughout was entirely on an inductive basis rather than deductive or speculative.

In conclusion, Professor Osborn called for a new physical concept of the evolution of life essentially different from the metaphysical concepts of the "Emergence" of Lloyd Morgan or the "Holism" of President Smuts.

At the Jubilee Celebration of the fiftieth year of the Natural History Museum, as a separate branch of the British Museum, delegates from many parts of the world gathered to convey messages of good will and congratulation. Professor Osborn said that the American Museum of Natural History of New York was proud to offer tributes, as a daughter to the mother from which she had sprung. He recalled the fact that when Prof. Albert S. Bickmore was planning the foundation of the American Museum, he had visited the British Museum in London and had been received there with the greatest courtesy and helpfulness by Professor Owen, who had given him a copy of his plans for an ideal Natural History Museum; and that the essential principles of these plans had been embodied in the first wing of the Museum building in New York.

Before the Section of Anthropology Professor Osborn explained his new method of assigning geologic dates to the various fossil species of men by measurement of the total length of the enamel folds in the molar teeth of the associated forms of extinct proboscideans.

An important evening lecture on "The Construction of Man's Family Tree" was delivered by Sir Arthur Keith before a brilliant audience in the hall of the Royal Geographical Society. The first scientific "family tree of man" was published by Ernst Hæckel in 1865 and, in the opinion of the speaker, this was a remarkably accurate and concise estimate of the degrees of blood kinship of man, first to the African anthropoids, then to the extinct ape *Dryopithecus* and so on down to the stem of the Old World monkeys, which were correctly related at the base to the New World monkeys. Proceeding to the results of most later authors, including himself, Sir Arthur showed that although they had all dealt with different aspects of the anatomical material, they were in essential agreement with Hæckel's first diagram, the only differences being as to the length of time that had elapsed since the separa-

tion of the various branches from each other. To Professors Osborn and Gregory, who were the guests of honor on the platform, Sir Arthur paid a generous tribute for the high plane of good humour in which they had carried on their recent scientific controversy over the relative nearness or remoteness of man's kindship to the anthropoid apes. Personally he was inclined to accept Professor Gregory's version of the family tree of man, as he could not see how the relatively close anatomical agreements between man and the apes could be cousistent with Professor Osborn's view that the two groups had been entirely independent of each other since early Oligocene or even Eocene times. Professor Osborn, in moving a vote of thanks to the lecturer, said that a fairer presentation of the subject could not have been desired and thanked Sir Arthur also for his important contributions to the comparative anatomy of the apes and man.

The Director and Scientific Staff of the British Museum of Natural History generously extended to Professor Osborn and Doctor Gregory the fullest opportunities for carrying on their respective researches. To Professor Osborn they entrusted the great collection of fossil proboscidean teeth and skulls from the Siwaliks of India. Professor Osborn, assisted by Mr. Edwin Colbert of the department of vertebrate palæontology of the American Museum, made a rich harvest of measurements and observations that will be embodied in his monograph on the Proboscidea.

The departments of recent and fossil fishes opened to Doctor Gregory their enormous stores of fish skeletons, and during the five weeks of his stay in London he was able to fill many lacunæ in his previous studies on the adaptations shown by the skull of fishes to different habits of feeding and locomotion.

RECENT PUBLICATIONS

Paradise Quest. A Naturalist's Experiences in New Guinea. By Lee S. Crandall, Curator of Birds, New York Zoological Park. Charles Scribner's Sons, New York and London, 1931, 8vo.; pp. xvii, 226, 52 photos.

STYLES will come and go, but let us hope that never again shall we see the gorgeous plumes of dead paradise birds flaunted above pretty faces by Fashion. It is so much more wonderful to see them on the live birds where they grow. Favored indeed is the dweller in our great city who can have this pleasure any day he cares to visit the New York Zoological Park. No need has he to risk tropical diseases and parasites, or dangerous savages, to feast his eyes upon these birds of miraculous beauty from the far side of our earth.

