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NATURAL HISTORY

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AN ILLUSTRATED MAGAZINE devoted to the advancement of natural history, the recording of scientific research, exploration, and discovery, and the development of museum exhibition and museum influence in education.

Contributors are men and women eminent in these fields, including the scientific staff and members of the American Museum, as well as writers connected with other institutions, explorers, and investigators in the several branches of natural history.

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DEVIL DANCERS OF TIBET

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BLAZING THE TRAIL

EXTENDING into the Gulf of St. Lawrence is the Gaspé Peninsula at the tip of which are some of the most beautiful of America's "bird rocks." The country still lies somewhat beyond the hurly-burly of modern life, and is the more charming on that account. It is of this country and of the rocks that form the outposts of this headland that John F. Kuerzi has written, and NATURAL HISTORY is glad to be able to publish his article in the March-April number.

THE study of prehistoric South American life has not been carried so far as has the same study of other continents. It was all the more important, therefore, that Dr. George Gaylord Simpson, of the American Museum's department of vertebrate paleontology, should have visited Patagonia in order to explore the fossil beds of that region. Doctor Simpson's experiences in Argentina began in Buenos Ayres at the time of the recent revolution, but the revolution was not permitted to interfere with his scientific work, which took him far south and into the interior. It is of this expedition that he will tell in an article that will appear in the next number of this publication.

SEA shells are almost as much a part of our beaches as are the sands themselves, and so are often accepted without question. Yet each shell suggests a life history, which often demands all the patience of science before it can be unraveled. We have all seen necklaces of cowrie shells, and most of us have seen these dainty little bits of color on the beach. It has remained for the scientists of the Plymouth Marine Laboratory, of Plymouth, England, to study the inhabitants of these shells under controlled conditions and to record their life story. Dr. Marie V. Lebour, a member of the Plymouth Laboratory staff, has written an account of the cowries of the English coast, and NATURAL HISTORY is fortunate in being able to publish in its next number what is probably the first "popular" account of the results of this new investigation.

RECENTLY we published an article by Robert H. Rockwell descriptive of his experiences on board the schooner "Blossom" and ashore on the Cape Verde Islands. At the same time we promised our readers another article by Mr. Rockwell. We are glad to be able to announce the second of his articles—on his experiences in Senegal—for the coming number.

READERS of NATURAL HISTORY will recall Mr. H. C. Raven's account of his expedition for gorillas in the Belgian Congo and in West Africa. Now, however, he has written an article on a chimpanzee that since Mr. Raven's return from Africa has been almost a member of his family. Everyone knows of the humorously human attributes of these intelligent primates, but Mr. Raven's account, which is scheduled for the March-April number, will throw new light on their intelligence and, in particular, on the character of his interesting pet.

THE COVER OF THIS ISSUE

THE cover of this issue of NATURAL HISTORY is another of the paintings by Arthur A. Jansson of the American Museum's department of preparation. The Devil Dance shown is a religious ceremony as it took place in Ladakh. Similar dances, however, are religious features throughout Tibet and Mongolia. The masks worn by the dancers are fashioned of papier maché in Lhasa, and are remarkable both in color and design. The gowns of the dancers are often made of gorgeous Chinese brocaded silks, while the orchestra in the background supplies the dancers with a weird cacophony of blaring horns (or *shawms*) bells, cymbals, and drums. Mr. William J. Morden's article "Beyond the Vale of Kashmir" tells of his journey to Himis Lamaseri where he witnessed the dance depicted in the cover painting.

EVEN stay-at-home naturalists are conscious of the difference between the active wild life of woods and fields in the daytime and at night. How much more obvious is this difference when one is in the jungle. It is of this difference between the life during the day and that during the night that Dr. Stanton C. Crawford writes, as he observed it in the jungle of British Guinea. This unusual account will appear in the next number.

SEA HORSES are such self-like creatures that it is easy to think of them as belonging to the realm of fancy almost more than to the realm of actuality. As a matter of fact, they have always strongly affected the imaginative

minds of poets and jongleurs. There is however, more than a little information available about them, and NATURAL HISTORY has an article dealing more accurately with these little creatures of the oceans than poets have been inclined to deal. It has been written by Robert H. Coles, and will appear in the next number of NATURAL HISTORY.

NATURAL HISTORY has been fortunate in being able to publish a number of articles by William H. Carr on various phases of his work at the American Museum's "Nature Trail" at Bear Mountain, New York. In the next number another of Mr. Carr's articles is to appear, this time on insects. The photographs illustrating the article are of extraordinary interest, and are a valuable addition to the text.

SWAMPS are ordinarily considered to be both unattractive and worthless sections of the landscape. This is far from true, and for the next number of NATURAL HISTORY Myron Ackland has written an account of Okefinokee Swamp which brings out many phases of such regions often overlooked.

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The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor



A. KATHERINE BERGER
Associate Editor

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A LAMASERY IN LADAKH

These religious houses are often located in the most inaccessible places—on peaks, on cliffs, or overlooking deep ravines. The lamas, or monks, form so large a part of the population that it has been said that the backwardness of the country is largely due to withdrawal of these able-bodied men from productive labor

See "Beyond the Vale of Kashmir," Page 5

VOLUME
XXXII

NATURAL HISTORY

NUMBER
ONE

JANUARY-FEBRUARY, 1932



BEYOND THE VALE OF KASHMIR

A Journey Over the Mountain Trails from Kashmir to Ladakh—The
Peoples of the Valleys and Plateaus—The Devil
Dancers of Western Tibet

By WILLIAM J. MORDEN

Field Associate, Department of Mammals, American Museum

ONE might say that there is a personality in trails. The trails of our own Rockies, for instance, are as different from those of the Trans-Himalaya as Pittsburgh from Peshawar—as Boston from Benares.

The Himalayan trail—or road as it is usually called—from Srinagar, in Kashmir, to Leh, in Ladakh, (or Western Tibet) is a way of ever-changing beauty and charm. It is a distinctly Asiatic charm.

But before I try to take you with me along this mountain route, let me refresh your mind a bit concerning its geography and the history of the country through which it passes.

North of the Punjab of India, beyond the Pir Panjal Range of the western Himalaya, lies the Vale of Kashmir. Well watered by the melting of snows heaped on the peaks that surround it on all sides, it is a land of forests and flowers, rightly called "The Happy Valley." The ancient city of Srinagar on the placidly flowing Jhelum River, is the starting point for journeys into the interior.

Ladakh lies north and east of Srinagar. Leh, its capital and chief city, is a distance

of 240 miles across the mountains, a journey of more than two weeks at the ordinary rate of travel.

There is evidence that Aryan Dards once had scattered colonies in Ladakh, and for some five hundred years it formed part of a Tibeto-Dard Kingdom. Then came a Central Tibetan dynasty, inaugurated about 900 A.D. Ladakhi kings ruled the land until 1840, when the Dogra army of Gulab Singh, the Maharajah of Jammu, conquered it. When Jammu and Kashmir were consolidated into a single state, Ladakh became part of the domains of the Maharajah of Jammu and Kashmir.

But Ladakhis have little in common with the Aryan Hindus and Mohammedans of Kashmir. They are a mongoloid people—Tibetan lamaists who acknowledge the Dalai Lama at Lhasa as the spiritual head of their church. The country, too, is entirely different from that south of the mountains; the highlands of Ladakh continue uninterruptedly into Tibet, for there are no natural geographical divisions between the two.

My trip to Ladakh was one phase of a



A SMALL LAMASERY

Perched high on a cliff, this detached structure lies well off the main trade route among the barren hills

summer's collecting in the Himalaya. In Srinagar I engaged my Kashmiri staff of five men, purchased stores and supplies, hired tents and camp equipment, and generally made my *bandobast*, (pronounced "bundobust") as arrangements are called in India. I left Srinagar late in April.

My way at first led up the lovely Sind Valley, where the mountains were clothed in deep forests of conifers, and where the gushing streams were crystal clear. In the Vale of Kashmir fruit trees had been in bloom and the picturesque houses were gay with purple irises growing on their sod roofs. But as we went higher up the Sind, signs of winter were more frequent. We began to cross snow-slides, and by the time we reached Baltal Rest House, five marches from Srinagar, we were traveling on snow much of the time.

Baltal is just at the foot of the Zoji La, the pass which leads a traveler in one

great step from the forested regions of Kashmir to the bleak and barren wastes of the Tibetan highlands. The high range which the Zoji traverses intercepts the moisture-laden clouds that come over India from the distant ocean. The Vale of Kashmir gets the benefit of this moisture, but beyond the great mountain wall rain almost never falls, and even the winter snow is so light that by mid-summer many ridges over 16,000 feet in elevation are entirely bare.

Like Tibet proper, Ladakh is largely a high, rocky desert, where one may ride for hours and see no vestige of any growing thing. Here and there inhabitants of the infrequent villages have led water in tiny canals from snow fields far up some valley to irrigate the little green oases which are a welcome relief from the surrounding desolation.

Along the road to Leh the traveler may use government Rest Houses at the end of



MR. MORDEN AND A LAMA

On the road to Himis Mr. Morden paused at the Tiksay Lamasery for a visit

each stage of ten to twenty miles, or may pitch a tent in an adjoining grove of poplars. These little government-owned "Maharajah's gardens" are pleasant encampments and are often used, for some of the Rest Houses have permanent inhabitants. As Mrs. Morden's bearer put it, "Memsahib, there are many little animals, hopping, hopping—biting, biting."

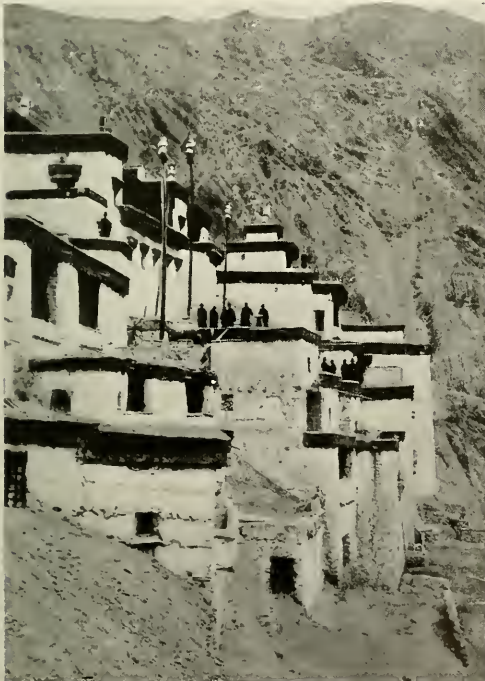
But to return to the Zoji La. In summer a wide pony trail zigzags up from Baltal to high above a ravine and brings one out to a rocky valley at the summit. But until about the end of May the pony trail cannot be used. The winter route ascends steeply up the gorge, where avalanche snow accumulates to great depths.

We hired coolies for the crossing, for ponies cannot negotiate the winter trail. To avoid the danger of avalanches, which is greater when the snow is soften-



KASHMIRI COOLIES ON THE ZOJI LA

Crossing the pass that leads from the wooded valley of Kashmir to the barren wastes of the Tibetan highlands



THE LAMASERY OF RIRDZONG

Of the Yellow sect of lamas whose robes are red, but whose caps and sashes are yellow

ed by the heat of the sun, our coolies started from Baltal at 2 A.M., each man with his load of sixty pounds. My staff and I followed a few minutes later. A waning moon in a cloudless sky illuminated objects in its light but accentuated the darkness once we entered the gorge.

I was unfamiliar with Himalayan travel then, and although the exertion of trying to keep on my feet while fighting my way up the steep snow slide took most of my attention, I was deeply interested in the sights and sounds around me. The amazing sharpness of the shadows, the towering cliffs which seemed to overhang us, the tremendous depth of the snow up which we climbed, and the roar of water rushing far beneath, all combined to give me a feeling of unreality.

We soon began to overtake our coolies, who stopped frequently to rest their loads on T-shaped sticks which they



LAMAYURU

The situation of this lamasery is very striking. The area of cultivation lies at the foot of a steep slope, while a village clings to the hillside at the top of which the lamasery is perched

carried. As we passed each group, my shikari encouraged them with shouts of "*shabash! shabash!*"—"well done!" All the coolies were cheery and returned his greeting with jokes and laughs. Had I been packing sixty pounds up that snow slope, I would have thought it nothing to joke about.

Dawn came as we reached the summit, 11,578 feet above the sea. From there to Matayan was but a few miles, though the rapidly softening snow made foot travel fatiguing. We were glad to reach the Rest House and even gladder that we did not have to go farther that day.

As we progressed, the mountains became less rugged and the country more and more barren. At first the people we met in villages were not mongoloid types, for the earlier stages of the road pass through part of the territory of the Dards, an Aryan race. But beyond Kargil, the ninth stage from Srinagar, we began to

feel that we were in Ladakh. Our pony men were Tibetan in feature, the villages had prayer-flags fluttering from each house, and now and then we passed a red-robed lama industriously twirling his prayer-wheel. Instead of the usual greeting of India and Kashmir, "*Salaam, sahib,*" we were now welcomed by the Ladakhi salutation, "*Julee.*" That is the respectful form—my return greeting was "*Ju.*"

Ladakhis are a jolly, pleasant people. They are mild mannered and as hospitable as any race I have met. Dirty they certainly are, but in that respect they differ only in degree from most Central Asians. The friendly Ladakhi, with his complete lack of religious prejudice and his ready laugh, is altogether a very likeable chap.

Ladakhi men wear queues of their own hair with added strands of horse-hair braided into them. They keep the appendages well oiled, with the result

that there are always greasy smears down the backs of their gray woolen coats. Their summer and winter headgear is a sheepskin-lined cloth cap with ear-pieces that are usually worn turned up in warm weather. Seen from a distance, these flapping ear-pieces look remarkably like horns.

Behind each ear a Ladakhi woman wears a large, flat piece of sheepskin with the fleece turned outward. These ear-pieces protrude straight out from the head and give the wearer a most odd appearance. A woman's headdress is especially striking. It takes the shape of a flat leather covering which forms a point over the forehead and in the back hangs down to about the waistline. This whole contraption is thickly studded with turquoise. We were told that a woman would put her entire personal fortune into her *peyrak*, as the headdress is called.

Although Ladakh is far from being a

wealthy country, Ladakhis seem to have a less fierce struggle for existence than is the case, for instance, in the neighboring district of Baltistan. The chief reason is said to be the practice of polyandry, which effectually prevents any increase in the population.

When a Ladakhi marries, his two next younger brothers become secondary husbands of his wife. Should there be more younger brothers than two, the others cannot share the wife of the eldest, but must either get out and hustle for a living or enter the church. A fortunate few are taken on as *maggas*, or special husbands, by heiresses who, because they had no brothers, have inherited the family fortune.

The two minor husbands of a wife are little better than slaves of their elder brother. If the eldest dies, the common wife may, if she chooses, divorce the other two by the simple ceremony of breaking a



LADAKHI WOMEN

The flat headdress, called the *peyrak*, studded with turquoise matrix and silver, often makes up the entire fortune of the wearer

string tied between her finger and that of the corpse. It is customary, I believe, for her to make each a present of a sheep before the final parting.

Polyandry is responsible for some amazing family trees. I was told that if one asks a Ladakhi who his father is, he will quite glibly rattle off a string of names.

We saw our first lamasery, or monastery of lamas, during our tenth march. It was high on a cliff face and reminded me of nothing so much as a swallow's nest, for so far as I could see there was no way of reaching it by anyone not provided with wings. However, as little of the building projected outside the sheer rock wall, doubtless there were interior tunnels and galleries with an entrance somewhere from the rear. Tibetan lamas almost invariably build their monasteries in most inaccessible locations, though

whether for the sake of the isolation conducive to profound meditations, or for the view, would be hard to say.

A few miles beyond Shergol, at the little village of Mulbek, there is a detached rock perhaps fifty feet high. One side has been smoothed off and on it is deeply carved a colossal figure of a god. A small temple nestles against the foot, while holes in the rock face show that at one time a larger building covered the figure.

Our Kashmiri staff were Mohammedans, and therefore hugely disdainful of everything Buddhist. Mrs. Morden's bearer, with fine biological indifference, looked at the carving for a time, and then said scornfully,

"That very bad goddess, memsahib. She eat up all the trees and grass in all this country. That is why this country so bare."

The memsahib smiled a bit skeptically and Aziza earnestly added,

"That is true, memsahib, that is true!"

We had seen our first *chortens* near Shergol, and as we went farther along the trail, these became familiar sights. Chortens are monuments erected sometimes in memory of a saint or lama, sometimes as a receptacle for sacred relics, especially the ashes of departed lamas. After the death ceremonies, which take several days, the corpse is cremated and part of the ashes are mixed with clay and moulded into various shapes. If the deceased has been a man of prominence, the tablet containing his ashes is placed by itself in a chorten constructed especially for it; those of ordinary individuals are tossed with others into an old chorten. The five divisions of a chorten represent the elements: earth, water, fire, air, and ether.

Chortens are sometimes built by the pious to "acquire merit," as the saying is. But apparently no merit is acquired by repairing an old chorten, for many of them—constructed, as they are, largely



A LADAKHI "ACQUIRING MERIT"

Prayer wheels are found in every monastery, and the devout person who turns them from right to left receives the benefit of the prayers they contain

of dried mud—are in various stages of dilapidation. Devout Tibetans always pass to the left of a chorten, as they believe they thereby “acquire merit.” Irreverent sahibs sometimes refer to the contents of chortens as “potted lamas.”

Mani-walls are another familiar sight as one travels farther into lama-land. These long, low structures of stone and mud have their tops and sides covered with flat rocks, on which are carved in Tibetan characters variations of the Buddhist prayer, “*Om mani padme hum.*” One must always pass to the left of a mani-wall to obtain the benefit of its prayers; to pass on the right is supposed to un-say them all and put one just that many in arrears. When a mani-wall or chorten occurs along a trail, the trail usually divides, so that a traveler may pass on the left going and the same returning.

In all Ladakh I saw no place whose situation is so spectacular—I might almost say dramatic—as that of Lamayuru. As one approaches the village from a cañon, one's first sight of the place is a large and very impressive chorten at the end of a long mani-wall. Then more chortens. The trail makes a turn and there ahead lies Lamayuru. High up a steep mountain-side straggles a village of Ladakhi huts, with prayer-flags fluttering from poles and housetops. Queer little streets ascend steeply, sometimes through tunnels dug in the rock. Above, perched on the edge of a sheer cliff, the lamasery surmounts the whole.

The Tibetan word for a monastery is *gompa*, literally “a secluded place.” Our English word “lamasery” seems to be a corruption of the two words, “lama”—a Buddhist priest or monk—and “serai”—an inn or hostel. Lamayuru gompa was once the stronghold in Western Tibet of the ancient Bon religion, the early form of devil-worship which flourished over the whole country before Buddhism was introduced about A.D. 650.



AN ALTAR IN A LAMASERY

The large bowl at the left is filled with *ghee*, or clarified butter, which in this particular case is being used as fuel for the chapel lamp

There are two principal sects of lamas, the Yellow and the Red. The Yellow lamas, to which branch belong the Dalai Lama of Lhasa and the equally holy Panchen Rimpoche of Tashilhumpo, are dominant in Tibet proper. The Red lamas of Ladakh acknowledge the spiritual leadership of the Dalai and Panchen lamas, but are less ascetic in their personal conduct and rituals.

It is difficult for a Westerner to understand the tenets of lamaism. Before the coming of Buddhism, the peoples of Tibet, like many others similarly situated, considered that all misfortunes were the work of evil spirits and devils. Demons were responsible for storms, blizzards, and avalanches. Devils of the air caused the bitter winds that blow across the vast plains of the Tibetan plateau. If a person fell ill, it was the work of a malignant spirit which had to be propitiated or

driven out before recovery was possible. They saw demons behind each rock—and there were many rocks.

Buddhism, though the official state religion, at first made small headway. Padma Sambhava, popularly known in Tibet as Guru Rimpoche, the "Precious Teacher," is supposed to have overcome the malignant demons and to have obtained their assistance. He incorporated into the Buddhist ritual many of the deities, beliefs, and practices of the Bon religion, so that present-day lamaism is far removed from the teachings of the Gautama.

The lamaist pantheon comprises innumerable gods, demi-gods, saints, demons, and various deified evil spirits. Some came from India, some from the old Bon religion, while others are local to special districts. Each locality has its own particular godling, who is especially revered and who is supposed to protect his people against wandering evil spirits. The chief gods are the Buddhas; next come the Bodhisattvas, those who have attained Nirvana, or heaven, but have renounced it to assist mankind in its struggle for salvation. From these the descending scale includes hordes of gods and demons of varying degrees of power.

A belief in reincarnation is basic in the lamaist faith. Upon departing this life,

the soul of a lamaist is reborn into one of several spheres. The chief of these is *Lhayul*, or region of gods, the lowest *Nyalwa*, the hells. By "acquiring merit" in various ways the soul may, in a long cycle of rebirths, free itself from earthly bonds and enter Nirvana.

For various sins the soul may return to earth as one of the animals or even a lower form of life. A good Buddhist will not kill, for fear he may be condemning some unfortunate soul to another rebirth. One day I noticed one of my Ladakhi coolies industriously "reading his shirt." Quite evidently the hunting was good, but each time he carefully placed his little find on a rock beside him. I inquired why, and was informed that my coolie did not know but that some of them might be his friends or relatives, condemned for their sins to a rebirth as "cooties." I thought of some people I knew—and wondered what their next incarnation might be!