It is only in recent years that birds of paradise have been shown in our Zoo. Someone must run the risks I have mentioned, in order that we may watch the antics of such beauteous birds close to our own homes. Mr. Crandall confesses that he longed to take his chances, and justifies himself by the reminder that "Fortunately, a naturalist is not supposed to be practical." Then he goes on to show throughout his delightful book how practical he was, and had to be in order to succeed in the mission entrusted to him, of securing and bringing safely home a collection of live birds of paradise.

One of the commonest questions is "Where do birds of paradise come from?" The public cannot seem to remember, and it would be a strange course in memory training that would couple Paradise with New Guinea and the adjacent islands. The origin of the birds' name is explained by Mr. Crandall. The first native-made skins to reach Europe lacked both wings and feet. This deficiency, "coupled with the ethereal beauty of the birds' plumage" gave rise to the romantic theory that they lived in the air and never touched earth until they died. Truly they must be birds of the gods.

The commercial exportation of paradise plumage is now forbidden, and the removal of live specimens is carefully controlled under permit. So while the birds are being made familiar to the civilized world, their continued existence in their homeland is fully assured.

A large part of the great island of New Guinea is mountainous, and the greatest variety of paradise birds is to be found in the highlands. Securing the assistance of Mr. John Ward, an experienced Australian bird-collector, Mr. Crandall entered New Guinea by way of Port Moresby and Yule Island on the southeastern coast, in early October, 1928. The difficulties of the trip into the interior were due not only to the unhealthy climate and poor mountain tracks, but still more to the independence and general unreliability of the sparse native population.

To reach Deva-Deva and Taruve in the mountains of the Central Division, where blue birds of paradise and other celebrated rarities could be had, was no simple matter. Black people who regard members of neighboring tribes as legitimate game, and with whom simple conversation is a difficulty, must be utilized as beasts of burden and as guides. Fortunately they were far more efficient as bird-catchers. They eat small birds, and they prize the paradise plumes as articles of adornment.

Ignorant as they are of iron-working, knives and axes of the white man, together with mirrors, cloth, and "sticks" of tobacco stimulated them to unusual activity. In the surprisingly short

space of two months Messrs. Crandall and Ward were ready to sail again from Yule Island with a collection of forty birds of paradise and two hundred other birds.

One might suspect that the work of guarding and feeding such an aviary would have been enough to prevent its custodians from making any other observations. Certainly the descriptions of habits and behavior of the birds of paradise are charming, but Mr. Crandall's book is brimming full with other information. Village life and methods of travel, hunting, and trapping are vividly portrayed, including scenes at a barbarously artistic dance which formed an appropriate climax just before his departure.

A still more intimate picture is given of the various natives who accompanied the party. Their individual peculiarities seem to have been no less diverse than among a group of civilized men. The oustanding figure among them all is Koi, "cooky boy" and interpreter, man of illustrious appetite, bulging with sweet potatoes and taro whenever possible, but a real helper with all his faults.

"Friendly cannibals" Crandall found the Mafulu tribe of the mountainous interior, but they ate nothing worse than pig while he watched them. It may be that when more fully subjected to our civilization they will become less likeable. Wise government measures discourage the wearing of cloth above the waist, for it is known to favor pulmonary disease. It does seem regrettable that no more suitable medium of communication has been adopted than Pidgin English.

The risks of the expedition must have seemed at an end when the whole collection was safely stowed on the S.S. "Morinda," sailing out of Port Moresby. The following morning the ship grounded on a coral reef, and only on the sixth day of bouncing on the reef could they be transferred to another steamer bound for Sydney. No wonder the unsavory odors of Gowanus Creek seemed strangely sweet when Crandall's precious collection finally reached New York, late in March, 1929. It was a splendid task well done.

The Earth—Our Ever-Changing Planet by Chester A. Reeds, curator of geology, American Museum of Natural History, has just been published by the University Society, Inc., and a review will appear in the next issue of NATURAL HISTORY.