To the traveler in Ladakh, the acquiring of merit seems mainly to take the form of endless repetitions of the prayer, *Om mani padme hum*. This is uttered millions of times daily, not only verbally but with the aid of mechanical contriv-



A LAMA WITH HIS PRAYER WHEEL
Each revolution of the wheel is supposed to offer a prayer by which the individual who turns it "acquires merit"

ances. It has been well called, "praying by machinery." Almost every Ladakhi one meets carries a prayer-wheel in one hand. Nearly all my coolies and pony-men

busily twirled prayer-wheels at all times on the march or in camp.

Larger prayer-wheels are found in lamaseries, in villages, and even along the trail where passers-by may give them a twist and obtain the benefit of their contents. I saw several instances where enterprising individuals had so harnessed personal "home" prayer-wheels that they were operated by water-power; others were fitted with vanes to catch the nearly constant wind. It rather seemed that these fortunate persons were several jumps ahead on the road to heaven.

The usual form of prayer-wheel is a cylinder of wood or metal, on the inside of which the invocations are placed. Sometimes the outside surface has prayers painted on it, but generally they are pretty badly weathered. I saw several old American oil tins giving excellent service as prayer-wheels.

Prayer-flags form another simple but supposedly effective method of gaining the requisite celestial credits. They are made by lamas from inked wood blocks and sold to the faithful. Every monastery has numerous prayer-flags; they flutter from houses and from roadside shrines. Villages give the effect of a continual wash day, for long lines of prayer-flags strung on ropes from house to house remind one of nothing so much as handkerchiefs drying in the breeze. But each

flutter helps acquire merit for the devout individual from whose house the flag flies.

The monastic system is the main support of lamaism. All through Tibet and Ladakh are scattered monasteries of greater or less size and importance. Grants of land, usually the most fertile in the vicinity, form one large source of revenue, while offerings of the pious serve to maintain the lamas in comparative affluence. Youngest sons of families usually become lamas; younger daughters enter the nunneries which form adjuncts of many lamaseries. The resultant drain of a considerable portion of the population into nonproductive pursuits is said to be a chief



A LARGE CHORTEN

Chortens are monuments usually erected to contain the ashes of departed lamas. Ordinarily, little effort is made to keep these in repair

reason for the backwardness of lamaistic countries, such as Tibet, Ladakh, and Mongolia.

I had the opportunity to visit several lamaseries, which differed mainly in details. That at Lamayuru is typical of the lot, so I will try to describe it. We reached its level by a stiff climb up village streets so steep and narrow that in places they are hewn in rough steps out of the solid rock. Deep chasms are crossed by tiny log bridges, while now and then adjoining house walls meet overhead and one falters upward in a dim—but not particularly religious—light.

The gumpa itself perches at the edge of a sheer drop of about two hundred feet.

The edge of the cliff is deeply serrated, and the monastery buildings are fitted into the irregularities, with some of them even overhanging yawning voids on pegs and props. Large prayer-wheels, which should be given a turn in the proper direction, clock-wise, are located at the entrance gates.

We entered a spacious court, enclosed on one side by the main lamasery building of mud-plastered stone and on the others by walls of the same general construction. This court forms the scene of the religious dances of the lamas, the so-called "Devil Dances," so dear to the Tibetan heart. From them he learns of the trials that will beset his soul on its onward path, also the eventual triumph of the forces of religion properly invoked.

We were led by our red-robed lama guides into a dimly-lighted hall, which reeked of incense, clarified butter, and unwashed humanity. The walls and

ceiling were draped with hangings, doubtless once brilliantly colored. Now, however, they were so blackened by smoke and dust that we could discern little about them beyond the fact that they were covered with hideous figures of demons.

At the far end of the room, a more than life-sized image of Buddha, flanked by lesser figures, looked down on the dais occupied during services by the chief lama. The abbot's place was to the left as one faced the altar, while rows of lower platforms down the center of the long room provided space for the lesser monks.

Before the altar, tiers of ledges were covered with dozens of brass bowls. Some were filled with offerings, mainly grain and seeds; others contained clarified butter, in which floated little wicks that burned with feeble flames. To one side stood a larger vessel of butter, evidently used to refill the small lamps from time to time.



THE LIBRARY OF A LAMASERY

Lettered on heavy sheets by hand, these books form an invaluable record of religious and lay matters

All sorts of offerings to the gods are placed before them. A favorite oblation is a little cake made of flour and butter. Flowers are nearly always present in summer. But one sometimes sees amazingly incongruous objects on lamasery altars. I have seen glass balls, such as are used to decorate Christmas trees, empty tin cans, equally empty beer bottles, kodak film spools, and lumps of lead foil. But I think the prize of the lot was an electric light bulb which had the place of honor in a little gompa away up the Indus. The lamp was not connected to anything, of course, for there are no electric plants in Ladakh. Its possible usefulness to the deity was not apparent to our Western minds, but it was very evidently considered the last word in gifts.

Interesting as Lamayuru had proved to be, we could not linger there, for we were still four marches from Leh.

Just beyond Lamayuru a tremendous stratum of brilliant yellow rock is cut through by the valley up which the trail leads. I had thought that I had seen the ultimate in glorious colorings in the Grand Cañon, the Painted Desert and the Yellowstone, but the Leh Road, particularly the bit just beyond Lamayuru, transcends them all.

We wound down into the depths of a mighty gorge, where the horizon was almost directly above us. We crossed and recrossed the stream several times,



BLOWING THE GREAT SHAWMS

The dawn and the evening are saluted by the booming notes of these collapsible trumpets. They are also sometimes used to welcome important visitors

then began a long ascent, with the trail cut into the face of a sheer cliff. The coloring was superb—great bands of reds and blues alternated with stretches of greenish gray. Now and then, as the cañon changed direction, we caught glimpses of distant peaks. I have heard that this Lamayuru cañon is one of the deepest in the world.

One approaches Leh across a wide, sandy plateau, where the sun's rays beat down so fiercely that an adequate head covering is necessary. As we rode toward the enticing green of the large cultivated area surrounding the town, the most prominent object was a many-



THE COURTYARD AT HIMIS LAMASERY

It is in this court that the Devil Dances are held. This famous religious festival is celebrated annually and lasts three days

storied building on a rocky hillside just behind. I thought it was a lamasery, of course, but it proved to be the palace of former kings of Ladakh. It is a small edition of the Potala, the palace of the Dalai Lama in Lhassa, and it overlooks the Leh oasis as the Potala does Lhassa. A small monastery perches on the very top of the hill above the palace, while far to the northward a great snow-capped range towers into the sky.

I have seen many Central Asian cities, but none more interesting than Leh. I have visited Kashgar, Urumchi, Turfan, Samarkand, and Bokhara. All of them are intensely interesting, though in each are touches of the outside world which somehow do not fit the picture. But as I rode through a gate and found myself suddenly at the end of the long poplar-bordered Leh bazaar street, filled with a heterogeneous mass of people, transport animals, and bales of goods, and

dominated by the palace beyond, I felt that I was truly near the heart of Asia.

Leh is the terminus of trade routes from India, Tibet, and Central Asia. From India and Kashmir come silks and spices; from Tibet wool and salt; from beyond the Karakoram, by the highest trade route in the world, come yak caravans loaded with felt numdahs. Everything is unloaded at Leh.

One sees a most amazing variety of types in Leh bazaar. Lean Turkis from Yarkand and Khotan rub elbows with sleek Hindu merchants from India; Tibetans, Kashmiris, Ladakhis, Baltis, Pathans, Sikhs, Chinese, and nomad *changpas* from the hills jostle one another in the milling crowd. The babel of tongues makes one's ears ring.

We stayed a few days in the comfortable Rest House at Leh, then pushed on to the Himis gompa, twenty-four miles farther up the Indus. Himis is the wealthiest

and largest monastery in Ladakh and one of the few that has a resident *skushok* presiding over it.

A *skushok* is theoretically the reincarnation of a saint who, by pious living and good deeds, has graduated from the cycle of rebirth and achieved Nirvana, but who has renounced his reward and elected to return to earth to assist his fellow mortals along the rough pathway of existence.

When a *skushok* is about to die, he indicates the place in which he will be reborn as a child. After his death his followers go to the designated village and locate a new-born male child that bears certain marks and otherwise seems the most likely incarnation of the saint. He is left with his family for the first few years of his life. Then, after he has successfully recognized various religious articles that belonged to him in his previous incarnation, he is taken to the monastery

to be educated. Later he is sent to Lhasa for several years to complete his religious education, after which he returns to his own *gumpa* as *skushok*. Sometimes a *skushok* presides over several monasteries and spends much of his time traveling between them.

The *skushok* of Himis *gumpa* is an alert, forceful man, now about forty-eight years old. He was born in Lhasa and for several years refused to take up his duties at Himis. Although he holds an exalted position in the Tibetan church, his manner to us was quite friendly and without any trace of the arrogance often displayed by Hindu and Mohammedan priests. During our conversation with the *skushok* it was evident that he had some knowledge of the outside world, for when one of us said that if he could arrange an invitation for us to visit Lhasa we would reciprocate by presenting him with a trip to New York, he



THE CENTRAL HALL OF A LAMASERY

Before the altars in the background and on the long, low benches, the lamas sit cross-legged during the services



THE "BENIGN" CHARACTER IN THE DEVIL DANCE

The masked figure represents the church in the Devil Dance. It overcomes the devils who threaten the souls of the departed on their road to reincarnation

asked how much it would cost. On our saying that the fare would be about a thousand rupees, the skushok replied that the fare to London was about that much and that as New York was farther from Himis than London, we must be low in our estimate!

Himis gumpa is situated some distance up a narrow gorge which rises sharply from the Indus valley. The monastery is the annual scene of one of the most famous religious festivals in the whole world—the "Devil Dances" of the Himis lamas. Pilgrims come from long distances to witness the performance, as great merit is thereby gained. The affair

takes three days, with services inside the lamasery alternating with dances staged in the great courtyard. Whole families attend, to spend the days in religious pursuits and the chilly nights sleeping out on rocky hillsides.

As we approached Himis, we were conscious of a dull, booming sound that seemed to fill the narrow valley. It echoed and re-echoed from the cliffs about us. At first we could not locate its origin nor hazard a guess as to its meaning. Then we rounded a bend in the trail and saw the gumpa high on a mountain-side before us. On its roof two lamas were blowing prolonged blasts on great *shawms*, the huge telescopic horns used to salute the dawn and the night. We were told that it was being done as a welcome to our

party. During our stay at Himis we became well used to the reverberating sound of shawms.

We went over to the monastery early in the morning on the first day of the performance of the Devil Dance, and found the large court already partly filled with on-lookers. Seats had been provided for us and a few other sahibs on a little balcony from which a good view of the proceedings could be obtained. From inside the buildings came prolonged chanting, broken now and then by the sound of drums, cymbals, and horns. As the dances would evidently not begin for some time, we decided to go inside and see what was going on there.

In a large room, lighted from the top only, forty or fifty lamas were seated cross-legged on rows of rug-covered low platforms. They kept up a droning chant, pausing frequently to take copious drafts of tea and barley beer, both of which were brought in large copper pitchers. The measure of the chant was at first slow, but the rhythm rapidly increased until, at the peak of its crescendo, cymbals, and flat drums held aloft on poles, were struck in time with the cadence. When the ultimate effect was reached the music suddenly stopped, to begin all over again in a few moments. Doubtless the service had a significance that was obscure to us.

By the time we resumed our seats on the balcony, the court was well-filled with spectators. The orchestra, composed of about twenty lamas with drums, cymbals, bells, and shawms, filed in and took places just beneath us. Then the skushok, escorted by several priests, came down the wide stairway from the main building and ascended the elevated dais reserved for him. On his way across the court the crowds besieged him for a blessing. Several came close enough to touch the bottom of his robe.

The first dancers to appear were lamas in gorgeous robes, who paced to slow music around the court, swinging lighted incense burners. This seemed to be in the nature of a prelude and did not last long.

Then the music became loud and violent, each musician seeming to vie with the others to see which could make the most noise.

Down the steps dashed troop after troop of lamas in hideous masks. They swirled and gyrated about the court until we became dizzy with the noise and motion. So far as we could determine, there was nothing especially allegorical about this portion of the dance—it seemed just a wild revel of demons.

The masks represented every form of fiend that could be conceived by the most diseased imagination. There were three-eyed faces with great protruding tusks and diadems of death's-heads; there were beasts with horns and antlers such as no animal ever wore; there were serpents; there were huge, grinning skulls; there were cross-eyed faces with the grin of an



A CHARACTER IN THE DANCE

Scores of similar masked figures play their part in the long-drawn-out religious festival



DEVIL DANCERS

These masked individuals represent two of the many evil spirit characters that take part in the devil dance

imbecile. All the masks were of papier-mache and, we were told, were made in Lhasa. They were all brilliantly colored.

The gowns worn by the dancers were, for the most part, of beautiful Chinese brocaded silk, and though some of them were a bit faded, their colors were very lovely. A few of the characters wore necklaces of human bones. All carried either daggers or swords, which they flourished wildly during the ceremony. We noticed that the death's-head was frequently used as a *motif*.

The music became quieter and gradually died away as a figure wearing a huge mask of benign—if cross-eyed—mien slowly descended the stairs. It represented the church and was sheltered by a large canopy carried by four bearers. At

its approach the demons fled and left the court.

Dance followed dance in bewildering sequence. One was supposed to represent lost souls wandering in space and beset on all sides by devils of the air. Another, in which a small effigy of a man was nearly hacked to pieces by fiends, indicated the difficulties in which the departing spirit would find itself after death. In every case the church, a figure representing an incarnation of the Buddha, was triumphant and rescued the victim at the last moment. But as soon as the gracious figure left the scene, the demons returned and the battle for the soul began again.

The performance lasted all day and we heard sounds of chanting at intervals throughout the night.

The following day there were more representations. One consisted of the elaborate smearing of quantities of red paint on two horses and a dog, after which the poor beasts were dragged about the court while the crowd shouted with satisfaction. The meaning of this ceremony was not apparent, but I have read that its significance was similar to that of the scapegoats of ancient Jewish beliefs. I have also read that after the ceremony the animals are considered sacred and are well-treated. I hope so, for they have a rough time during it.

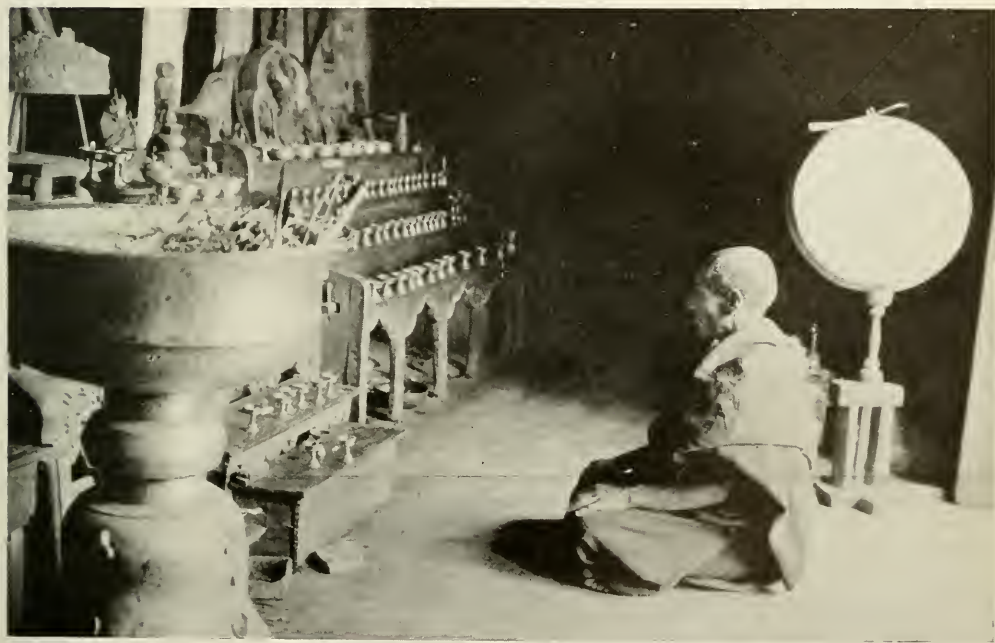
Other dances seemed mere clowning. I remember one particularly, which showed a school teacher bedeviled by his students. The little imps made his life miserable by their antics until they were

chastised by a stern-faced mask, who presumably represented higher authority. The audience thoroughly enjoyed the lighter vein of most of the second day's performances. As for us, we were in rather a daze by the time it ended.

Whether or not the lay Tibetan understands much of the significance of the Devil Dances seems doubtful. But without question they serve to strengthen

the hold of the church. To the traveler from the West they are a part of the picture—part of that weird, fascinating section of the globe, the Tibetan highlands.

As we left Himis, the gumpa shawms again boomed out far up the valley above us—a farewell from the land aptly described by Kim's lama when he said "These are the true hills."



A LAMA BEFORE AN ALTAR AT TIKSAY LAMASERY

On the left is a large brass bowl of *ghee*, and before the altar are many small brass lamps burning with feeble flames. The drum at the right is used during services



Pitcher, Plate, and Hammered Goblet from the Coast of Peru

PERUVIAN GOLD

Specimens of the Art of the Old South American Goldsmiths Who Were Conquered
by Pizarro and His Successors

BY WENDELL C. BENNETT

Assistant Curator in Anthropology, American Museum

ATAHUALPA, captive Inca of the Peruvian kingdom, sought deliverance from his captor, Pizarro. One day he offered to cover with gold the floor of the apartment in which he was detained. When the Spaniard did not accept, Atahualpa said that he would not merely cover the floor, but would fill the room with gold as high as he could reach. Pizarro was startled, but accepted the offer. A line was drawn at the agreed height and the compact put in writing. The dimensions of the room have been estimated as about seventeen feet broad, twenty-two feet long, and the line was about nine feet above the floor. A tremendous treasure was required to fill such a space, but Atahualpa fulfilled his bargain in two months' time. Unfortunately the Spaniards failed to keep their part of the agreement, and so Atahualpa lost his life as well as a quantity of gold approximately \$17,000,000 in value.

This is only one of the incidents that gave to ancient Peru its fabulous reputation for gold. The Spaniards discovered a tremendous mass of gold at Cuzco. For years the New World was the source of the Spanish bullion. Most of the gold was melted or hammered into bars and so the original forms of the pieces were destroyed.

One of the important stipulations of the Atahualpa agreement was that the gold was not to be melted down into ingots, but was to retain the original forms of the articles into which it was manufactured. By this the Inca was allowed the benefit of the space which the articles occupied in filling the room. It is interesting to speculate on what the forms were.

In the days of scientific research many small articles have been recovered from the graves and burial caves of the old Peruvians. The early Spaniards left some descriptions of the wonders they

saw. Over a number of years the American Museum has collected specimens of gold until now the exhibit displays many of the small objects and some of the large ones which may have been like those comprising the Atahualpa ransom.

Gold was not used as money in the pre-Columbian days. There were no Peruvian coins. However, the metal was highly valued, and was used most extensively by the chiefs. Tribute was paid in gold and accurate silver balances were used to determine the exactness of the quantity. The gold was, however, used principally as ornament.

Buildings were ornamented with gold and niches left in the wall-spaces were filled with gold plates and jewels. Astonishing descriptions are given by the early explorers of Curicancha, "House of Gold," at Cuzco. The walls were built of closely fitted stone blocks and were covered with sheets of gold and studded with jewels. Pizarro, describing the same temple, mentions "a bench of gold encasing a great stone which had been worked into the form of a bench on which they said the Sun was wont to sit down." Within the religious temples the extensive use of gold is best illustrated by this quotation from Prescott: "All the plate, the ornaments, the utensils of every description, appropriated to the uses of religion, were of gold or silver. Twelve immense vases of the latter metal stood on the floor of the great saloon, filled with

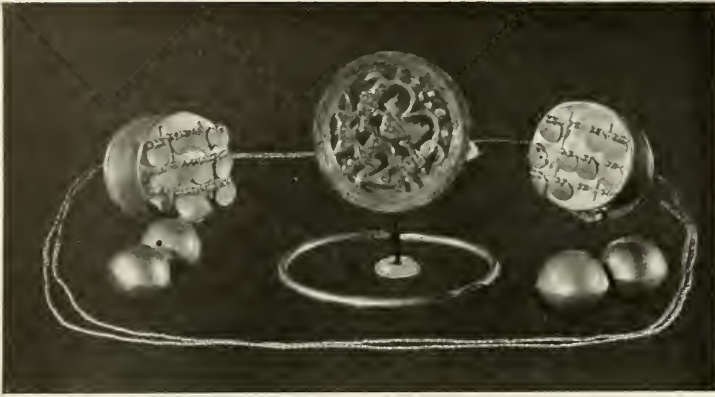
grain of the Indian corn; the censers for the perfumes, the ewers which held the water for sacrifice, the pipes which conducted it through subterraneous channels into the building, the reservoirs that received it, even the agricultural implements used in the gardens of the temple, were all of the same rich materials. The gardens, like those described belonging to the royal palaces, sparkled with flowers of gold and silver, and various imitations of the vegetable kingdom."

An examination of the American Museum's collections reveals many of the small forms into which gold was worked, and these are illustrated in the accompanying pictures. Gold was used extensively as a part of the costume. Large and small discs and thin strips were sewn



NOSE AND EAR ORNAMENTS FROM COLOMBIA

The nose pieces are either circular plates or two-pointed bars. The two series of six pieces in the center were probably sewn on cloth



MISCELLANEOUS ORNAMENTS

The string of small gold beads is from Ecuador and the four large, hollow beads are from Peru. The central ear-plug is from Peru and has a fretwork design. The two ear-plugs with the hanging disks are from Panama

ations are found in the Museum's collection.

Gold had other uses besides costume

on to the garments. Pizarro mentions crowns of gold. The description which Joyce gives of the nobles of the Quimbaya tribes of Colombia, applies equally to the Inca: "The nobles glittered with gold: gold forehead ornaments, gold collars, gold bracelets, gold breastplates and shields, and over all a feather crest set in gold and emeralds."

Nose rings are numerous in the Museum's collection. Most of them are round, flat plates, with points at the top that pinched, or actually pierced, the septum of the nose. Other nose pieces are ring-shaped and some have two conical points which protruded on each side of the nose.

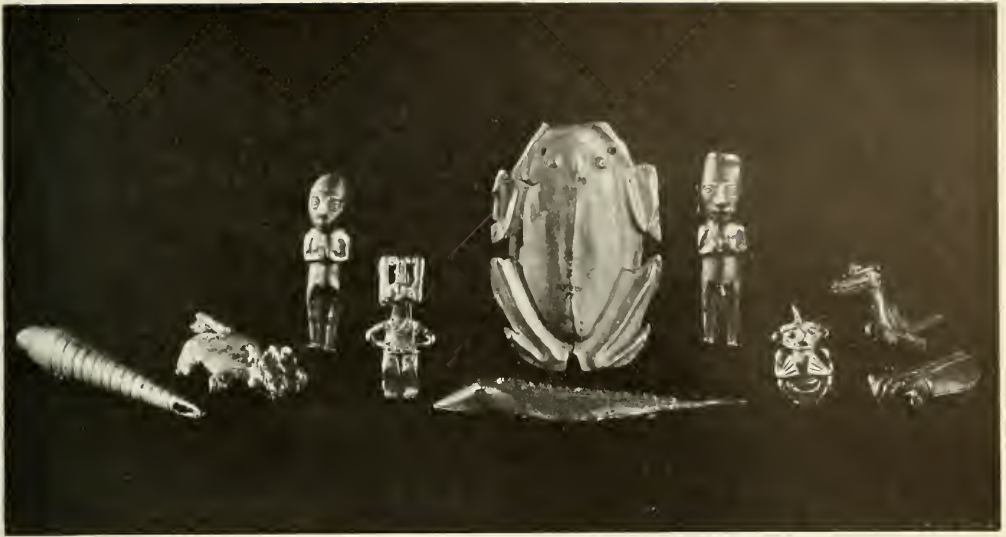
The ears of the ancient Incas were pierced and large plugs inserted. Some of these were like large cuff links, and others were in the forms of rings, plates, cylinders, and spirals of thick wire. Finger rings were popular, made of wide bands of smooth gold. Necklaces were made of small gold beads or of large, hollow, gold balls. Golden pins (*topos*) with flat curved heads were used to fasten shawls as well as for decoration. Similar pins in plume shapes were possibly worn in the hair. Prominent men in Ecuador had small holes drilled in the outer faces of their incisors and small gold plugs hammered in. These were ornaments, not fillings. (Fortunately the artisans were skillful enough to miss the nerves of the teeth.) Examples of all these ornate decor-

ornamentation. The plates from which the Inca ate and the pitchers and goblets at his table were of gold. The polished tweezers with which he carefully plucked his beard were of the finest metal. Many of the implements and tools were at least gold plated. Imitation shells, frogs, beetles, lizards, and small animals were made in gold as shown on page 25. Some are cast and some hammered from gold plate. The two human figures in the same



THIN HAMMERED BREAST PLATES AND PINS

The two large breast plates in the center are from Panama and the figure is from Ecuador. All the other pieces are typical Peruvian specimens. The plume-like pin in the lower right hand corner is suggestive of the large ones shown on page 27



MISCELLANEOUS ANIMALS AND FIGURES

The two human figures are from the Lake Titicaca region and the other objects are from Colombia. Shells, frogs, lizards, beetles, and unidentified animals were commonly fabricated in gold

picture are cast from molds. Such figures are common to the Lake Titicaca region. The casting technique is further illustrated by the herd of llamas seen in the illustration on page 26. Llamas were domesticated by the Incas and their wool was extensively used in weaving. It is, therefore, quite fitting that they should be reproduced in gold.

In 1921 the Museum acquired one of the most remarkable collections of Peruvian gold ever discovered. (Described in *NATURAL HISTORY*, Sept.-Oct., 1921). This collection is now on display in the Peruvian Hall. It consists of twelve pieces of finely finished, heavy gold. There are two pitchers, composed of about 64% gold, 30% silver and 6% copper, made in two parts with stirrup handles and a fish and Z-form design. There are four shallow plates of pure gold. The three plume-shaped objects are similar to others in the known Peruvian collections, but are larger and better made. Finally, there are three collars, two of which are composed of bands of different alloys of gold and silver. These objects are illustrated on pages 22 and 27.

A close examination of these specimens shows that no techniques were employed that the Peruvians did not know. Imperfections and patches on some of the pieces make them doubly interesting. The designs and forms are not unique but are quite consistent with other Peruvian specimens. The Museum has since acquired four more of the shallow gold plates. Early literary sources furnish references to the use of gold plates, pitchers, and collars.

Dr. Ronald Olson visited the locality of this gold on his Peruvian trip for the American Museum, and the discovery of the gold, as well as he could determine it in 1930, is given in his field notes as follows: The gold was found on a hill called "Maltino" a short distance to the north of Huarmey which is located on the Peruvian coast between Lima and Trujillo. There lived in Huarmey an old fellow named Moreno who was very much addicted to automatic writing. Through the spirits he learned that the treasure was buried on the hill, Maltino. (There actually may have been some tradition of buried treasure.) Moreno was digging



FINELY FINISHED GOLD TWEEZERS

Small tweezers of this type were used in plucking the beard. These are too large to serve practically

about the hill and by accident or otherwise set fire to the desert plants called "corazon" which grow thickly over the higher hills, and which, lacking roots,

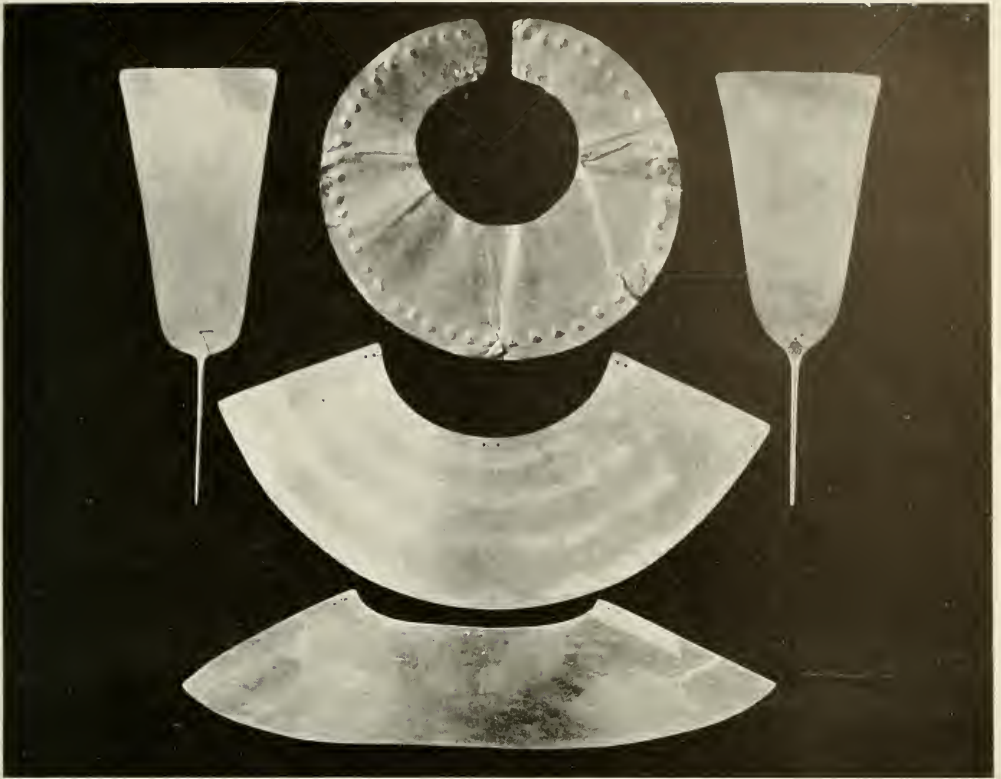
may drift into considerable heaps during the high winds which infrequently occur. Evidently one or more gold pieces were seen after the fire. Moreno found an indefinite number of pieces that year, which he hammered down and sold in Lima. A year or more later, about 1920 or 1921, he returned with an associate. Again the effort was successful and a number of other pieces were found. They worked some three months with several men. Again Moreno hammered down his share, and his associate sold his in Lima. It was the latter quantity that the Museum acquired.

The Peruvians were patient rather than intelligent miners. They excavated caverns in the steep mountain-sides, or followed a vein of metal for a moderate depth, but never sunk shafts. Their tools were of stone, and their knowledge of extracting the gold from the dross with which it was united was decidedly limited. They never made use of quicksilver to effect decomposition. Perhaps the greater part of the gold was obtained by washing the gravels of the mountain streams. They built dams of flat stones across a stream which caught much gold during



A HERD OF GOLD LLAMAS

These specimens all come from the Lake Titicaca region where the llamas were abundant. They were skillfully cast in molds in several pieces and then soldered together



COLLARS AND PLUMES FROM THE COAST OF PERU

The circular collar is from Panama and is illustrated for comparative purposes. The bands on the middle collar are composed of strips containing different alloys of gold and silver. Collars and plumes are of heavy, well polished gold

the rainy season. This was carefully washed out of the gravel with coarse sieves. The patient Indians of Peru can make a living washing the gold out of gravel even today. The great mass of gold found by the Spaniards when they first reached Peru was an accumulation of years. Historians say that each Inca used only new dishes, garments, ornaments, and other gold objects.

The ore was smelted in small pottery furnaces. Small holes in the base of the furnace admitted copper tubes through which the worker blew to fan the flames. Other furnaces, called *huaira*, were larger and tubular in shape. These were about a yard wide at the base and slightly expanded near the top. Holes were pierced in the base and the furnaces placed on the

higher slopes of the hills where the evening breezes fanned the flames with great force and regularity. The ore and fuel were placed inside and the molten metal ran out into a clay receptacle at the base. There were said to have been five thousand of these *huaira* at Potosi at one time, which shows the extent of the gold working.

Bars of pure gold have been found in the Inca country and these were probably used as tribute. However, most of the known gold was shaped by one of the many techniques known to the early Peruvians. With hard stone anvils and copper hammers it was pounded into many forms or flattened into leaf. On page 24 are illustrated some of the pins and thin types that resulted. The ham-



LLAMA, AND SILVER FIGURES DECORATED WITH GOLD BANDS

The figure to the left has had the bands of gold removed, but the grooves show where the bands originally were. The decoration on the llama's back is of gold

mered gold leaf was applied as decoration to many pieces. The shell illustrated on page 29 has a strip of gold leaf around the center as well as two modeled bird heads. Thin gold was hammered on a stone carved in relief and a stamped effect was thus obtained. The two cylindrical pieces on page 29 illustrate this.

Gold was cast in molds. Many varieties of solid gold objects were made in this way. (See page 23 for small figures, and pages 27 and 28 for large objects.) In Colombia, and probably in other sections, the *cire perdue* process was employed. In this a model of the desired object was made in wax over a core of clay and then plastered to form a mold which was baked. Then the wax was run out and the gold poured in. The core and mold were kept apart by small pieces of wood

and the resulting holes in the gold were skillfully filled. Some objects were cast in several sections and later joined together by welding. The solder was simply a different combination of metal with a lower melting point than the pieces being joined.

In Colombia the Chibcha extensively employed the method of amplifying the edges and details of a flat gold figure with gold wire soldered to the surface. (Page 30.) The large nose plug in the center of the illustration on page 23 shows filigree technique which was, however, uncommon.

Many of the larger tools of copper or bronze were gilded. According to Joyce "the leaf may have been hammered on, or the mold may have been lined with leaf before the molten copper was poured in."

BREAST PLATES
AND HAMMERED EAR
ORNAMENTS

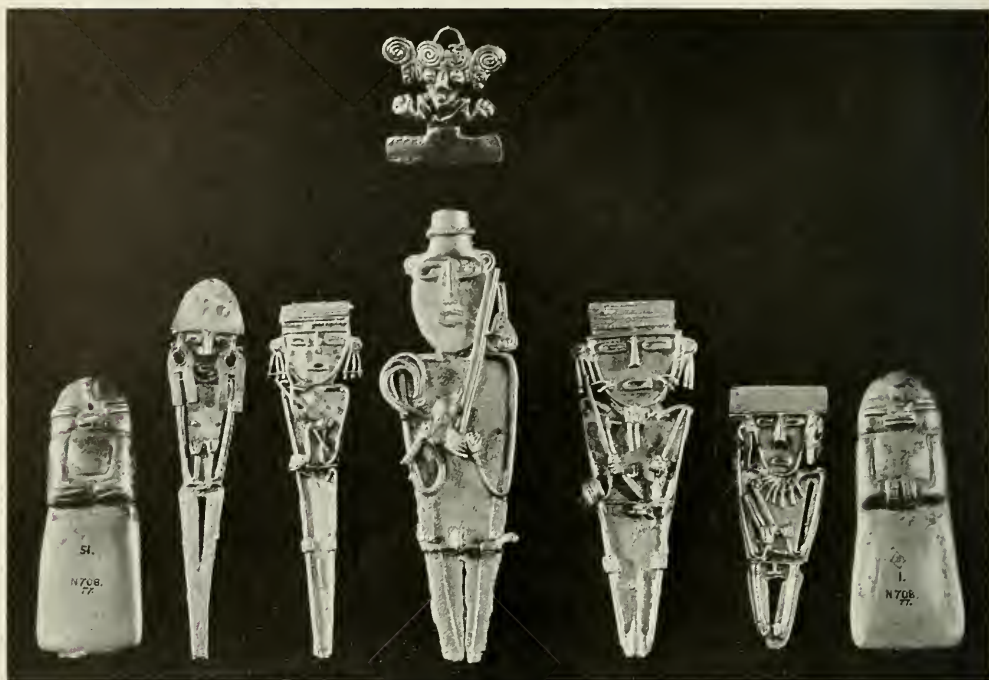
The central plates are from Colombia and are very similar to specimens from Costa Rica. The two cylinders were decorated by being pounded over stones carved in relief



DECORATED SHELL AND
BREAST ORNAMENT

The bivalve to the left has been banded with gold leaf and decorated with two bird heads of gold. Pieces of stone have been inlaid as imitation wings. The gold specimen to the right was possibly a breast ornament





FIGURES MADE BY THE CHIBCHA OF COLOMBIA

These figures illustrate the technique of reëmphasizing cut-out designs with gold wire

On page 28 is illustrated the method of decorating silver figures with gold bands. The gold has been removed from the figure on the left but the grooves are clearly seen. The figure on the right is intact.

The Quimbaya tribes of Colombia were skilled gold workers. Although Colombia was not actually a part of the Inca empire, the gold technique passed beyond the political boundaries. The following quotation from Joyce illustrates the importance of gold in the ceremony of installing a chief. The population "repaired to the sacred lake of Guatavita clad in their finest ornaments of gold and feathers. Innumerable sacrificial fires were kindled on the banks, and the lake was encircled with a cloud of gold-dust. Attended by his four sub-chiefs he (the chief) embarked upon a reed raft ornamented with gold and furnished with four braziers for incense; at his feet was piled a mound of

gold and emeralds, and amidst the shouts of the multitude, and the sound of whistles and other instruments, he proceeded to the middle of the lake. There he plunged into the waters and washed off the offering of gold-dust, and the gold and emeralds were thrown in at the same time, the four chiefs making offerings on their own account."

Colombia is interesting in the study of gold, as it furnishes a link, if not a center, between the Peruvian region to the south and the famed gold working regions of Panama and Costa Rica to the north. Definite contacts between the higher civilizations of South and Middle America are hard to establish, but certainly some of the gold forms have a wide distribution. The two Colombian pieces in the center of the upper illustration on page 29 might well be placed with the Costa Rica collections. The circular gold collar from Panama, shown on page 27, has in many

ways the same idea as that employed in the gold collars from Peru illustrated in the same picture.

The distribution of forms in Peru itself is not particularly enlightening. Casts of llamas and small human figures are localized around the Lake Titicaca region. The Island of Coati, in Lake Titicaca, has some peculiar animal forms cut out of gold plate and amplified with detail etched on the outer surface. The coast region of Peru, on the other hand, has gold worked into some of the more delicate designs typical of the Chimu and Nazca cultures.

The gold work from the Coast has numerous affinities with the Colombian gold to the North.

Any discussion of metallurgy of Peru should not be limited to gold. Silver and copper were used equally extensively, and most of the gold forms are duplicated in other metals. Indeed, much of the Peruvian gold is itself alloyed with silver or copper or both. However, Atahualpa said he would fill the room with gold, and I have tried to describe some of the articles and forms which he may have used in fulfilling his offer.



CAST SPECIMENS FROM ECUADOR

The turtle is from Panama and illustrates the same casting technique employed in the cross-legged human figures with the large nose rings

EARTH AND NEIGHBOR WORLDS

The Sun and Its Children—The Little Cluster of Worlds that
Form the Group of Which We Are a Part

By CLYDE FISHER

Curator of Astronomy, American Museum

THAT the earth was the center of the universe was a common belief a few centuries ago, and a natural belief it was, for it seemed to be proved by observation. The sun, moon, and stars were seen to rise in the east, to pass over the sky, and to set in the west, and then rise again in the east; but after the work of Copernicus it was realized that these were apparent movements caused by the rotation of the earth on its axis.

Although the ancients believed that all of the heavenly bodies in the sky revolved around the earth in perfect circles, the early astronomers were puzzled by the retrograde motion of Mercury, Venus, Mars, Jupiter, and Saturn. Each of these bodies moves part of the time eastward through the sky, and part of the time westward, and on account of this apparent erratic motion, these bodies were called "planets," or "wanderers," as the name signifies.

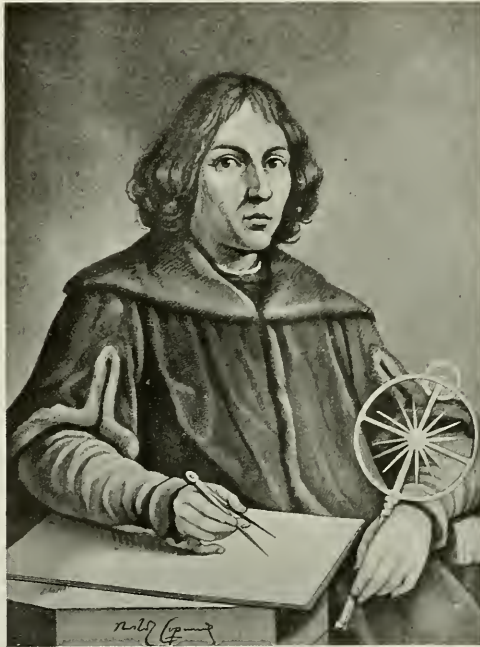
Ptolemy, the great Alexandrian astronomer, in order to explain the retrograde motion of the planets, imagined a

system of epicycles, that is, he believed that each planet moved around a small circle (or epicycle) the center of which revolved around the earth in a perfect circle. And the Ptolemaic system was

orthodox astronomy for more than a dozen centuries, but finally it was abandoned in favor of the Copernican system, which is today universally accepted.

It was less than one hundred years ago that Bessel measured the distance to 61 Cygni, the first star whose distance was ever measured. Before that time it was not realized how closely associated the known planets were to our sun around which they revolved. Now we know the distances to many stars, and

these distances are vastly greater than the distances of the planets from the sun. Using the speed of light as a yard-stick, the closest star, Proxima Centauri (which is about one light-month closer to us than Alpha Centauri) is nearly four and one-half light-years distant. A light-month is the distance that light travels in one month, and a light-year is the distance



NICHOLAS COPERNICUS

The great Polish astronomer, who in 1543, by the publication of *De Revolutionibus Orbium Coelestium*, promulgated the modern theory of astronomy



"NINE PLANETS AND A MILLION SUNS"

From the oil painting by D. Owen Stephens, who has portrayed the night sky in color with great beauty

that it travels in one year; and light travels 186,000 miles a second, or about 11,000,000 miles a minute, or about six trillion miles a year.

In our solar system, light travels from the sun to Mercury in about $3\frac{1}{4}$ minutes, from the sun to the earth in a little more than 8 minutes, from the sun to Pluto in about 6 hours, and from our moon to the earth in about $1\frac{1}{4}$ seconds. So, it will be seen that the dimensions of our whole solar system are insignificant when compared to stellar distances.

However, when we compare the sizes

and distances among our system of planets and their central body, our sun, we are well-nigh overwhelmed. Thoreau said he did not know how far it was to the sun because he had never walked it. He said he did know how far it was down to Walden Pond because he had walked it lots of times.

If one were to construct an old-fashioned Copernican planetarium, and make the distance of Mercury from the sun 10 feet, then the distance of the earth from the sun would be about 26 feet, and Pluto would be nearly a quarter of a mile away. Pluto is more than forty times as far away from the sun as the earth.

The beginner has some trouble to distinguish the planets from the stars, but the matter is easily mastered. It should be remembered that all of the stars are suns. Our sun is an ordinary star, brighter than the rest only because it is so much nearer. All of the stars, including our sun, shine by their own light, that is, they are very hot and incandescent. All of the planets are comparatively cold, and shine only by reflected sunlight. In consequence of this fundamental difference, together with the great difference in distance, stars are said to twinkle while planets do not. But this distinction is not always easy, for in the winter time on a cold, windy night, the planets sometimes seem to scintillate.