A MONOGRAPH ON THE ARCHÆOLOGY OF KAUAI has just been issued by the Bernice P. Bishop Museum in Honolulu. The author is Dr. W. C. Bennett, who has just joined the curatorial staff of the department of anthropology at the American Museum. Kauai is one of the smaller and more westerly inhabited islands of the Hawaiian group. An intensive study on this island by Doctor Bennett while he was connected with the Bishop Museum in 1928–29, showed Kauai to be rich in structures of stone and other archæological remains. Some unusual stone structures were those carrying irrigation ditches around the faces of cliffs and across ravines. In the best preserved the walls are of well-cut stone, a feature unique in Hawaiian antiquities. Of general interest is the apparent individuality in the prehistoric culture of this small island, its archæology showing numerous implements and structural forms not observable in any of the other islands nor in Polynesia as a whole. The author concludes, then, that in this instance the island was sufficiently detached and possessed of so virile a population that many new variants of Hawaiian culture were created.

"Paleolithic Man and the Nile-Faiyum Divide." By K. S. Sanford and W. J. Arkell. Vol. I of the Prehistoric Survey of Egypt and Western Asia, issued by the Oriental Institute of the University of Chicago. Edited by Prof. James Henry Breasted.

SINCE Napoleon's military expedition to Egypt, 1798-1801, the world has been kept in a state of growing astonishment over the gradual unearthing of the ancient and forgotten historic civilization of the Nile valley. Whisperings about things prehistoric have been heard now and then for nearly fifty years, to be sure; but though they were sometimes founded on fairly extensive collections (one of which is in the American Museum) they were drowned by exultation over such discoveries as Tutankamen's tomb.

Now, at last, there are signs that interest is about to be fairly divided. The authors of the above mentioned volume, representing the University of Michigan, are accredited geologists thoroughly familiar with the typological succession of flaked, chipped, and ground stone implements and thus prepared to determine the essential synchronization of outstanding geological and archæological phenomena.

The publication before us is in the nature of a partial or preliminary report on two seasons' work (1926–28), covering a large portion of the Nile valley proper and also the tributary basin known as the Faiyum. In it are set forth in clear and concise terms: (1) the geological origin and history of the Nile valley as dating from early Miocene times; (2) the origin and development of the Faiyum basin as dating from early Pleistocene times; (3) the absence of evidence pointing to the presence of man in Egypt in Pliocene times; (4) the presence of four river terraces in the upper Nile valley which contain

implements of Chello-Acheulean and Mousterian types; and (5) the presence in the Faiyum lake basin of no less than eleven ancient beaches marking temporary standstills in the gradual drying up of the lake and containing a succession of stone implement industries which range from the Mousterian down to the Neolithic.

Limitations of space forbid further exposition, but we have here obviously one of the most beautiful chronological demonstrations ever put forth by the joint labors of geologists and archæologists. Professor Breasted and the authors are deserving of the heartiest congratulations and of encouragement that they go on to complete their remarkable undertaking.—N. C. N.

BASHFORD DEAN MEMORIAL VOLUME

THIS MEMORIAL, under the editorship of Dr. E. W. Gudger, is making substantial progress. Three articles have been published and two are in press.

Artiele I, A Memorial Sketch with seven portraits was published December 15, 1930. This was by Dr. W. K. Gregory, curator of ichthyology, an old student of Doctor Dean's.

Artiele II, The Segmentation of the Egg of the Myxinoid Eel *Bdellostoma*, with two lithographed plates from Doctor Dean's drawings, appeared on May 7, 1931. The authors were Dr. E. W. Gudger, bibliographer and associate in ichthyology, American Museum, and Dr. B. G. Smith, professor of anatomy, New York University.

Article III, The Genital System of the Myxinoidea, by Dr. J. LeRoy Conel, professor of anatomy in the Boston University School of Medicine, appeared on September 25, 1931. This was illustrated by four lithographed plates from Doctor Dean's drawings.

Articles IV and V are in press. Article IV, The Structure of the Devonian Fossil Placoderm Fish *Dinichthys* by Dr. Anatol Heintz of the Paleontological Museum, Oslo, Norway, is in the hands of the printer for second galley proofs. From new as well as old material Doctor Heintz has completely cleared up the puzzling points in the structure of this fish on which Doctor Dean worked for many years. Article V, The Natural History of *Chlamydoselachus* by Doctors Gudger and Smith, is now in the hands of the printer for type-setting. This is based in part on specimens and notes brought back from Japan by Doctor Dean in 1901 and in 1905.