SOLAR TOWER AT MT. WILSON

The 150-foot tower telescope from the 60-foot tower. (Courtesy of Mt. Wilson Observatory)

By observing the position of a given planet from night to night, one can, after a time, note that the planet is moving among the stars, and this motion distinguishes a planet from a star. All of the planets revolve around the sun, moving from west to east in a narrow belt in the heavens called the zodiac.

While it is true that there are noteworthy similarities among the orbits of the planets and among the planets themselves, there are also striking differences, as a little survey of our neighbor worlds will show.

Mercury is nearest the sun of the known planets, and consequently receives the most light and heat from the sun. Since the invention of the thermocouple, it has been found that the side of Mercury next to the sun is hot enough to melt lead, and it is believed that this planet always keeps the same side toward the sun, just as our moon always keeps the same side toward the earth. Mercury is the swiftest of the planets, making a trip around the sun in 88 of our days. As Flammarion points out, a centenarian on Mercury has lived but twenty-four of our years.

Mercury has the most eccentric orbit of any of the planets except Pluto and some of the asteroids. This has made it possible to make one of the astronomical tests of the Einstein Theory of Relativity in the movement of its perihelion point, as shown by de Sitter. Mercury is the



THE NORTHERN PORTION OF THE MOON
Age 18 days. Through the 100-inch telescope at Mt. Wilson Observatory, August 7, 1925. (Courtesy of Mt. Wilson Observatory)

smallest of the planets except the asteroids. It is one of two, the other being Venus, that can pass between us and the sun. It is one of two, the other being Venus, that go through all of the phases that our moon passes through. It was the discovery of the phases of Venus and Mercury by means of the telescope that gave the last blow to the old Ptolemaic theory of astronomy.

Schiaparelli, the Italian astronomer, discovered some faint permanent markings on Mercury. Barnard, who is generally considered one of the most



SATURN OVERTAKEN
BY THE MOON

Conjunction of Saturn and the earth-lit crescent moon. (Courtesy of Yerkes Observatory)

nearly the same size and density as the earth, and probably resembles it closely in other conditions.

The atmosphere is so opaque that it is extremely difficult to make out any surface markings. "Large dusky spots" were reported by Barnard, but he got the impression that they were not permanent.

The first person to see Venus as a waxing and waning crescent was Galileo in 1610. The position of science

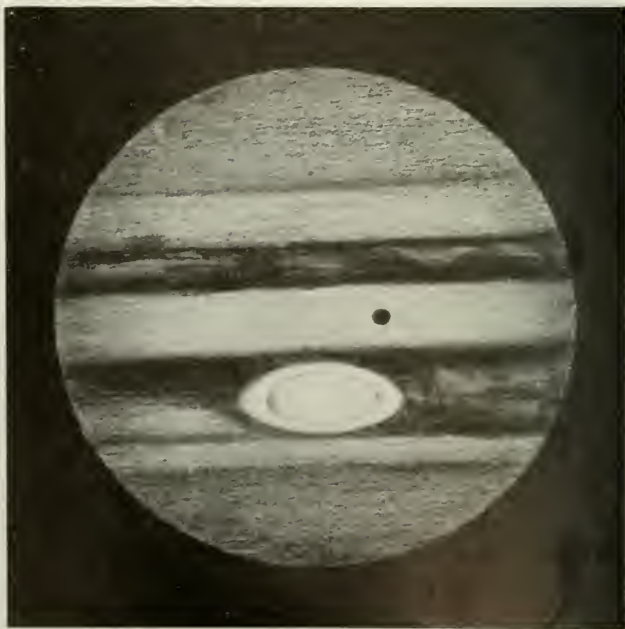
dependable seers among American astronomers, described these markings as "very much resembling those seen on the moon with the naked eye." Lowell drew them more definitely as streaks.

Mercury has little or no atmosphere and for this reason and also because of the high temperature, can have no life as we know it.

Venus is second in order from the sun, and for us is the brightest object in the sky except the sun and moon. When near its greatest elongation, it can easily be seen in the daytime. It goes around the sun in 225 of our days, and it comes closer to the earth than any other of the major planets, approaching nearly 10,000,000 miles closer than Mars. It is very

in those days is illustrated by the fact that Galileo announced his discovery in an anagram.

The transits of Venus were formerly used in calculating the distance of the sun, the method having been first pointed out by Halley. The last transit of Venus



JUPITER

Showing cloud bands, large red spot, and shadow of one of the Galilean moons. Drawn by Barnard. May 26, 1908. Courtesy of Yerkes Observatory)

was in 1882 and the next will be in the year 2004.

Although Venus has an atmosphere, it has not been possible to show that there is oxygen or water vapor present in this atmosphere. Therefore it seems probable that there is no life on Venus as we know it.

The earth is the third planet in order from the sun, and it is the first one that we are sure possesses a satellite. This satellite, known as our moon, is the largest one in the whole solar system in comparison with its primary planet, its diameter being a little more than one-fourth that of the earth.

Several ranges of mountains may be seen on the moon with the telescope, first discovered by Galileo. The most prominent range is known as the lunar Apennines, a range 400 or 500 miles long, and rivaling the Andes of South America in height. Scores of craters on the moon's surface may also be seen with the telescope. These vary in size from very small to as much as one hundred miles in diameter. Two theories have been advanced to account for the formation of these craters, namely, the volcanic theory and the impact theory. The former needs no explanation, while according to the latter the craters were formed by the impact of falling bodies such as large meteorites. The large size of these craters, regardless of how they were formed, seems to be correlated with the



THE PATHS OF THE PLANETS

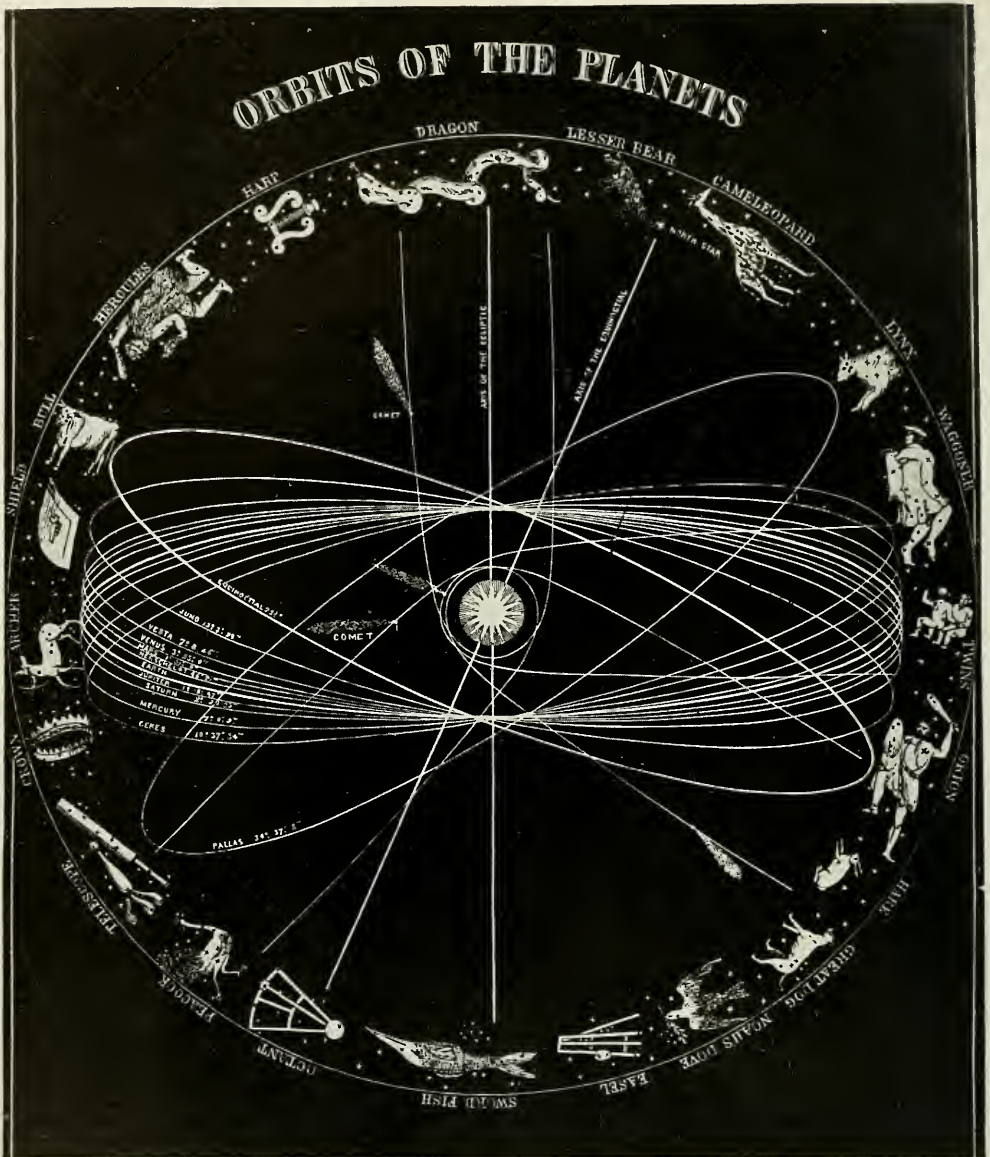
From Smith's *Illustrated Astronomy*, New York, 1851. Here are represented the orbits of the eight major planets then known, a few of the larger asteroids, and three comets. It will be noted that Uranus is known as "Herschel" and Neptune as "Leverrier" in this old text-book

low gravity on the moon. Gravity on the moon is about one-sixth as great as that on the earth. A man weighing 150 pounds on the earth would weigh about 25 pounds on the moon. Babe Ruth could bat a ball six times as far on the moon, and Bobby Jones could drive a golf-ball six times as far. A volcano would throw material six times as far, and a meteorite would splash material six times as far.

Smooth areas of large size may be seen on the moon with the naked eye. These the ancients called seas, but now we know there is no water on the moon, and these surfaces are known to be plains.

The moon is the only heavenly body that revolves around the earth, making the trip in a little less than a month.

Since there is no water and no air on



THE ZODIAC

From Smith's *Illustrated Astronomy*, New York, 1851. The major planets revolve around the sun in a narrow belt in the sky known as the Zodiac

the moon, there can be no life as we know it.

The fourth planet from the sun is Mars, which has about half the diameter of the earth and about twice the diameter of our moon. On account of its smaller mass, gravity is less on Mars. A man weighing 150 pounds on the earth would weigh 57

pounds on Mars. Two tiny moons attending Mars were discovered by Asaph Hall, Sr., in 1877, at the U. S. Naval Observatory. When discovered, these moons were the smallest objects known in the universe, except meteors. The outer one is estimated to be five miles in diameter, and the inner one ten miles.

Mars rotates on its axis in almost exactly the same time as the earth, and its axis is inclined almost exactly the same as that of the earth. Since its axis is inclined and since it revolves around the sun, Mars must have changes of seasons, as the earth has. Since the Martian year is 687 days as compared with 365 days, its seasons must be nearly twice as long as ours. The seasonal changes are very evident in the behavior of the polar caps, which increase in size and shrink in size, as the polar caps of the earth do.

We know more about the surface of Mars than we do of Venus for two reasons; first, because when nearest to the earth Mars has its bright side turned towards us, while Venus has its bright side turned from us when closest; second, Mars has a transparent atmosphere, while Venus has a dense, opaque atmosphere.

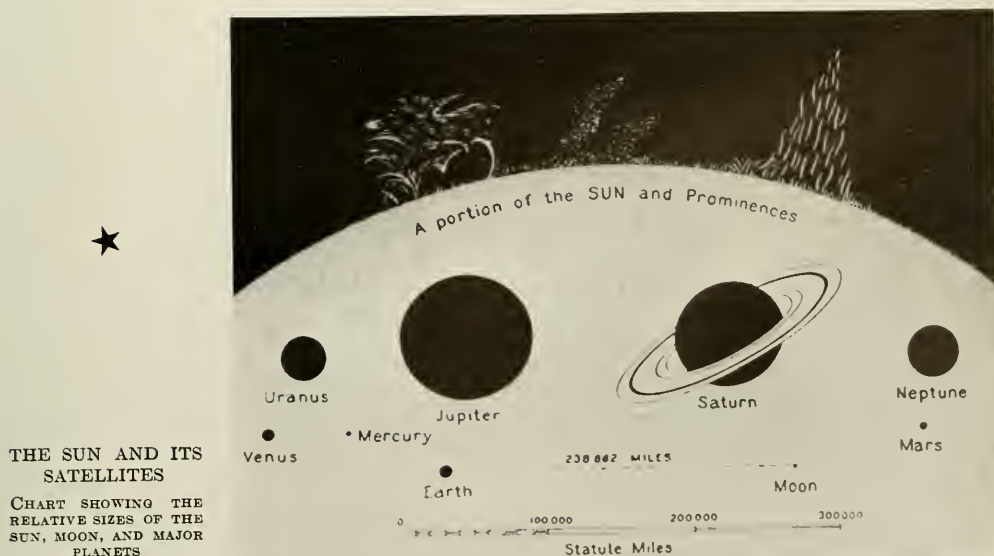
Within the last ten years, it has been proved that Mars has an atmosphere containing oxygen and watery vapor, and it has been proved that the temperature of Mars is high enough to support life as we know it on the earth. Consequently the majority of astronomers now believe there is probably life on Mars, at least plant

life. Since plant life and animal life have developed together on the earth, it is easy to believe that they have probably developed together on Mars.

In 1877, the same year that Hall discovered the moons of Mars, Schiaparelli discovered a network of markings, which he called "canals." Professor Lowell considered these to be waterways constructed by intelligent beings for the purpose of conducting water from the melting polar caps over the planet in an irrigation enterprise. There can be no doubt that there are certain markings on Mars, but the character and extent of these have been matters of great difference of opinion among astronomers.

Between the orbit of Mars and that of the next large planet outside there are found more than a thousand tiny planets called asteroids. One of these, named Eros, comes closer to the earth than any other planet, this close approach being possible on account of the very eccentric orbit. The most accurate means of calculating the distance to the sun is by using the orbit of Eros as an astronomical yardstick.

The next large planet outside of Mars is





JUPITER

Four views: Upper left, March 28, 1920; lower left, February 12, 1921; upper right, March 15, 1921, showing satellite Ganymede and shadow; lower right, May 29, 1922. All photographed through the 100-inch Hooker telescope, the largest in the world. (Courtesy Mt. Wilson Observatory)

Jupiter, the largest of all our solar family. Whether we regard its bulk or its mass, it is larger than all the rest of the planets put together. Gravity is between two and three times as great as on the earth. Jupiter is so far from the sun that it makes one revolution in about twelve of our years. But it rotates on its axis in less than ten hours. For many years it has been known that it rotates faster at the equator than at the poles. Formerly this was thought to be due to a highly heated, plastic condition, but since the invention of the thermo-couple, it is known that Jupiter is cold on the outside, and that it presents only an outer surface of clouds.

Galileo discovered four large moons revolving around Jupiter, which are still known as the Galilean moons. Since Galileo's day five other satellites have been discovered.

The temperature of Jupiter is much too low to support life as we know it.

Saturn is the sixth planet in order from the sun. It is next to Jupiter in size, and because of its unique ring it is considered by many to be the most beautiful telescopic object in the sky. Originally this ring was thought to be hot, and was referred to as the fiery ring of Saturn. By means of the thermo-couple it has been determined that this ring is cold, and that the rest of Saturn is cold. The ring is now known to be made up of myriads of tiny solid bodies or "moonlets." Besides the ring, Saturn has ten satellites.

Saturn is so far away that it requires nearly thirty of our years to go once around the sun, but it rotates on its axis once in a little more than ten hours.

The temperature on Saturn is entirely too low to support life as we know it.

Uranus is the seventh planet, and is the

first ever "discovered." It was found accidentally in 1781 by Sir William Herschel. This planet is so distant that it takes about 84 of our years to go once around the sun. It rotates on its axis in about $10\frac{3}{4}$ hours. The planet has four satellites, which are inclined more than ninety degrees to the planet's orbit, and this makes their revolution retrograde.

Not much is known about the physical conditions on Uranus, except that it is extremely cold.

The next world out beyond Uranus is Neptune, whose distance is so great that it requires nearly 165 years to revolve once around the sun. It has made about one half a circuit since its discovery in 1846. Neptune has one satellite.

In January, 1930, there was discovered at the Lowell Observatory at Flagstaff,

Arizona, a ninth planet, which has been named Pluto. It is so far away from the sun, nearly 4,000,000,000 miles, and it receives so little light from the sun, that the name of the god of the lower world or the god of darkness is most appropriate. Pluto requires more than 250 years to make one trip around the sun. The planet is probably larger than the earth and smaller than Neptune.

After an imaginary excursion from Mercury near the sun, clear out to Pluto so far away that it takes light six hours to reach it from the sun, we shall surely wish to come back to the comforts of earth. Only two members of our solar family, the earth and Mars, seem to support life as we know it, and the climate on Mars is known to be quite boreal.



THE UNIQUE
RING OF SATURN
Drawings of Saturn
showing different
phases with respect
to its ring. (After
Proctor)



Photograph by W. G. Hassler

The "Basilisk"

SHIPWRECKED ON INAGUA

The Adventures and Accomplishments of the Joint Expedition of the Natural History Society of Maryland and the American Museum that Set Sail in the Yawl "Basilisk" in November, 1930, for Scientific Studies Among the Islands of the West Indies

BY GILBERT C. KLINGEL

With Photographs by the Author

SEATED on the ground with our backs against a folding cot, we rested after our day-long labors. Before us the ground sloped away to a gorgeous semicircular lagoon of emerald-green water. Behind, over a bluff and an eighth of a mile away, the surf crashed and thundered over a needle-edged reef. With every roller our wrecked sailing ship, the "Basilisk," rose a bit and crunched a little deeper into the coral.

Two weeks before to the day my companion and I had watched the light-house at Cape Henry, Virginia, drop behind and finally disappear in the dark. For fourteen days we had battered our way through howling winds and mountainous seas, and finally, just at sunset, December 10, 1930, we sighted land after safely crossing fifteen hundred miles of open ocean.

Though only forty feet in length, our tiny ship the "Basilisk" had well justified my pride in her. A replica of a

famous model, the "Spray" of Capt. Joshua Slocum, the "Basilisk" had proved herself a thoroughly seagoing boat. The "Basilisk" was built and outfitted solely for natural history work and was equipped to carry on research among the lesser known islands of the West Indies. But for the unfortunate incident of the wreck, the "Basilisk" would undoubtedly have proved herself most practical for the work for which she was designed. A full description of the yawl appeared in the January-February issue of NATURAL HISTORY.

We hove to about eight miles off shore as the twilight deepened, and went below for some badly needed rest. Hardly an hour before dawn a terrific lurch threw us clear off our bunks. We were on the reef. A heavy sea was running and there was little that we could do. Amid a welter of crashing timbers, foam, and reeling decks, we worked to save our instruments and necessities. Food and water casks were

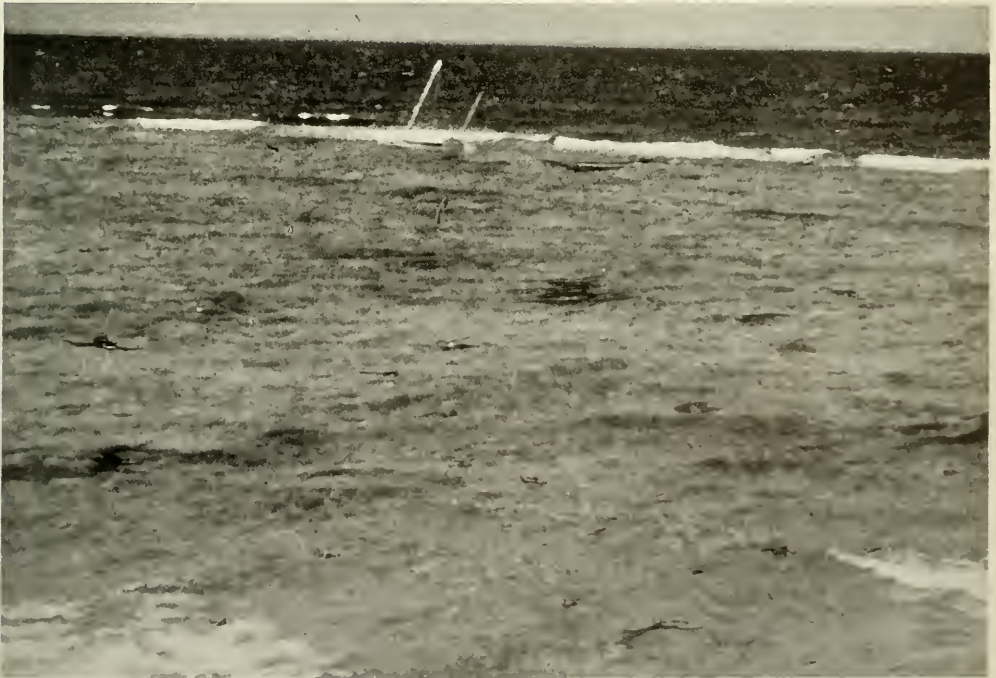
floated ashore first, then a jumble of guns, tents, books, instruments, and general wreckage. By late afternoon we had most of our valuables and working equipment ashore. Thoroughly tired and cut by the sharp coral, we lay down to rest.

After a bit we rose and walked through some stunted thatch palms down to the crescent beach. The scene was desolate, vegetation hardly more than knee high, bare rocks protruding through a thin layer of top soil and a few mangroves sticking their roots into the salty pools. Nowhere were there signs of humans or human habitation. A faint honking came from above and in V-shaped formation a scarlet line of flamingoes circled the lagoon and disappeared in the gathering twilight.