Other articles are being worked up and will appear in the future.

CREDIT

THE photograph of the black bear and cub credited to the American Museum, which appeared on page 520 of the September–October issue of NATURAL HISTORY was taken by Mr. J. M. Johnson, of New York City. Mr. Johnson presented the negative to the American Museum, and the editors of NATURAL HISTORY desire to give Mr. Johnson full credit for the picture.

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total membership 12,032.

Patron

Mr. PIERPONT ADAMS.

Life Member

Miss FLORENCE C. MARTIN.

Sustaining Members

Mesdames BERTHA B. ALEXANDER, DENNIS F. O'BRIEN.

Annual Members

Mesdames EDITH CONNOR, CHARLES V. DREW, CHARLES J. DUNLAP, JOHN J. GORDON, GEORGE F. GOUGE, D. G. LEGGET, G. C. MARSHALL, J. J. NAUDE, HAROLD G. PERRY, EDWARD HEATH PETERS, R. M. RAYMOND, JOHN J. RUDOLF, RUTH WEISS, MARY W. WOLTGE.

Misses ELSIE T. BAHR, MIRIAM BIRDSEYE, MINNA P. BOLZE, LAURA F. CRAFT, JUDITH C. DINKELSPIEL, MARGARET M. FINCK, ADELE FORBES, EMMA L. HAUSELT, VIOLA PAUCEK, DOROTHEA RICHTBERG, DOROTHEA G. STEPHAN, REGINA STOLZ, BERNICE WIESENFELD, JULIA P. WILKINSON.

Doctors JOSEPH H. ABRAHAM, C. MONFORD COLE, JOHN JOHNSTON, ALOIS F. KOVARIK, H. HORTON SHELDON, HUGH STUART.

Messrs. SIDNEY BIRCHER, CURTIS J. BROOKS, MAX D. COSEL, EUGENE A. DEMONET, JR., HARRY ELDRIDGE, THOMAS E. HARDENBERGH, B. FRANK HAYS, ALFRED KNIGHT, HOWARD N. KNOWLES, L. A. MAC COLL, C. D. MALLORY, S. A. MEGEATH, HORACE E. PAYSON, LOCKWOOD M. PIRIE, ROBERT SCHMEIDLER, CHARLES D. SCHNEIDER, JOHN B. SPARKS.

Associate Members

Dr. GRACE B. HOLMES.

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THE AMERICAN MUSEUM OF NATURAL HISTORY

FOUNDED IN 1869

SIXTY years of public and scientific service have won for the American Museum of Natural History a position of recognized importance in the educational and scientific life of the nation, and in the progress of civilization throughout the world. Expeditions from the American Museum and members of the scientific staff are interested in facts of science wherever they may be found. As a result, representatives of this institution are forever studying, investigating, exploring, not merely in their laboratories and their libraries, but actually in the field, in remote and uncivilized corners of the world, as well as in lands nearer home.

From these adventuring scientists and from observers and scientists connected with other institutions, NATURAL HISTORY MAGAZINE obtains the articles that it publishes. Thus it is able to present to the members of the American Museum the most fascinating, the most important, and the most dramatic of the facts that are being added to the sum total of human knowledge.

MEMBERSHIP MORE THAN TWELVE THOUSAND

For the enlargement of its collections, for the support of its exploration and scientific research, and for the maintenance of its many publications, the American Museum is dependent wholly upon members' fees and the generosity of its friends. More than 12,000 members are now enrolled and are thus supporting the work of the Museum. There are ten different classes of members, which are as follows:

Associate Member (Persons residing fifty miles or more from New York City)	annually	$3
Annual Member	annually	$10
Sustaining Member	annually	$25
Life Member		$200
Fellow		$500
Patron		$1,000
Associate Benefactor		$10,000
Associate Founder		$25,000
Benefactor		$50,000
Endowment Member		$100,000

Memberships are open to all those interested in natural history and in the American Museum. Subscriptions by check, and inquiries regarding membership should be addressed: James H. Perkins, Treasurer, American Museum of Natural History, New York City.

FREE TO MEMBERS

NATURAL HISTORY: JOURNAL OF THE AMERICAN MUSEUM

This magazine, published bi-monthly by the American Museum, is sent to all classes of members, as one of their privileges.

AUTUMN AND SPRING COURSES OF PUBLIC LECTURES

Series of illustrated lectures held on alternate Thursday evenings in the autumn and spring of the year are open only to members or to those holding tickets given them by members.

In addition to these lectures, illustrated stories for the children of members are presented on alternate Saturday mornings in the autumn and in the spring.

MEMBERS' CLUB ROOM AND GUIDE SERVICE

A handsome room on the third floor of the Museum, equipped with every convenience for rest, reading, and correspondence, is set apart during Museum hours for the exclusive use of members when visiting the Museum. Members are also privileged to avail themselves of the services of an instructor for guidance.

SCIENCE
EDUCATION

RESEARCH
EXPLORATION

SIXTIETH ANNIVERSARY ENDOWMENT FUND. Already, $2,500,000 has been contributed to this $10,000,000 fund, opened in January, 1929 to commemorate the Sixtieth Anniversary of the Founding of the American Museum of Natural History and to further the growth of its world-wide activities in Exploration, Research, Preparation, Exhibition, Publication, and Education. Committees are now engaged in seeking the $7,500,000 which remains to be contributed. It is greatly to be desired that this fund, so vital to the scientific and educational progress of the Museum, shall reach completion at an early date.

EXPEDITIONS from the American Museum are constantly in the field, gathering information in many odd corners of the world. During 1930, thirty-four expeditions visited scores of different parts of North, South, and Central America, of Europe, Asia, Africa, and Polynesia. New expeditions are constantly going into the field as others are returning with their work completed, or in order to digest material gathered preparatory to beginning new studies.

SCIENTIFIC PUBLICATIONS of the Museum, based on its explorations and the study of its collections, include the *Memoirs*, devoted to monographs requiring large or fine illustrations and exhaustive treatment; the *Bulletin*, issued in octavo form since 1881, dealing with the scientific activities of the departments except for the department of anthropology; the *Anthropological Papers*, which record the work of the department of anthropology; and *Novitates*, which are devoted to the publication of preliminary scientific announcements, descriptions of new forms, and similar matter.

POPULAR PUBLICATIONS, as well as scientific ones, come from the American Museum Press, which is housed within the Museum itself. In addition to NATURAL HISTORY MAGAZINE, the journal of the American Museum, the popular publications include many han books, which deal with subjects illustrated by the collections, and guide leaflets which describe individual exhibits or series of exhibits that are of especial interest or importance. These are all available at purely nominal cost to anyone who cares for them.

THE LIBRARY of the American Museum is available for those interested in scientific research or study on natural history subjects. It contains 115,000 volumes, and for the accommodation of those who wish to use this storehouse of knowledge, a well-equipped and well-manned reading room is provided. The LIBRARY may be called upon for detailed lists of both popular and scientific publications with their prices.

COLLEGE AND UNIVERSITY SERVICE. The President of the Museum and the Curator of Public Education are constantly extending and intensifying the courses of college and university instruction. Among some of the institutions with which the Museum is cooperating are Columbia University, New York University, College of the City of New York, Hunter College, University of Vermont, Lafayette College, Yale University, and Rutgers College.

PUBLIC AND NORMAL SCHOOL SERVICE. The increased facilities offered by this department of the Museum make it possible to augument greatly the Museum's work, not only in New York City public schools, but also throughout the United States. More than 22,500,000 contacts were made with boys and girls in the schools of Greater New York alone, and educational institutions in more than thirty states took advantage of the Museum's free film service during 1930. Inquiries from all over the United States, and even from many foreign countries are constantly coming to the school service department. Thousands of lantern slides are prepared at cost for distant educational institutions, and the American Museum, because of this and other phases of its work, can more and more be considered not a local but a national—even an international—institution.

THE AMERICAN MUSEUM OF NATURAL HISTORY
77th STREET and CENTRAL PARK WEST
NEW YORK, N. Y.

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TEXT AND ILLUSTRATIONS

Names of articles are set in capitals and small capitals. Titles of works are set in italics