The scene of the wreck was, as we later found, the northeast tip of Great Inagua Island, Bahamas. The second largest

island in the Bahamas group, Inagua is a huge, desolate waste uninhabited save for a small settlement near its southwestern tip and a few huts on the northern coast. It was to the settlement, Mathew Town, that we finally made our way some two weeks later with the aid of a few natives and a couple of rickety Bahaman sloops.

There was no use crying over split milk, our vessel was lost and of necessity our plans had to be changed. We decided to remain on Inagua and make a thorough herpetological survey of the island. In many ways it was a wise decision. As a result the life histories of several lizards were worked out as well as their distribution on the island; several interesting species were discovered; and a large collection of live material was shipped back to the department of herpetology and experimental biology of the American



THE WRECK OF THE "BASILISK"

Lying on the reef off the shore of the island of Inagua. This photograph, enlarged from a motion-picture film, barely shows the masts of the little vessel as the waves pounded her on the coral reef, but it does show clearly the different color of the water inside and outside the reef



FIRST CAMP OF THE SHIPWRECKED CREW

After struggling ashore with such belongings as could be salvaged, Mr. Klingel and his companion, Mr. W. W. Coleman, managed to set up their tent on the wind-swept island. The lagoon referred to in the text is shown in the background



A LIZARD OF INAGUA

Leiocephalus inaguae, basking on a rock in the tropical sunshine. Mr. Klingel made this and the following photographs without the aid of telescopic lenses



HEADQUARTERS

Shipwrecked and discouraged, Mr. Klingel and Mr. Coleman nevertheless determined to continue the scientific work that had led them to the West Indies. It was in this hut that they finally gathered together their undamaged supplies and began their work



ANOTHER SPECIMEN OF *LEIOCEPHALUS*

On a dead palm tree. Many of these lizards were captured and tagged, after which they were liberated as one step in the study of their ranges

Museum for detailed study under laboratory control.

At first we had many troubles. We were hailed into His Majesty's Court by the local Commissioner to explain why we picked Inagua of all places to be wrecked on. Wrecking being a time-honored custom among Bahamans, we had to contend with greedy natives who claimed wrecking fees and so forth, but thanks to the services of Messrs. Branch and Jones of the Imperial Lighthouse Service then engaged in erecting a lighthouse on Southeast Point, our worries gradually smoothed away and we settled down to a regular routine of work.

The island is roughly sixty by forty miles in length and breadth and presents one of the most forbidding and desolate surfaces to be found anywhere. Rocky and flat, barren, thorny and windswept, it offers many difficulties to the traveler.

Fresh water exists only in rocky holes left by the rain and, due to the porous character of the rock, seldom lasts for long.

Our preparations for exploring the island were simple. We purchased a donkey for the magnificent sum of eight dollars; or to be more exact we bought two dollars worth of donkey and six dollars worth of stubbornness. A couple of blankets, several canteens, some tinned beef, and a can of formalin for preserving specimens completed our equipment.

Early one morning we followed a path into the bush and headed inland. For some miles the way led through thickets of thorny and tangled vegetation. A few lizards scampered away among the rocks and frequently we startled small flocks of tobacco doves and wild pigeons. Anolis lizards bobbed their heads at us from near-by tree trunks and now and then a humming bird swooped by. Our donkey



READY TO RUN

Leiocephalus inaguae, alert, with body raised and tail curved over the back, ready to scurry away



THE MOST BEAUTIFUL OF THE INAGUAN LIZARDS

Owing to their extreme shyness, *Ameiva maynardi* were very difficult to photograph. They are found most commonly over the western half of the island

soon acquired the interesting if annoying habit of viciously rubbing his saddle bags against every convenient tree. As we worked inland, the vegetation thinned until finally we burst through the last line of trees. Before us, as far as we could see, stretched a vast plain, flat as a floor, barren and windswept. A thin, straggly line of thatch palms lined the horizon and through them we caught the distant sheen of water.

The coast line of Inagua on the northern and western side is covered with a low, dense layer of vegetation, *lignum vitae* and similar woods predominating, but a few miles inland this gives way to great savannahs. These savannahs comprise the greater part of the interior of the island. During the rainy season they are generally under water. The only inhabitants are the wild donkeys and the huge-clawed land crabs.

Exaggerated stories of the occurrence of snakes on a little island off the northern coast prompted us to visit Sheep Cay.

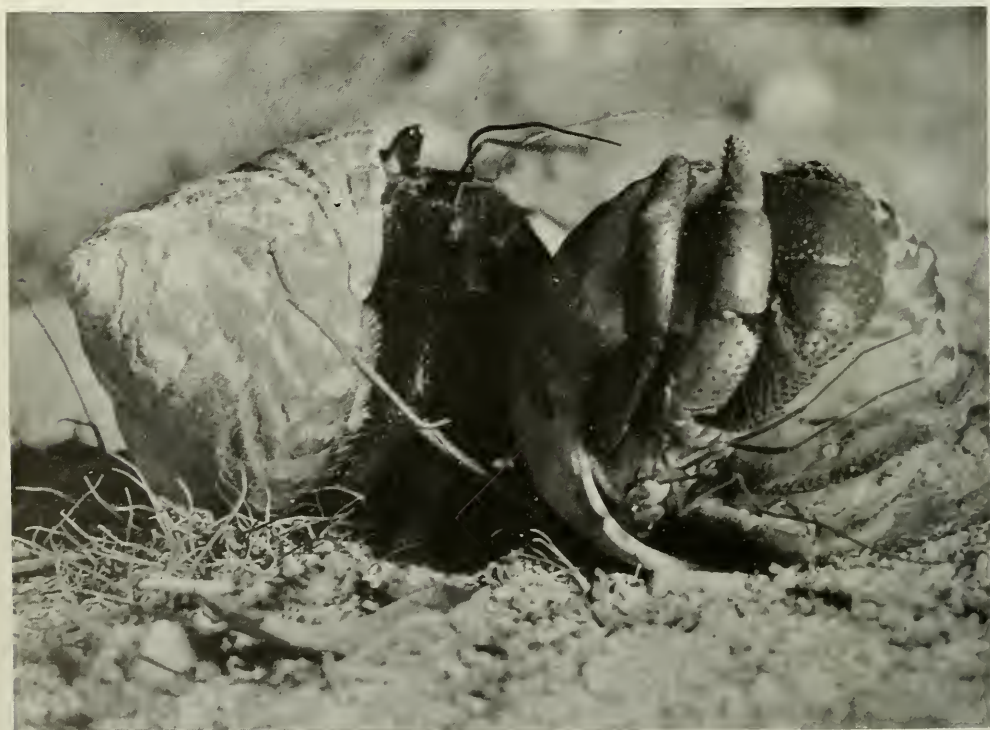
The Cay is about one quarter mile from the mainland and at low tide can be reached by wading, the water coming only to the armpits. About three quarters of the way over, a fin cut the water near us and a good-sized shark slowly circled us five or six times and disappeared. We kept wading but the goose pimples were close and numerous. Needless to say the island was quite devoid of snakes though we did locate some interesting lizards. Coming back we were not molested.

Next day we crossed Union Creek, a shallow tidal basin bordered and studded with huge mangrove growths. Egrets and pelicans flapped from us and little green herons slipped in and out among the arching roots. Here our donkey refused altogether to move. We somehow managed to get him thigh-deep in water but farther we could not budge him. So we tripped him and floated him the rest of the way to the accompaniment of much loud braying and splashing. On reaching



AN ADULT *SPHAERODACTYLUS*

The size can clearly be estimated from the ring. These tiny creatures are among the most common of Inaguan lizards. They come forth in the late afternoon and early evening to feed



HERMIT CRABS

The hermit crabs are active principally at night. These particular specimens were fighting over their shells when their picture was taken with the aid of a flash-gun



EGGS OF LITTLE *SPHAERODACTYLUS*

Large numbers of these eggs were shipped from Inagua to the American Museum. This lot was found among the fibers of a decayed palm. One shell shown has already hatched



DOMINICAN GREBE

A fairly common resident of the lagoons and ponds of Inagua, but very shy and hard to photograph. This specimen was quite wild, and was photographed from a blind

shore he retaliated by biting and kicking and trampling over our wet blankets. A day later I was forced to turn him loose. As I used up the last of our water, we reached a terrible strip of torn and eroded coral country over which the poor beast could not travel. The last I saw of him he was disconsolately making his way inland.

I crossed the bad country on foot, ten miles of it, and a more grueling trip I never had. Eroded coral becomes needle sharp and spongelike in character, pitted with thousands of holes and crevices. The ten miles cut the soles completely off my shoes. Two days later, with badly cut feet, I reached some huts near Northeast Point.

It was here I discovered a very interesting form of lizard. One of the first lizards which had engaged my attention on reaching Inagua was a handsome black species with two vivid yellow stripes down his back. The species is known to science as *Ameiva maynardi*. It had been named

many years before in honor of the naturalist, C. J. Maynard, who had captured the first specimens. The lizard which I found here at Northeast Point was identical in form and structure to *Ameiva maynardi* but was uniform fawn gray in color. Every one has heard of melanistic or albinistic sports appearing in nature, but the recorded cases of other types of pronounced mutation are not so numerous. If color patterns can be suddenly replaced by uniform tones in nature, the degree of divergence in color between two species will not serve as a reliable guide as to their relationships. I felt that in this drab-colored lizard I had made a real discovery, because it illustrated perhaps better than any species previously secured how nature creates new kinds of animals.

A week later I returned to Mathew Town by native boat and began explorations in other directions. The east and south of Inagua were explored on later trips and proved to be even more barren



AT MATHEW TOWN, INAGUA ISLAND

Inagua is an uninhabited waste except for a few huts on the northern coast and a small settlement near its southwestern tip known as Mathew Town



ANOTHER VIEW IN MATHEW TOWN

For three months Mr. Klingel carried on experiments and collected on Inagua before sailing for Haiti and Santo Domingo

than the north and west sides. In many places the vegetation scarcely reached above the knee. The center of Inagua is occupied by a huge lake roughly rectangular in shape and some twenty by thirty miles in area. It is bitter salt, pinkish brown in color from the suspended sediment in the water, and extremely shallow, being at most only six feet in depth. The shores are often piled two and three feet deep in snowy foam whipped off the water by the wind. The lake is the favorite haunt of all the flamingoes of the island. On the far end of the lake is a breeding colony and the great pink birds can be seen at all times wading about the lake. The lake is dotted with hundreds of small islands. We visited a number but found them be to barren and mosquito ridden.

Returning to Mathew Town we took up again a more careful study of the reptile life near at hand. There were lizards of many species including a re-

markable nocturnal lizard which was found to be both a genus and species new to science. The diurnal lizards were abundant and often conspicuously cross-barred with black. Many were captured and, after being tagged with proper identification numbers were liberated at various points with a view to determining if each individual had a "home" territory to which he or she would return. During the breeding season many animals appropriate areas which they defend against all trespassers of their own kind. It is not known how well-established is this home idea in the reptile mind, and it was planned that our work in the West Indies should be to find out not only what species are there but what they do, and to learn, if possible, why they do these things. Our experiments with the range of wandering yielded some interesting results. One lizard liberated with a number attached was found a quarter of a mile away from the point of release only two hours after



A HUMMING BIRD OF INAGUA

This dainty little creature is a male *Nesophlox lyrura*. It is brilliantly colored, with an emerald green back, a gorget of iridescent royal purple, and a breast of soft rose. The tail is reddish brown



ON A FAVORITE PERCH

A female *Nesophlox lyrura*. Despite the thorns, these birds liked to perch on cacti and prickly pear. They were often seen feeding from cactus blossoms

A "HUMMER" ON
THE WING

The camera was too slow to
"stop" the rapidly beating
wings of this little sprite as he
paused in midair to thrust his
bill into a flower of a bitter
aloe



THE INAGUA WOOD STAR

A popular name for *Nesophlox
lyrura*. The commonest and
tamest of Inagua's birds,
they often permitted the
careful photographer to ap-
proach to within two or
three feet





THE INLAND SAVANNAH

The interior of Inagua is like this for miles. It is the home of numerous land crabs and wild donkeys

being freed. It was concluded that some individuals at least may move about considerably over the island.

Other data we obtained were difficult to explain. Of 126 *Anolis* collected at random only nine were females. Were the females hiding at this season or is there a real preponderance of males in the species? If so, the competition for the females must be tremendous. Such competition is believed to have great biological effects tending to produce by selection stronger and in some instances more ornate males in the course of time.

For six months I remained on Inagua studying and photographing its wild life. The egrets, flamingoes, hermit crabs, and my friends the lizards, I will always remember pleasantly. However, the most fascinating creatures with which we came in contact were the humming birds. They were everywhere. Extremely tame, darting here and there, feeding on the cactus blossoms, occasionally lighting on a twig or thorn, chirping in odd notes, and buzzing like bees, they were most entertaining.

There are several species, but the most numerous is one found nowhere else in the world but on this desert isle. Its scientific name is *Nesophlox lyrura* and its nearest relative lives today in Costa Rica, whence the ancestor of the present species may have been driven long ago in a storm. In common with most humming birds it is a beautiful little creature; brilliantly colored with emerald green over the back, gorget of iridescent royal purple and breast of soft rose. The tail is reddish brown.

One breezy afternoon I was seated in the one-room hut that made the expedition headquarters when an angry buzzing against the screen attracted my attention. A "hummer" had entered the open door and was trying to penetrate the transparent screening. I picked him off the mesh, placed him in a near-by lizard cage, and continued writing. I had hardly started, when another began buzzing at the screen. I captured him, too. For a few moments I admired the two gorgeous birds preening their ruffled

feathers in the cage. They were quite composed and went about their feather cleaning most methodically, chirping the while and paying me not the least bit of attention. Even when I picked them up they did not struggle but lay quietly in my hand. After a bit I opened the cage door and allowed them to escape. They flew up into the rafters and began flying back and forth. As I settled back into the chair they seemed to have forgotten my presence. I lay back and watched.

One was perched on a rafter when the other backed the entire length of the hut and rushed headlong at the sitting bird. The impact knocked him clean off his perch but he recovered before he had fallen far and retaliated with a rush. Back and forth they swooped, wings a blur and squeaking and calling in trilling crescendoes. Suddenly, as if a truce had been declared, the two sat side by side on a convenient beam and carefully preened and combed their ruffled feathers. The open door and myself were ignored. The battle, if battle it was, started again. I watched fascinated. The impacts of

their meetings were terrific. Again the birds rested.

Half an hour later they were still at it when I left for dinner. The door was carefully left open so they could escape.

On my return I looked in vain among the rafters for the birds. They were not there. My eye fell on the cot. In the center was a tiny fluff of bedraggled feathers. It was one of the "hummers." The bird was still alive but very weak. It lay quietly in my hand but sent up series after series of discordant squeaks. I perched him on the edge of a prickly pear blossom. The bird drank once, twice, rested, and very weakly flew between two large cactii and out of sight.

After three months on Inagua I felt my work there had been completed, and early in March set sail for Haiti. En route to the United States, I paused at Santo Domingo for several weeks of profitable collecting. Despite the unfortunate end of the "Basilisk" we were able to ship more than 2000 specimens from Inagua and Santo Domingo to the American Museum.



THE GREAT INLAND
LAKE, INAGUA



Frightened Tarpon Making a Curving Leap into the Air

FISHES OUT OF WATER

Some of the Interesting Creatures That Leave Their Natural Element on Occasion To Invade the Realms of Land and Air

By FRANCESCA LAMONTE

Assistant Curator, Department of Fishes, American Museum

WITH FIVE DRAWINGS BY D. M. BLAKELY

THE dictionary defines a fish as "a vertebrate animal with gills retained through life, breathing and passing its life in the water." The ordinary fish does take oxygen into its blood from the water, by means of its gills, and the greater number of fishes are unable to live for any length of time out of water, or at least out of considerable moisture but, as usual, there are exceptions to the rule. There are extraordinary fishes,—fishes equipped for breathing atmospheric air, suffocating if they do not get this air, and passing part of their life out of water.

We may arbitrarily divide such fishes out of water into those able to leap or to fly above the surface and those that have accessory breathing organs and can breathe both air and water. In the first, and to us more familiar, group are the fishes that leave water for air,—the sailfish, swordfish group, the tuna, tarpon, salmon, etc. In the second group are those fishes that leave water to go on land,—the climbing perch, snake-head, mud-skipper, etc.; those fishes that are unable to get along merely on the oxygen supplied by the water, and must occasionally breathe air to live.

The fish that leap and fly generally do so either because of pursuit, or some other disturbance of the water which frightens or excites them, or because they are battling current or falls to reach their spawning grounds, as in the case of the salmon. Some of them, the tarpon for instance, seem to enjoy leaping from the water as a sort of a game. Using their strong body muscles in a powerful upward rush through the water, with a final push of the tail they clear the surface in a curving leap into the air. The tarpon, swordfish, sailfish, tuna, etc., make their most spectacular leaps when they are fighting for their lives against the sportsman's hook. The gray mullet and a few others also leap from the water when fleeing larger hungry fishes. Their leap is rigid.

Even the devilfish, *Manta*, with its enormous wingspread and its weight of some thousand pounds, has been known to rise above the water five feet or so in an awkward, twisted leap, flopping down again on the water with tremendous noise.

The iridescent blue and silver of the marine flying fish is familiar to many of us who have been through the Gulf Stream. These fishes, so like airplanes in con-

struction, take off from the water by means of their tail, rise to about five feet, and then skim through the air like a glider for fifty or a hundred feet. This is the average flight, but they often rise high enough to come aboard a steamer, and they have been known to fly a quarter of a mile. There is another less familiar flying fish in the fresh waters of South America. This is *Gasteropelecus*, a small, deep-bodied fish which can fly for five or ten feet.

The salmon is probably best known among the fishes whose exit from water is part of a dogged fight to obey that impulse carrying them from the waters in which the greater part of their life is spent to their spawning grounds in other waters. This urge carries the salmon upstream on its long journey from the sea. Neither current, rapids, rocks, nor falls stop its progress until it arrives bruised and spent in the pebbly, clear waters where it spawns. Its leaps from lower water up falls have been seen to exceed twelve feet. It often attempts heights beyond its power, falling back exhausted from the unsuccessful leap.

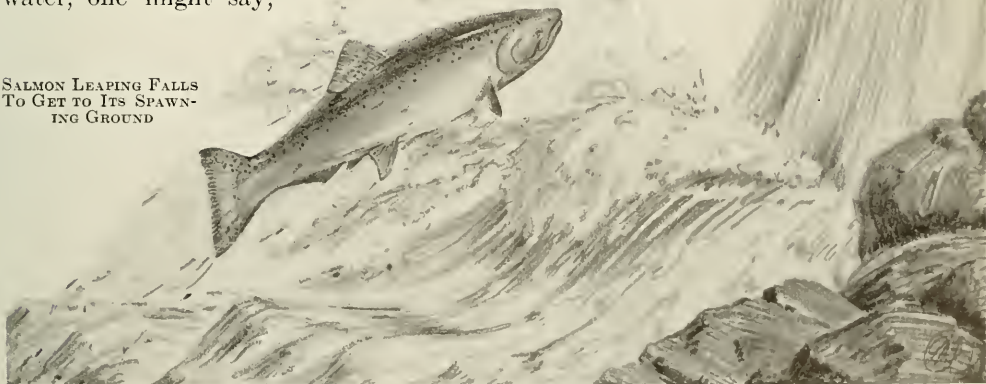
These and a few other fishes are able to spring out of the water and remain in the air as long as their initial take-off and the air will support them. For their departure from their natural element they depend on their strong body muscles and tail fins. They leave the water, one might say,

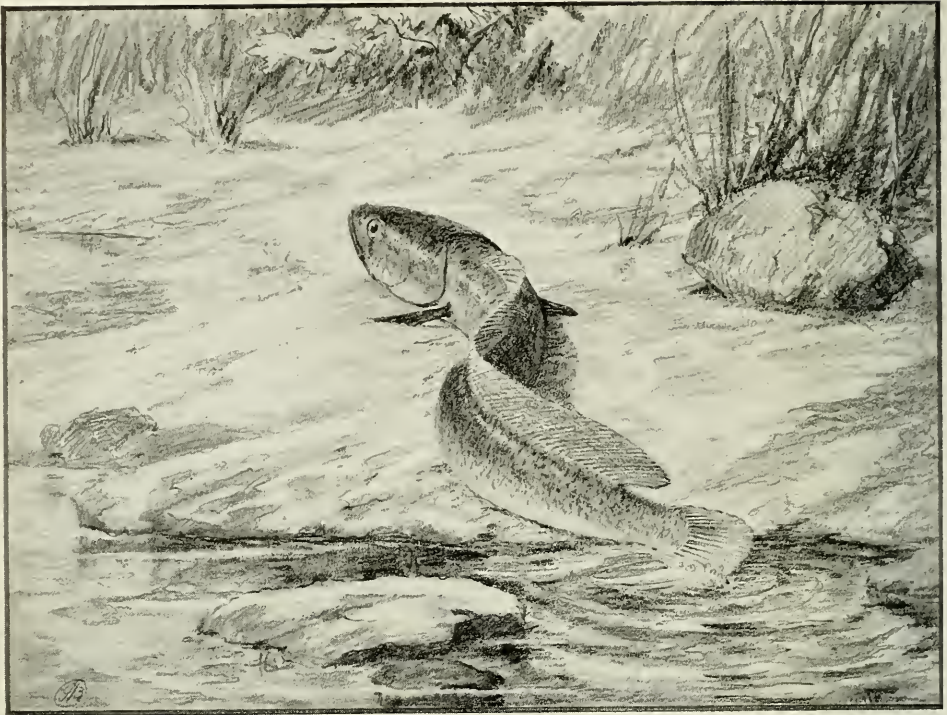
more or less voluntarily, not of necessity, and could not live without its moisture from which, and from which only, they draw their oxygen supply.

Far more remarkable than these are the fishes that are at home and at ease out of water, that is, the fishes that can breathe and progress on land. These animals have developed various kinds of accessory air-breathing arrangements, ranging from the simple pharyngeal pouches—mere hollows lined with a membrane containing blood vessels—of *Amphipnous* to the complicated, lunglike organs of the lung-fishes. In addition to these organs, these land-going fishes have adaptations for locomotion out of the water, such as the particularly strong development of the pectorals in *Periophthalmus*, the gill-cover spines of *Anabas*, and the eel-like body of *Amphipnous*.

Doubtfully in the class of "amphibian fishes" is the common eel, sometimes credited with overland progression from one body of water to another. It is, however, certain that this fish is extremely tenacious of life, and possible that the necessary amount of oxygen for breathing

SALMON LEAPING FALLS
TO GET TO ITS SPAWN-
ING GROUND





SNAKE-HEAD BEGINNING A LAND JOURNEY

During the dry season this large tropical fish buries itself in mud and remains torpid until the rains come again

might be taken in through the skin if the fish goes out of water but remains in dampness, such as damp grass.

Anabas scandens, "the fish that climbs trees," is, in all probability, greatly over-rated as an athlete. This native of the fresh waters of India, Ceylon, and the Malay Peninsula, has air-breathing organs on either side of its head and does crawl out of the water and invade near-by gardens in order to gather earthworms and other food. It progresses on land by sticking the sharp spines of its spread gill-covers into the ground, meanwhile pushing with its pectoral fins in a rowing motion, first one, then the other, and aiding with the tail. Level-headed observers have reached the conclusion that, although it has been found more than once in trees, it has arrived there through no effort of its own, having been picked up from the ground by hungry birds and by

them deposited for future consumption on its lofty perch.

In the same family group with the climbing perch is the snake-head, *Ophiocephalus*, a large tropical fish sometimes three or four feet long, frequently carried around by Indian jugglers who exploit its ability to walk on dry land. It is necessary to keep its traveling container tightly covered, or in between performances the energetic creature clambers out of the box and continues its journey independent of the juggler. This adaptable fish can also bury itself in mud during the dry season and remain there torpid until the rains come again.

Cuchia (*Amphipnous*), another Indian fish, is apparently happiest living like a snake on the damp land of the water edge, rather than in the water itself where it has to rise to the surface very frequently to get air. This fish moves chiefly by



MUD-SKIPPER IN A MANGROVE SWAMP

Using its pectorals almost like arms, the mud-skipper manages occasionally to work itself up quite steep inclines

wriggles of its eel-like body. It does not confine its attention entirely to the water edge, but has been found traveling along dry roads.

The river mouths of Asia and Polynesia are the homes of one of the most entertaining of fishes, the mud-skipper, *Periophthalmus*. While out of water, the mud-skipper keeps its gill cavities well filled with air, and it is probable that there is some absorption of oxygen through the skin when touching water. Due to the strong muscular development of the base of the pectorals, *Periophthalmus* is able to use these fins both as organs of propulsion and as elbows to lean upon. This fish is in the habit of advancing some distance up mangrove roots and branches. Perhaps this could be called climbing, but as the mangrove is more or less banyan-like in manner of growth, the advance is really more horizontal than

vertical. However, by means of using its pectorals almost like arms, the fish does manage occasionally to work itself up quite steep inclines. It is not a timid fish; Day, in his *Fishes of India*, tells us that when his boat was moored along the side of a Burmese river, he sometimes saw these fishes crawl up to the boat rope and even on to its sides. The name mud-skipper comes from the animal's agility in skipping around mud flats, snapping at flies and other insect food. It is also fond of sitting on rocks to sun its rainbow-hued little body, its tail usually partly in the water, the elbow-like bend of the pectorals and its fat, pop-eyed head giving it an air of observant impertinence.

But most interesting of all this air-breathing group are the lungfishes. Their air-breathing apparatus is much more like that of higher vertebrates than is that of any other fish. Take, for instance, the

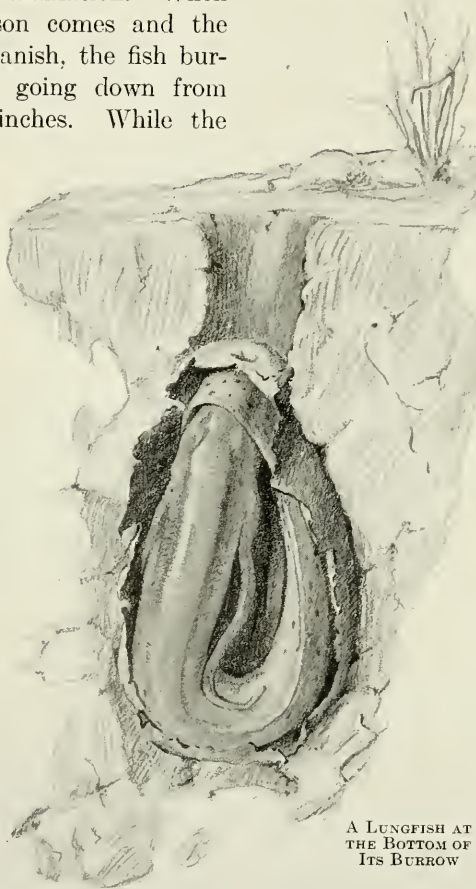
lungfish *Protopterus* which lives in the rivers and lakes of Africa. This fish not only breathes both air and water, but also has the power of something closely resembling suspended animation. When the annual dry season comes and the waters of its home vanish, the fish burrows into the mud, going down from twelve to eighteen inches. While the mud is still moist and soft, *Protopterus* travels up and down the burrow to breathe air at the surface. When the last water vanishes and the mud begins to harden, the fish coils itself at the bottom of the burrow in the tightly curled-up position shown in the accompanying illustration, head pointed up the burrow; tail wrapped over the snout. It then covers itself with a cocoon of slime from the skin glands, which, drying, becomes papery in substance. This cocoon is sucked back into the mouth like a small tube, and through it the fish can do whatever breathing is necessary. In this position *Protopterus* estivates through the long, dry season, unless it is unlucky enough to be dug up

by the natives who like to eat it. When the rainy season softens the mud, the fish wakes up and is set free again.

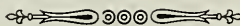
In 1912, a *Protopterus* was sent to the American Museum from Gambia in a large lump of dried, hardened mud from the bottom of a stream bed. On its arrival at the Museum after months of traveling, the dried earth was chiseled away, exposing the cocoon-enveloped fish. It was then placed in tepid water and in a few minutes the cocoon showed signs of life and soon the living fish emerged. This was exhibited for some time in an aquarium in the Museum.

A few other fishes belonging to the air-breathing division have not been discussed here because, although they come

to the surface to breathe air, they do not come farther out of the water. They do, however, share the strange characteristic of the "amphibian fishes" who, although their home is in the water, must occasionally breathe atmospheric air or drown!



A LUNGFISH AT
THE BOTTOM OF
ITS BURROW





Ruins at Gondar, Northern Abyssinia

THE HEIGHTS OF THE SIMYEN

Northward Across the Abyssinian Plateau to the Edge of the Great Escarpments—
Collecting Ibex for the Field Museum Among the Cliffs of Ethiopia

By ALFRED M. BAILEY

Director, The Chicago Academy of Sciences

PHOTOGRAPHS BY THE AUTHOR

So far as was known, the Simyen Mountains, forming the northern boundary of Abyssinia, had never been visited by Americans and had not been thoroughly worked for zoölogical specimens, when the Field Museum of Chicago and the Chicago Daily News organized an expedition to cover the region. The party, led by Dr. W. H. Osgood, zoölogist, and including the late Louis A. Fuertes, artist and ornithologist, James E. Baum, Suydam Cutting, and Alfred M. Bailey, left Addis Ababa and traveled northward across the plateau that terminates in the precipitous ranges of the Simyen. Mr. Bailey wishes to express his appreciation of the courtesy of Director S. C. Simms of the Field Museum and of Doctor Osgood for the privilege of publishing the following story of this expedition.—THE EDITORS.

OUR caravan of thirty men and sixty mules had plodded northward across the Abyssinian plateau day after day; travel was necessarily slow, for Ethiopian roads are merely trails worn in the ground by the feet of men and beasts of burden, and a good day's journey rarely exceeded fifteen miles.

Three thousand feet below us we could see the waters of the Blue Nile—the waters which, through the centuries, have been depended upon by the people of Egypt. The distant cañon walls were visible through the bluish haze,—and

three days later our tired pack animals scrambled or were pulled up the rocky paths to the plateau of fertile Gojjam. This province is ruled by Ras Hailu, the most powerful chieftain of northern Abyssinia, and we were royally entertained by him while in his country.

We hunted with Ras Hailu, with hundreds of his men as beaters, and he gave a great raw-meat banquet in our honor. Finally, however, we made our escape from his hospitality.

We had now been more than two weeks on our way northward from Addis Ababa,



THE MEMBERS OF THE FIELD MUSEUM EXPEDITION

Alfred M. Bailey, James E. Baum, Louis A. Fuertes, W. H. Osgood, and Suydam Cutting are shown here with a group of Abyssinians on their expedition to the Simyen Mountains. They made up the first American party to visit this district

the picturesque capital of Ethiopia, which is centrally located on the great plateau that ascends abruptly from the low countries bordering the Red Sea on the east, and the Sudan on the west. The plateau rises gradually to the northward to an elevation of approximately 15,000 feet, ending in a series of precipitous escarpments which drop to the valley of the Takazze River 11,000 feet below. The rugged ranges which form this northern boundary of Abyssinia are known as the Simyen Mountains. The bases of the cliffs are masses of tropical vegetation, and their crests are crowned with alpine growths; chilling winds and cold fogs sweep the summits, and torrential rains send waterfalls cascading down the stupendous heights during many months of the year—rains which flood the rocky caverns and prevent all travel.

It was at Ras Hailu's stronghold that our party divided, for Doctor Osgood and

Mr. Fuertes were to work northwest along the left shore of Lake Tsana, while Baum, Cutting, and I started for the heights of the Simyen to hunt walia, the Abyssinian ibex, and to become acquainted with the people who were supposed to be the mysterious Falashas who lived in the remote highlands. Our destination was still a month's journey ahead, over difficult trails. Ras Hailu offered many suggestions and gave us letters to the chieftains of the north, and then, as our route lay near a village he desired to visit, asked that we meet him there.

That night at the village of Deema was a memorable one, for we were encamped on a rain- and wind-swept slope. Ras Hailu was our guest, and we sat up until the small hours listening to the stories of the early days of Abyssinia, while his poor retainers huddled outside and secured what shelter from the storm they could. One of his anecdotes comes

to mind. When Ras Hailu visited England with Ras Tafari, now emperor of Ethiopia, they were entertained by the King of England. Hailu sat near the King and he was asked, through an interpreter, whether he spoke English, French, German, or Italian. On his reply that he did not, King George said that he was sorry, for he should have liked to dispense with the interpreter and converse directly with him. Hailu asked to make reply, and being granted permission, asked if King George spoke Amharic, Galla, Guargic, or Shankalla, and on the King's smiling reply that he did not, the Ras said that he also was sorry, for he should have liked to speak directly with the King!

The following morning Ras Hailu came to our camp with a big following, and we talked for an hour while our men were packing.

Then the mighty Ras, with the power

of life and death over thousands of people, shook our hands and rode away with his retinue of white-shammaed footmen trailing after,—about as picturesque a highland chieftain as one will see these modern times.

On trek! It seemed good to be moving toward our goal, the Simyen. The trail led over the typical rolling plateau country, with the great cloud-capped Choke Mountains on our left; we wound through one great wheat field after another, up hill and down; occasionally we passed little clusters of tukels with herdsmen caring for their flocks, or encountered small villages with the customary gentlemen of leisure reclining in the shade of wide-spreading fig trees. After three hours we came to the settlement of Debra Werk, a picturesque town on a high hill; there were many stone granaries for the storing of wheat, and on the summit, amidst the grove of cedars, was an ancient



THE EXPEDITION CROSSING THE BLUE NILE

The river flows in a cañon three thousand feet deep, cut through the plateau of northern Abyssinia



THE STOCKADE AT AYALU'S HEADQUARTERS
Dejasmach Ayalu, a powerful native chieftain who is the feudal lord of a great section of northern Abyssinia, dwelt in the protection of this crude defense wall

church. I asked the age and received the reply, "It is older than man remembers." The majority of Abyssinians are Christians, and the walls of the churches are decorated with gory pictures representing martyrs having heads and sundry other portions of their anatomies removed. A favorite, to be found in most of the wayside places of worship, is that of their patron saint slaying the dragon.

Two days' journey brought us to the village of Mota where there is a church several centuries old,—the usual circular type, with the floors and walls polished from contact with generations of bare hands and feet. The old priest in charge, named Mamur Kumfu, was a picturesque patriarch, and he was evidently a power in the community for he promptly secured negadis (mule men) for us without the usual delay. He was much interested in America and, as elsewhere in Abyssinia, one of the first questions pertained to

prohibition. He had a kindly smile and a sympathetic attitude toward us in his questioning, as though he were speaking to children. He said he understood that we in America believed the earth to be round, and on our reply in the affirmative he shook his head sadly and said, "We people of Abyssinia have known for a long time that it is flat."

We made a short trek over a sterile, rocky plateau, our trail gradually descending until we pitched camp on a level, uninviting spot named Shamat, at an elevation of 7500 feet. The Blue Nile flowing from Lake Tsana makes a great bend, and we were now on the south rim of the upper part of the loop; the valley seemed very wide and the drops not so precipitous as we had encountered on the lower crossing.

We were away on an early start the next day, that we might end our trek before the intense heat of noontime, and the trail led gently down until the last



RAS HAILU IN CEREMONIAL ROBES
Feudal ruler of the fertile Gojjam district and one of the most powerful of Abyssinian chieftains

drop which was very precipitous, the narrow, stony path twisting back and forth. As each mule slid downward, it seemed the packs would topple the animal over. The river itself is about forty yards wide, very deep and swift, and is confined between upright walls. An ancient stone bridge, built by the Portuguese about 1650, crosses the Nile at this place. It was repaired by the former King Menelik, and later by Ras Hailu. The influence of the Portuguese is shown in northern Abyssinia, for they entered the country in the Sixteenth Century and brought the art of stone masonry. In consequence, there are many bridges, old churches, and other buildings, mostly now in a poor state of preservation, scattered throughout the upper provinces. The most impressive of all the buildings erected through Portuguese influence are the palaces and fortifications (now in ruins) at Gondar.

The altitude of the river is 4400 feet,



TYPICAL VEGETATION IN THE SIMYENS

The bases of the cliffs are masses of tropical vegetation, and their crests are crowned with alpine growths; chilling winds and cold fogs sweep the summits



Photograph by W. H. Osgood

LOUIS A. FUERTES

With Ras Hailu at a raw-meat banquet given by the chief in honor of the visiting Americans

so we had dropped a little more than 3000 feet from our camp, and probably an additional thousand feet from Mota.

We climbed the steep ascent on foot the following day, our riding mules scrambling after us, and finally reached the summit at 7300 feet, although there was a gradual rise of the plateau beyond. Another province had been reached, that of Amhara, governed by Ras Guksu, and a custom man awaited us—that bane of all overland travel throughout Ethiopia. Owing to our letters we had no difficulties, however. The trail led over rolling hills through very rocky country, the whole landscape being covered with lava boulders. It was a most uninviting region, the few little villages being on treeless, sun-blistered hills.

The following day proved more interesting, for we traveled through a beautiful valley with a fine crystal stream which flowed over small falls, leaving deep,

shaded pools lined with giant fig trees. Beautiful white paradise flycatchers flew among the branches, their long tails trailing after them like wind-blown ribbon, and in a little bend we surprised a yellow-billed duck and her brood of young. We gradually ascended to 8300 feet, and in the distance could make out Lake Tsana, many miles away. The trail dropped abruptly through a rather thickly settled region. We passed a large church in the midst of a thick grove and made camp near a fine stream, at a place called Mahagey.



AN ANCIENT TOWER AT GONDAR

In the valleys and on the hills are impressive ruins surrounded by walls with portholes in protective towers that project above the enclosing vegetation

The only trouble we encountered from custom officials was two days later, when traveling along the Gumara valley, a wide, flat expanse lined with rugged hills. We presented our papers, as usual, and the Abyssinian looked them over with apparent indifference and returned them to us, saying that his master was Ras Guksu, that Ras Tafari had nothing to do with his country, and we should have to pay heavy duty. We had no letter from Ras Guksu, but some days before we had sent runners to him to apologize for not calling on him at his capital of Debra Tabor, and asking that he grant us permission to travel in his country. We felt that Tafari's papers were all that was necessary, but as a matter of policy we always asked the local chieftains for their help. Abyssinians are apt to be like lighted firecrackers—they explode suddenly. When our custom man and his retainers grew insistent that we pay heavy duty for the privilege of passing over his trail, and rustled his gun significantly, we pitched camp in a favorable spot, and Baum, with his syce, started off for Debra Tabor for a personal interview with Ras Guksu. The customs man then grew alarmed and decided that possibly he was in error, and sent runners asking Baum to return. But about that time a couple of Ras Guksu's soldiers were met, who were on their way to accompany us to the Simyen. They had been ordered to facilitate matters for us in every way,—to see that provisions were supplied, and that all our wants were attended to. The first official act of our chief guide, a practical looking old codger astride a



A REMINDER OF DEPARTED GLORY

This old structure seems to belong in Europe rather than in the heart of Africa. Little remains of Gondar's once important position. The imposing buildings have fallen into decay and vegetation grows upon the walls

sturdy mule, his big toes thrust through small iron rings which served as stirrups, and an immense curved sword trailing beyond the extremities of the mule, was to place our customs man in chains.

Our "victualer," as we learned to call the petty officer who accompanied us, was a hustler, and in spite of our protests, insisted on throwing into chains anyone who failed to deliver the grain for our mules. As a consequence, our caravan was usually accompanied by a few prisoners. We managed to have each set liberated after a day or so, however, and no harm was done.

We camped a mile from Lake Tsana along a little slough, and in the morning were treated to a beautiful sight in the flight of birds—hundreds of many species, including Egyptian and knobbed geese, egrets, and white herons, black and sacred ibis, shore birds, many ducks, and several sea eagles. On trek, we skirted the lake, a shining body of quiet water

with great rafts of white pelicans and geese swimming a short distance off shore.

Two days later, after traveling across a rather sterile, rolling region, we pitched camp at the foot of a large hill upon which is built the city of Gondar, the largest trading center of northern Abyssinia. Gondar is chiefly noted, however, for the ruins of old castles which crown the hills—old fortresses which have seen a great deal of fighting. Their origin is not so romantic, however, as we were led to believe.

The Portuguese are undoubtedly responsible for the wonderful ruins near Axum, but according to C. F. Ray in his book *In the Country of the Blue Nile*, credit must be given to King Fasiledes, the Abyssinian who reigned between 1632–1665, for those of Gondar. He expelled the Portuguese from his country in the early part of his reign, and built the medieval palaces which are now in ruins—due to "fire and sword." Gondar has

had stirring times. Fasiledes made it the foremost city of Abyssinia during his reign, with a population of about 30,000 people. Now, however, it is merely a cluster of tukels upon sterile, precipitous hills, with the imposing ruins the sole reminder of the past.

We were content to leave the city behind us. Two days' travel over fairly good, if precipitous trails, brought us to the stronghold of the most powerful of the far northern Abyssinians, Dejasmatch Ayalu. Our way led over a gently rolling plateau, dotted here and there with tukels and groves of acacias. Off to our left dropped a great escarpment, while in the distance ahead we could make out a prominent triangular peak, with the Simyens looming faintly far beyond. We had sent a runner ahead to advise Ayalu of our coming, and when we were within a few miles of his headquarters, we were met by a small delegation of white-clad men who brought word from their ruler. They said they had been ordered to lead us to a good camping site, and that Ayalu requested that we should wait until the next day to come to his city of

Davart, and we were gently reprimanded for not giving him an earlier warning of our arrival, as he wanted to bring his men in from the surrounding country to give us a proper reception.

We heard trumpets in the morning, and saw a band of thirty white-robed Abyssinians coming over the level plateau at breakneck speed. They pulled their horses to a standstill before our tent, and we realized that they were our official escort, so we climbed upon our jaded mules, and with our boys following with every gun they could muster, started on our visit to Ayalu. Near the great hill upon which the village stands, we passed between rows of soldiers in khaki uniforms, with belts of cartridges dangling from their shoulders, and wound up the steep trail to a formidable stockade of upright poles erected on a stone wall. The rails were lashed together with vines, and a protecting series of poles were thrust at right angles to prevent one from scaling the walls. Inside were fully two thousand men drawn to attention—a motley collection armed with guns and cutlasses. We rode through this courtyard into another and dismounted to pass through the final gate.

The house was the usual circular type, but of two stories, and we were met by the Dejasmatch on the porch. He proved a man of medium stature, rather heavy, and soft-handed, as is usual with the chieftains and priests who do little manual labor. Two machine guns were mounted at the entrance of the building, and men were stationed there in readiness, while the whole courtyard was



ON THE RIM OF THE ESCARPMENT

This vast depression, suggestive of the Grand Cañon of the Colorado, is the home of the ibex. The natives are carrying ibex specimens collected by the expedition

overlooked by small towers in which were stationed guards with machine guns. It was evident that Ayalu intended to protest any uprising. We entered a large room, the floor of which was covered with fine carpets, and passed our usual compliments concerning the wonderful country, climate, and people. As was usual, we assured the Dejasmach that nowhere had we seen such fine, fertile soil, such fine looking soldiers, or received such cordial

reception, and we told of our trip, of the game animals of the different regions, of Ras Hailu, and of America. Ayalu had lived years in Addis Ababa, and was one of the best informed men we had met.

We were seated at a large table with white linen, and down the center ranged some fifteen bottles of imported liquor. Fortunately, the majority of the bottles were considered as scenery, and few were opened. A twenty-course dinner was followed by an inspection of guns, and Ayalu showed weapons ranging from antique elephant guns which shot round balls, to the modern machine guns. He liked our rifles and insisted that he should be given the privilege of buying them when we had finished our hunt. Permission was granted us to go after ibex, but the Dejasmach assured us that we would be unable to get them, for, as he expressed it, "only an Abyssinian can go where the ibex live." Ayalu proved a very genial host, and we made our escape only with the promise that we should visit him on our return from the mountains. He then presented us with three large bands of



ANOTHER VIEW OF THE ESCARPMENT

The Simyen Plateau breaks off abruptly and drops fearsomely away in vast cliffs thousands of feet above the valley below. It was on the faces of these cliffs that the ibex were found

soft native gold and a leopard skin apiece, and waved us on our way. We had ordered our caravan to travel on, while we were visiting the Dejasmach, so we had an enjoyable ride along the winding trail which made a gradual rise as we wound northward. Large bands of dog-faced baboons challenged us from the crest of the great escarpment at our left; there were series of precipitous drops which seemed never ending, and when we observed these gigantic cliffs dropping thousands of feet to where the Takazze River meandered through its haze-filled valley, I think we all had our doubts about the pleasure of ibex hunting. We asked the officer Ayalu had sent with us if the ibex lived in such places and he looked along the towering wall indifferently and shook his head.

"Oh, no," he replied, "the walia lives in a much worse place than that."

Another day's climb over rolling plateau brought us to the town of Devark, a distance of less than twenty miles from Ayalu's town of Davart. It proved merely a collection of dirty tukels upon a treeless, windy mountain-side, but it was of



PLOWING

The implements are crude and the methods are those that have been used for thousands of years

importance because traders visited it at regular intervals.

Devark is on the edge of the Simyen range, and our next day's journey carried us over precipitous trails. On the way, our interpreter, who was loaned us by Ras Hailu, found on the trail one of Hailu's men who told us a story of being captured, with others, and robbed. Our soldiers found where the others were held, liberated them, and seized the leader of the gang, so our following included an alleged "shifta," or bandit.

We camped near the village of Sankaber, in a beautiful little valley which was dotted with picturesque lobelias; a fine, clear stream rippled over rounded boulders in front of our tent, and there was an abundance of grass for our pack animals. A half mile to the north was the edge of the escarpment, with abrupt drops of two and three thousand feet, and far below was a chaotic series of sharp ridges and desert valleys. We could hear the distant calls of Gelada baboons, and several klipspringers were seen leaping goatlike along the steep walls. It was cold in camp that night, the thermometer registering 28°.

At last we were in the ibex country. The next day, our guides assured us, we should see walia. After we were on trek, and our caravan had wound along the walls of cañons for a few hours, the natives advised us that we might well start hunting. We climbed along steep slopes, holding on by tree heath and dried grass. Cutting and Baum worked in one direction, and I, with a local hunter, in the other. We had worked

out to the edge of an upright wall and were holding on with both hands when we heard a clatter of rocks, and two female ibex came bounding along the cliffs within a few feet of us. There were several reasons why I did not shoot. One was that the ibex were females, and we wanted a big male first; secondly, the animals would never have stopped falling; and, last, but most important, I did not dare to let go of the vegetation to which I was clinging. We returned to camp a rather subdued group of hunters. We felt that the ibex could not have lived in more inaccessible places. Cutting had shot the Asiatic ibex with the Roosevelts, and he gave it as his confidential opinion that hunting in the Himalayas was a pleasant pastime for a wooden-legged man, in comparison with the task we had before us. In one way, hunting ibex in the Simyens was unique. Our camp was always pitched above the hunting country. In other words, we had to descend the precipitous cliffs for our game, while in other countries the hunters camp in the valleys and climb the mountains.

I acquired a local guide, Demurku by name, and with Allamaya, set out a

couple of hours before dark to a place we learned to speak of as the "hell hole." It must have been the place referred to by Mayden as the "Abyss," for there could not be two such places on earth—a deep cut in the mountain which dropped sheer into the grayness below, a straight plunge for two thousand feet, walls so perpendicular that it did not seem possible that there would be a foothold for any animal. A basaltic dike led to a little rocky islet which projected over the chasm, and while I rested in a safe position, Demurku perched on the rim of the cliffs with nothing but several thousand feet of atmosphere beneath his dangling legs. Allamaya gazed, pop-eyed, and muttered "kufenu, kufenu," which in the vernacular, would mean "not so good." I hoped our guide would see no ibex.

Never will I forget the hunt the next day. Our guide led us to the left of the "hell hole," and by taking advantage of the vegetation, gradually descended a thousand feet until we reached a sloping, narrow shelf of bunch grass, some thirty feet wide, which ran to the foot of a great overhanging cliff. Above was the upper wall of the escarpment, while below was an equally straight drop. The ledge we were on was fifty feet wide at a maximum, dwindling to nothing in places, and was grown with a tangle of ferns, weeds, cedars, and tree heath in the broad areas, and in others, merely worn bunch grass. Here the going was extremely precarious. Animal trails led along the foot of the cliff, with droppings of walia, klipspringer, and Gelada baboons

showing that we were in the haunts of game.

At places, Demurku would walk beneath me, holding to the bunch grass with one hand, and his other supporting one of my shoes to keep me from slipping. His calloused bare feet were good anchors on the rocks and grass, while my heavy shoes gave no footing.

I followed him as best I could, being in a cold sweat most of the morning. When a precarious crossing occurred, I always made it with the thought that the going would be better beyond, and that we should finally work our way out at another place. After two hours of hazardous traveling, we came to the end of our road. An ibex could have traveled farther, but we could not. I sat upon a little stump of rock with the blue haze of the valley under me and upright walls above; a cold wind was blowing, and I knew I had a two-hour journey over my old trail. I could visualize every bad crossing to be made, and at the time I was almost willing to concede that Ayalu was right when he told us that "Fregies" (whites) could not get walia. As we sat there we



ON THE SHORES OF LAKE TSANA

This lake forms the headwaters of the Blue Nile, and about it the natives cultivate the land in a manner reminiscent of Biblical times



A RECEPTION COMMITTEE

These horsemen, sent out by Dejasmach Ayalu, came to take the scientists to their master who awaited them in his quarters behind the wall of saplings shown in the distance

saw two small ibex on the wall beyond, and we watched them with the glasses; they were extremely protectively colored, the rich brown of their backs blending with the brown sepias and shadows of the rocks, while the white of their legs matched the dried out grasses. They were hard to see, even though on this straight up and down cliff.

That evening I shot our first ibex at the left of the "hell hole," a fine young male. I lay flat on a rock looking straight down into the abyss. A narrow ledge extended from the wall one hundred feet below me, and as I watched a big Gelada baboon, I was startled to see a walia appear around the corner of the wall. While Allamaya held my legs and Demurku breathed, "Tolo, tolo" (hurry, hurry), I shot straight down. The ibex flattened out on the rock, killed instantly; it gave a little kick, plunged into space, turned over, and disappeared from view. For what seemed like hours we could hear the rattle of stones and the dull thud as the ibex struck one ledge and another.

Demurku looked at me and shook his head. There was no chance that we would ever get that specimen.

We worked several days in the vicinity of "hell hole" without securing the big male ibex we desired for our museum group, and then broke camp and trekked to Geech, one of the highest mountains of the Simyens. Camp was made at 11,200 feet. It was hard to believe that we were at such an altitude, for the slopes, away from the escarpment, are rolling. Several villages with poorly made tukels of wood and dung, were scattered on the mountain-sides, and herds of cattle fed upon the grass. Here we camped and hunted, and the three of us were successful in securing the animals necessary for a museum group. But none of us enjoyed the work. Hunting ibex is far from being sport.

Small mammals of several species were very abundant, and we found many interesting kinds of birds. The choughs were always about the village, and while they occurred in flocks, it was evident that mated pairs worked together. They have

a strident call like that of a tern, and in flight the pairs sail about, the two keeping their interval to a nicety.

It is customary for African hunters to name the most dangerous of the wild animals, and after being jumped by a leopard at ten feet distance, I was inclined to award the palm to this beautiful creature. However, my last day at Geech changed my point of view. We had secured all the animals we needed for our group, although we should have liked another large male, and were packing up for our long trip to the Sudan border. The hunt was over and we were more than pleased. Our men had suffered severely from the cold, our clothes were torn to shreds, and no one regretted our leaving—except, possibly, Demurku. He hung around camp while the pack mules were being loaded, and then, as I was about to climb on my mule, he motioned toward the escarpment. “Walia tidlik” (big ibex), he suggested questioningly. I asked our interpreter what he desired,

and it seemed he wanted one more hunt, with the idea that I could leave the mule at the edge of the cliff, and then afterward ride to the new camp.

After the caravan was on its way, I took Demurku's suggestion, hoping for a chance for a big fellow, and he, Allamaya, and I dropped down the cliffs at a thousand feet or so. Along the edge of the wall, a half mile away, we located a band of a dozen or more animals, and one appeared to have a good head. After watching for an hour we decided to stalk them, Demurku to stay with the glasses and direct us by waving his hands. There was a narrow trail only a few feet wide, but with good footing, with a straight drop below us, while extending from the inner edge of the narrow platform was a precipitous wall. We were walking along slowly, Allamaya following me with the rifle on his back, when we heard a rattling of stones ahead. The ibex saw or smelled us, for he whirled, and then, instead of darting to safety,



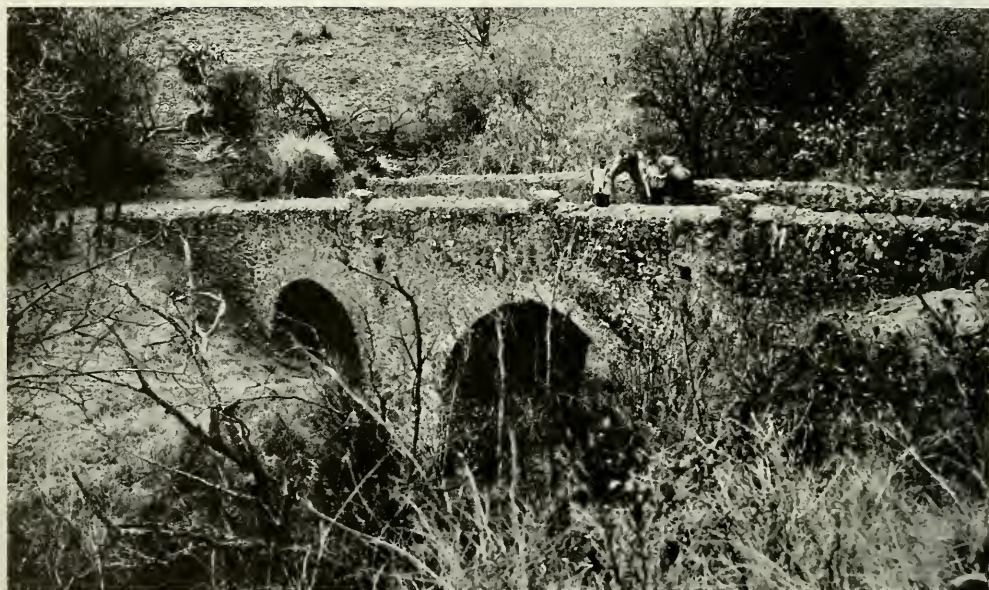
A SON OF AYALU

The attendants are personal slaves. Efforts have been made to combat slavery in Abyssinia, but success is still in the future

the way he had come, he started to climb what seemed to be a perpendicular wall. His line of flight brought him directly above me, and without thinking, I threw the gun to the shoulder and fired. The ibex dropped like a hogshead of molasses, struck the edge at my feet, so close that I could have touched him with the gun, bounded into space and fell—well, it was so far that I had to use the binoculars to locate him on the rocks below. Three feet nearer and he would have taken me with him. That is why I believe the most dangerous of African animals to be a dead ibex! It took us the most of the day to recover our specimen, and it was long after

dark before we reached the camping place.

Our Simyen adventure was over, and with it, we felt, our Abyssinian trip. We retraced our steps to Gondar, and then trekked over sterile, sun-baked ground to the Sudan. We found Osgood and Fuertes within a day's travel of Gallabat and our party reached the border together, after traveling some two thousand miles over Abyssinian trails. The town of Gallabat, on the Abyssinian-Sudanese border, is connected with the outside world by telephone, so at least we were in civilization. Motor cars were ordered from Wad-medani, and we were soon on our way to Khartum.



An Ancient Portuguese Bridge in the Province of Amhara



The Camp on Strickland Creek below Buffalo Jump-off

THE BUFFALO DRIVE

An Echo of a Western Romance

By BARNUM BROWN

Curator of Fossil Reptiles, American Museum

HALFWAY between Livingston and Gardner, Montana, on the way to the National Park, trains hesitate a moment at a small village named Emigrant snuggled in a bend of the Yellowstone River at a spot strikingly beautiful. Here the Yellowstone flows northward in a moderately wide valley bounded on the west by the Gallatin Mountains, and on the east by the higher, more abrupt Absaroka range, dominated by the picturesque Emigrant Peak south of the village.

Timber-bordered mountain streams flow into the river from either side and the level lowlands are now cultivated alfalfa fields, but the higher rolling uplands are still covered by the original buffalo grass. It is essentially a ranch country, and aside from the cultivated patches, houses and fences, the landscape presents little change from its primeval state.

Along the streams occasional teepee rings and stone hearths protrude from the sod, marking the site of Indian villages, but from the surface all perishable re-

mindings of those earlier inhabitants have disappeared.

Strickland Creek, one of the small streams west of Emigrant, flows southward through the property of the celebrated Ox-Bow "Dude Ranch" owned by Mr. Charles R. Murphy.

While in the Yellowstone Park, I learned from Dr. C. P. Russell of the Park Service, that several hundred arrowheads had been recovered from the base of a lava cliff on the Ox-Bow Ranch where there had been an Indian buffalo drive, and he obtained permission for my party to investigate it.

Pitching our tents on Strickland Creek near several ancient hearth sites, we could readily visualize the scene on this same spot long ago, when teepees were scattered along the stream on either side, invisible from the higher grazing land beyond the cliff less than a quarter of a mile away.

This cliff, like all of the near-by exposures, is the face of a lava flow, twenty feet thick at this point, grassed over on top and planed by glacial action, with



THE APEX OF THE CHUTE

Men are standing on the edge of the cliff marking the terminal lines of the chute. The Absoraka Mountains may be seen in the distance

glacial striations pronounced on all bare surfaces. Huge sharp-angled blocks of lava broken from the cliff face lie in irregular positions and cover the talus slope below.

Before the arrival of the white race with horses and rifles, Indians killed game with stone-pointed arrows, and with such weapons the destruction of the long-haired, tough-hided buffalo must have been a matter of considerable uncertainty even under the most favorable circumstances.

The habits of the buffalo undoubtedly led to coöperative hunting, when numbers of people from the same village worked together and drove or enticed herds of animals to places prepared for slaughter. Several tribes evidently practised communal hunting at different periods.

Women, and presumably men, had labored here in the common necessity of securing food, preparing a place to slaughter herds of buffalo, and back on the

prairie from the edge of the cliff they had gathered and placed piles of large stones in two irregular lines that gradually approached like an open V with its apex at the cliff, thus forming a runway.

Apparently the stones had been collected chiefly from the surface between the two lines, thus leaving a comparatively smooth surface for the rushing feet. Evidently the people had learned by experience, or through observation, that the cloven-hoofed buffalo ran more readily on an even surface.

The two lines of stone piles were approximately fifty feet apart at the edge of the cliff and extended back on the prairie for at least a mile, the lines being a quarter of a mile apart where last seen.

The piles of stone, wide at the base and averaging six feet apart, are usually less than two feet high, but evidently were higher when used, as many, at the base, are almost completely covered by grass roots.



BUFFALO BEING STAMPEDED OVER THE CLIFF

Restoration by Arthur A. Jansson

As the frightened animals rushed onward, the men hidden behind the rock piles arose shouting and waving blankets or brush so as to keep them headed down the chute



BUFFALO JUMP-OFF AT EMIGRANT

The vertical cliff is twenty feet in height. Approximately fifteen hundred arrows have been sifted from the talus slope above the fence

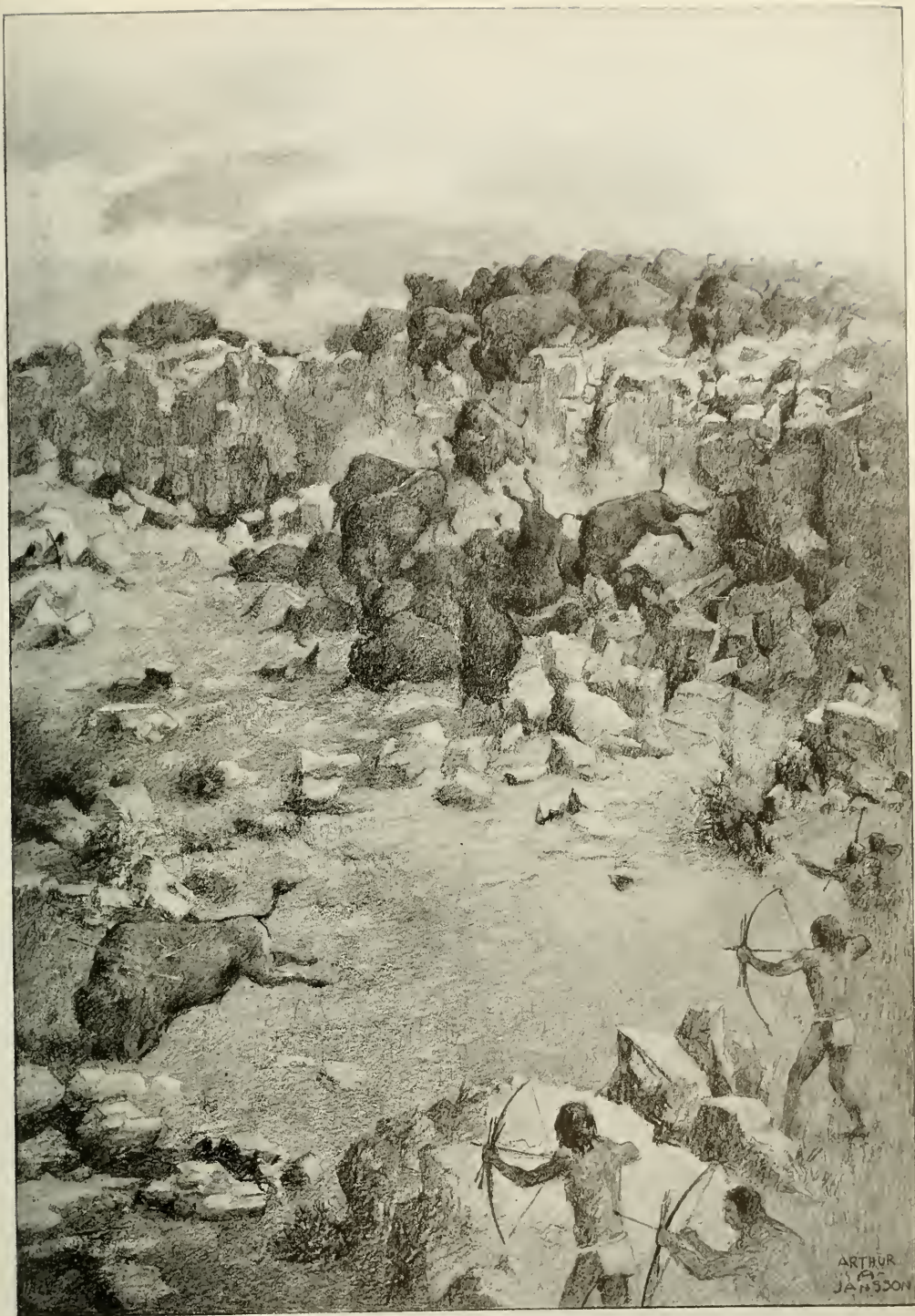
As one looks toward the cliff from almost any position between the lines, the stone piles appear to be a continuous natural barrier, and so it must have looked to running animals.

With the scene staged, we can readily re-picture the operation of a "buffalo drive," although few white writers have given an authentic description of actual observations. Evidently the drive varied somewhat among different tribes as reported in the journals of Umfreville, Henry and Thompson, and later by Grinnell.

In a description of "Material Culture of Blackfoot Indians," Dr. Clark Wissler has given a very clear account of the essentially common features of the drives:

A drive was made by working a bunch of buffalo between the outward ends of the lines. This was done by a few young men on foot, working quietly around a bunch grazing within a few miles of the drive and causing them to drift toward the lines. This was by no means easy and the failures were many. The camp was

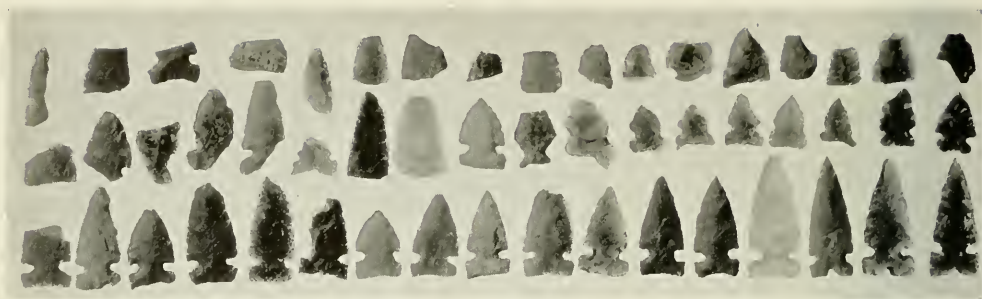
usually on the flat in the vicinity of the drive and a watcher was posted to give notice when a bunch was approaching the chute. When the conditions seemed favorable, he ordered all the young, or able-bodied men, out to the lines where they took their stations behind the rock piles, concealing themselves under blankets or newly cut branches. Then, if the buffalo drifted into the wide entrance to the lines, the outlying men began to stampede them and as they moved forward, the men concealed on their flanks arose shouting, waving blankets or brush, so as to keep them headed down the chute and to increase their fright. When near the brink, the leading buffalo attempted to stop and turn aside. Here, the number of men was greatest and the danger of being run down, considerable; but the pressure of the frightened buffalo in the rear, and the demonstrations of the men near the brink, were usually effective in forcing over the leaders whence the whole bunch followed blindly. The Indians claim that once the buffalo were running in the chute, success was practically assured. The fall maimed some of the buffalo and the others were shot as they milled around in the enclosure. When all were down, the struggling ones were dispatched by striking their foreheads with stone mauls;



BUFFALO HERD PLUNGING TO DESTRUCTION

Restoration by Arthur A. Jansson

The pressure of the stampeding buffalo in the rear and the shouts and gesticulations of the men near the brink forced the leading animals over the edge, and all the others followed blindly



FROM THE SITE OF THE GREAT BUFFALO JUMP-OFF

A portion of the fifteen hundred arrowheads that have been recovered—all of similar design.
(Two-thirds natural size)

Whether or not there had been an enclosure or pound at the base of this cliff we could not determine, but I am of the opinion that in this case the fall was sufficient to maim all animals that went over the cliff, and that men below concealed behind the rocks dispatched the cripples with arrows.

In describing one of these pounds Henry says: "The stench from this enclosure was great, even at this season, for the weather was mild." It is quite evident at the Strickland Drive that the Indians had burned the accumulated carcasses, thus preventing the stench which would have caused the animals to balk and refuse the plunge.

Previous excavators had sifted most of the talus slope so that we found very few areas that had not been disturbed. In such places the burned and broken bones, decomposed horns, grass roots, and sand were from one foot to fourteen inches thick, but without any definite stratification. In sifting over such favorable spots we obtained between fifty and sixty arrowheads—broken and complete. We were struck by the uniformity of shape and the smallness of size, as shown in the accompanying pictures.

Mr. C. A. Kinsey of Belgrade, Montana, has done the greatest amount of excavating at this site and informs me that he, with an assistant, worked there from ten

to twelve days securing more than 500 perfect points and an equal number of broken ones—all of them were of the same design and like those we secured. He estimates that previous to our excavating others had taken out from 250 to 300 additional points. He informed me that in the central portion of the area the accumulation was thirty inches deep with a quantity of buffalo hair at the bottom.

A quarter of a mile west of this cliff, on the border of the same lava flow, our efforts were more richly rewarded, for there we discovered the place of another kill which had not been disturbed. At that point the cliff was not more than ten feet in height and below the slope was very gentle. At this point buffalo coming over the cliff would not have been badly maimed, and a pound or enclosure is indicated by the restricted area in which the remains have accumulated.

We dug and sifted an area of approximately twelve feet square, taking out more than three hundred arrows, all of very uniform shape and small size. Here the debris of charred bones and arrows was unstratified and about one foot thick. This drive was evidently much more ancient than the one previously described, as all evidence of stone piles on the flat above had been completely covered by the sod. In both cases more than half of the arrows were made of obsidian (volcanic glass).

There is no evidence of great antiquity in this discovery for the Bison were the living species, but the form of the arrows indicated that they were not made by the Indians who inhabited that region at the time of white settlement. Several implements were found by other people on the camp sites, among them a steatite bowl (found and owned by the proprietor of the Wanagen Store, a few miles from the buffalo jump-off site). Such vessels were used by the Shoshone Indians, but not by the Blackfoot tribe who recently inhabited this region. The arrows were probably not more than two or three hundred years old. The most important

features about this find are the great quantity of points, their form, and size, evidently made by a number of people approximately at the same period for one definite purpose—that of killing buffalos.

Buffalo were more important to the plains Indians than all other game animals combined, as they were the chief source of food, shelter, and clothing of several of the western tribes, hence it is not difficult to appreciate the Indians' consternation at the rapid disappearance of the great herds nor their resentment at circumstances that brought it about.

Conservative estimates by Seton, based on the published accounts of early explorers, places the maximum number of buffalo before the advent of white men

at 60,000,000 to 70,000,000 head. In 1870 these great herds had dwindled to 14,000,000 head, and before 1890 the buffalo had completely disappeared as a wild range animal due chiefly to white hide hunters.

In view of the great economic importance of the buffalo to the Indians it is small wonder that there was general friction between the nomadic tribes and the ever increasing invasion of white men who so completely altered their daily lives. History presents no parallel of equal importance in any part of the world—where a hunting people has been completely changed to agriculturists within so short a time.



FROM AN AREA ABOUT TWELVE FEET SQUARE

A part of the three hundred arrow heads recovered at the site of the ancient drive a quarter of a mile west of the Strickland drive. (Two-sevenths natural size)

Fossil remains disclose a number of extinct species of buffalo, and it now seems quite certain that throughout the Pleistocene period succeeding species of buffalo have inhabited the prairie lands of our western states.

Gold-dredging operations in Alaska during the past few years have uncovered numerous remains of an extinct buffalo, by far the most numerous of the Pleistocene animals in that region, and where conditions of preservation are favorable we may expect to hear of associated remains of man.

Recent discoveries in New Mexico have shown that our earliest known prehistoric inhabitants (The Folsom Culture), 15,000 to 20,000 years ago hunted a species of buffalo now extinct, and in the opinion of the writer future discoveries will disclose other cultural stages of man asso-

ciated with extinct species of buffalo. Hunters have always followed the buffalo, which was a seasonal, migratory animal and preëminently the pathfinder of the animal kingdom.

It would seem, then, that the earliest and the latest known tribesmen in America followed and hunted the buffalo, whose complete history may eventually disclose the migration of man to this continent.

In all probability prehistoric Asiatic hunters have crossed Behring Straits several times. Some of them stayed awhile, following the migrating herds southward and, after a time, perished. Others came and returned or perished. Finally came the people who were the direct forebears of our modern Indians, whose life has been so intimately interwoven with the life of the modern buffalo.



Sifting Arrows at the Ancient Drive



A Clearing at a Government Coast Village

A TENDERFOOT EXPLORER IN NEW GUINEA

Reminiscences of an Expedition for Birds in the Primeval
Forests of the Arfak Mountains

By ERNST MAYR

Recently the American Museum of Natural History has undertaken the exploration of the animal-life of the South Sea Islands. Doctor Mayr has taken part in this project and during 1928 and 1929 studied the fauna of the mountains of New Guinea, where he visited five different ranges, three in Dutch New Guinea (Arfak, Wandammen, and Cyclop Mountains) and two in the Mandated Territory of New Guinea (Saruwaged and Herzog Mountains). In the following article he describes his experiences during his collecting activities in the Arfak Mountains—THE EDITORS.

I FACED one of the biggest decisions of my life when, at the International Zoological Congress at Budapest in 1927, Lord Rothschild, of the Zoological Museum in Tring, the largest private collection in the world, asked me if I would undertake an expedition to New Guinea for him and Dr. L. C. Sanford, trustee of the American Museum of Natural History. I was barely twenty-three years old, had never been on an expedition before, and all that could be said in my favor was that I had had many years of experience in the study of European birds, and, what counts more, had

the ambition and untiring enthusiasm of youth. My mind was therefore made up quickly. I said, "Yes" to Lord Rothschild's proposition and started immediately with my preparations.

Anyone about to undertake an expedition should possess a thorough knowledge of the animal-life occurring in the region he plans to visit. Thus, before starting for the field, I went to several of the large European museums and worked through their New Guinea collections, with the result that when I arrived in New Guinea, I knew not only the name of every bird I might collect, but also whether it was

rare, or desirable for my collection, and whether it showed any peculiarities of particular interest to science. Equipped with this knowledge, I departed from Europe feeling a good deal more confident than when I had agreed to the expedition.

After a pleasant journey through the Mediterranean, the Suez Canal, the Red Sea, and the Indian Ocean, I arrived in Java to make the final arrangements. The Zoological Museum, of the Department of Agriculture in Buitenzorg, Java, assisted me by the loan of two Javanese bird-skinners and one plant collector. These "mantris" were of invaluable service to me and proved themselves faithful and hardworking companions during the six months I stayed in Dutch New Guinea.

After a beautiful trip through the East

Indian Archipelago, which gave me an opportunity to get acquainted with such interesting places as Bali, Celebes, and the Moluccas, I arrived on the 5th of April, 1928, in Manokwari, the capital of Dutch New Guinea. What a thrill I had when I saw the towering Arfak Mountains, rising abruptly to an altitude of 9000 feet on the other side of the Dorei Bay! The summits were hidden in clouds,—clouds that envelop the higher mountains of New Guinea for many weeks during the rainy periods of the year.

Manokwari, the largest settlement in northern Dutch New Guinea, has a white population of twelve, a fact that indicates somewhat the backwardness and wildness of the country. There are no railroads, no motor cars, not even horses and mules in this part of New Guinea. All the carrying is done by the natives.

In all tropical countries the mountains possess an animal-life strangely different from that which is to be found in the lowlands and hills. The lowland seems to be much more affected by the going and coming of forms from neighboring places, and we find many recent invaders, while the mountains are the homes or refuges of the primitive types and perhaps the original inhabitants of the whole area. This is true of mankind as well as of animals. In the lowland of New Guinea we find the Melanesians—tribes that are related in culture and language to the Malaysians in the West and the Polynesians in the East. In the mountains we find the Papuans, a very primitive type of mankind, in my opinion inferior in their culture to any other human race, including even the aboriginals of Australia.



DOCTOR MAYR (RIGHT) WITH HIS MALAY *MANTRI*
Arriving at Kofo, Anggi Lakes, after two months in the
wild interior of New Guinea



THE WANDAMMEN MOUNTAINS FROM THE COAST

For the most part the coast of northern New Guinea is lined with mountains that rise abruptly from the sea

The same is true of the bird-life. In the lowland we find mostly species and genera which are distributed over wide parts of the Indo-Australian region, while in the mountains we find endemic genera with no close relatives anywhere. It is here in the mountains that we meet the choicest of the birds of paradise. It is in the mountains that we find the most beautiful parrots and some of the most peculiarly developed members of the honey suckers. To make a thorough investigation of these mountain forms in the different ranges of northern New Guinea was the main object of my expedition.

I did not spend much time in the lowland, and after I had bought the necessary provisions, I said "good-bye" to the small white colony in Manokwari and sailed across the bay to Momi on the south-eastern foot of the Arfak Mountains. For several months thereafter I did not speak a European word, using Malay in all my conversations until my return from ex-

ploring the Arfak Mountains. In Momi I sent out word to the surrounding villages asking for carriers, and with the help of the Malayan district officer I succeeded, after several days, in assembling a caravan of about fifty.

No one who has traveled in Africa can imagine the carrier difficulties in New Guinea. The race is small and, considering the roughness of the country and the bad condition of the bush-trails, the carriers refuse to take loads weighing more than thirty pounds. Only in exceptional cases could they be persuaded to take two man loads. It required a good deal of figuring to cut down the outfit into such small loads.

After much hard and noisy gesticulation, the long string of carriers finally departed. We soon left the vicinity of Momi village with its secondary growth, its native gardens and open clearings, and entered the virgin forest that spreads over the alluvial plain of Momi River.



THE HUT OF A MOUNTAIN CHIEF

The houses are erected on poles with the floor ten feet or more above the ground. The left side of the house is reserved for women and the right side for men

The noise of the forest edge with its numerous parrots, starlings (*Mino*), leather-heads (*Philemon*), and New Guinea magpies (*Cracticus*), was exchanged for a deep silence only occasionally interrupted by the voice of a thickhead (*Pachycephala*) or a fly-catcher (*Monarcha*). From the tree tops we heard now and then the deep oo-oo-oo of forest pigeons, but suddenly all these voices were overpowered by a melodious whistling series of calls.

"Boeroeng goening," whispered the interpreter excitedly, and, leaving the trail, we began cutting our way through the vines and shrubs with bush knives. Soon we reached the foot of a medium-sized tree on which—I shall never forget this exciting moment—I saw for the first time in my life the display of the yellow bird of paradise (*Paradisæa minor*). Two males in full plumage and a few immature males displayed and went through all the eccentric and acrobatic movements of this

performance. I had no time on this day to study any details, but full of joy and satisfaction at this impressive sight I continued the march.

In order to get more opportunities to collect data on the vertical distribution of birds in different altitudes, I had chosen a route into the mountain which had been used by but few parties before me, but which led through a well populated district with villages at all altitudes between sea level and 6000 feet. The powerful chief Basi, of the Manikion district, and I were in the lead as we penetrated deeper and deeper inland, following the Momi River.

In Momi I had been told many stories about the treachery of the mountain tribes, and I was somewhat worried about what might happen during the coming weeks. Occupied with these thoughts I was suddenly startled by a noise that began at the end of my caravan and ran along the string of carriers toward me,

increasing rapidly until it became a blood-curdling series of screams and yells. I was frightened, feeling certain that this was a signal to attack, and I expected every moment to feel the knives of the carriers in my back. I looked cautiously back to Basi, but he, apparently guessing my worries, assured me there was no danger. As it turned out, it was really the war-cry of the Manikion tribe, but on this occasion it was uttered only to inspire the energy of the carriers. With increasing experience I grew surer of myself, but on this first occasion I showed that I was a thorough greenhorn.

Late in the afternoon, after long and strenuous wading in a rocky river-bed, we arrived at the first camping place at the foot of the real ascent. My tent was set up, my carriers built their leaf-houses, and the regular camp life developed. The few birds collected during the march had to be prepared, and soon darkness fell on my first night in the tropical forest. What this means only the man who has witnessed a tropical night himself, can appreciate. No words can describe the concerts produced by the cicadas, locusts, tree-frogs, and night birds, a symphony of peculiar and deeply impressive harmony. Listening and dreaming, I lay awake for a long time in spite of the fatigue caused by the march and all the exciting experiences of the day.

When I awoke the next morning, camp life was in full swing again. Breakfast was served quickly, and soon the loads were packed, and we started on a long and

strenuous climb toward the summit of the Taikbo Mountain, 4000 feet above us.

The trails of these mountain tribes have no similarity to those familiar to us in civilized countries. There are no zig-zags, but the trails go straight up the slopes, steep as they may be. Only when the crest is reached does the road become somewhat easier. I had plenty of occasion to admire the stamina of these mountain people who, although inferior to the white man in their physique, are superior in heart and lungs. Despite their loads they could set a pace that I was hardly able to follow.

Before we had climbed a thousand feet the appearance of the forest had begun to change. The number of forest giants be-



A MOUNTAIN CAMP

In uninhabited mountain districts extensive clearings are necessary before camp can successfully be established



A PRIMITIVE BRIDGE

Native "boys" arriving at Doctor Mayr's camp in order to offer their services as hunters

gan to decrease, the undergrowth that was rather open in the lowland forest grew thicker. Thorny rotan palms entangled the shrubs with their long vines, and a few tree-ferns and epiphytes were in evidence. Above two thousand feet this change of formation was quite obvious.

The bird-life also showed a change. Many of the species leading the concert in the lowland forest disappeared and new voices could be heard. The weather likewise began to change. The temperature was lower and soon we reached the zone that is enveloped in clouds after ten o'clock in the morning. The wind blew the fog through the forest, moisture collected on leaves and twigs, and big, heavy drops fell to the ground. No wonder that

moss and lichens grow luxuriously in this atmosphere, and, although the true moss forest is decidedly higher up, moss was quite abundant on the trees and on the ground even at less than three thousand feet altitude. The moist fog gradually changed into rain and, at the request of my carriers, I decided to camp at the highest water-place, which was still considerably below the summit. Big fires were built to warm my carriers. I could imagine how cold they felt, being entirely naked but for a narrow strip of cloth around their loins. The temperature went down to 19° C. but singing and talking, and with very little sleep, the carriers sat around their fires during the night.

In the beautiful, clear sunlight that greeted us the next morning, the forest looked entirely changed.

The birds were much more

active and were singing all about, and, knowing that I would reach my first real permanent station on that day, I started collecting. One of the first birds shot was the "superb bird of paradise," one of the most beautiful creatures of the New Guinea mountains. The breast is covered by a shield, composed of little, glossy, green scales. On the neck is a large, black, velvety crest, which can be spread out during the display as are the tail-coverts of a peacock. Another welcome addition to my collection was *Drepanornis*, another bird of paradise with an extraordinary, long, sickle-shaped bill. After a short climb I reached the top of Taikbo Mountain, but here, as in most cases in New Guinea, reaching the

summit was a disappointment, for the heavy forest did not permit any view.

The path that led down to the Siwi Valley was just as steep as the one that led from the coast up to the summit, and after a hurried descent we reached a little creek in the Siwi Valley. Now signs of population became apparent, the forest became lighter, and soon we entered a large clearing, the area of Siwi village. These Arfak Mountain villages do not quite come up to our ideas of a village. Siwi, like other places I visited afterward, consisted of single houses, 200 to 500 feet above the bottom of the valley and located on both sides. It covered an area of several square miles. Most of the houses are within calling distance of one another, and whenever there is any news to tell, the valley is filled with shouts. The arrival of a white man was occasion enough to make this signal service work full blast, and soon the natives began to come down from their houses to help in establishing my camp. In order

to have water handy, I decided to camp on the shore of the little creek, on a place high enough to be safe from floods. I was warned against these floods and before long I had an opportunity to witness such a spectacle.

I was very glad that we had finally reached the camping place, for I had a bad infection on my leg and was hardly able to walk. When swimming in Manokwari, I had hurt my foot on a coral reef, and such coral wounds heal very slowly, even if properly attended. I, however, had had no time to attend to the wound, and the marching in river-beds on the previous days and constantly wet shoes had done their part to make the infection really dangerous. My whole leg was swollen and weeks passed before I could do any strenuous collecting.

While I paid off my carriers (they received 25 cents a day), the natives started to clear away the secondary growth, to erect my tent, and to build houses for my baggage and my Javanese "mantris."



NATIVES OF THE ARFAK MOUNTAINS

These natives never leave their huts without carrying their bows and arrows. Hunting is one of the favorite occupations of the men



DISPLAY GROUND OF A BIRD OF PARADISE

Most birds of paradise display in the trees, but a few species clear a spot on the forest floor and collect in small numbers to dance and to display. At the climax of the display they jump to the horizontal twigs about the opening and show their plumes. This particular spot was prepared by the species *Parotia sefilata*, the six-plumed bird of paradise

The arrival of my party was like a big festival, for the natives made little huts for themselves all around my camp, sang and danced, and the boys and younger men especially stayed in my camp even over night and for several days afterward.

The river bottom, where the camp was situated, was at an altitude of 2400 feet, but all around mountains rose steeply to 4800 feet. The real forest had been destroyed by the natives in the valley and on the lower slopes, and had been replaced by native gardens, savanna-grass ("alang-alang") and open secondary growth. There I found grass finches (*Munia*) and parrot finches (*Erythrura*), wren-warblers (*Malurus*), and even (in winter quarters) a Siberian sedge-warbler (*Locustella fasciolata*), a bird that puzzled me considerably and which I regarded as a new species for a long time, knowing that it was none of the known New Guinea birds.

The Arfakers are hunters rather than farmers. Most of the field work is done by the women, while the task of the men is to cut down the forest. But they prefer to take bow and arrow and wander about and hunt birds or, if luck is favorable, even "big game,"—cassowaries and pigs. Except for some phalangiers and other marsupials, a few small rodents and bats are the only indigenous mammals on this island. Pigs have been introduced, but are in a more or less wild state all over the island. To get the desired meat, the New Guinea hunter has to look for smaller game, so he devotes his attention to the abundant bird-life. From his early youth he has learned to know the voices and habits of the birds, and I was amazed at the exact knowledge of the life-histories of the birds these natives possessed. Almost every species had its own name, and they even distinguished some species which have been confused

with others by some systematists on account of their similarity.

The natives are wonderful shots with bow and arrow, and soon learned to handle the several small shotguns which I had brought with me. After I had acquired the vocabulary of their bird names I had only to send out my hunters with orders to secure certain species and I was sure to get them. I thus succeeded in obtaining a collection of unusual quality, consisting of the rare and desirable species and lacking the great number of common birds so often found in the collections of inexperienced travelers.

The joy over the success of my collecting activity was a great help to me in overcoming the many difficulties that sometimes almost crushed my energy and will-power. The rainy season was not yet quite over and on some days the fog and rainstorms prevented collecting completely. The drying of the skins was also quite a task, as the air was saturated with

moisture and the sun was not seen very often. Half-starved native dogs broke into my tent during the night and managed to get away unharmed with a few skins, thoroughly poisoned with arsenic. I never saw anything so thin and shabby as these dogs, which are related to the Australian dingo and do not bark. All these things, however, were only minor difficulties. What was much worse was that most of my boys fell sick, and all at the same time. One developed arsenic poisoning on his hand, and his whole arm swelled so that he could not work. The other of my mantris had malaria and alarmed me by his fantastic speeches in his delirium, while another helper fell sick with pneumonia. His life was saved only by the most careful nursing day and night. My sore foot had not healed and my plant collector was also laid up with a big tropical sore, so that my camp really resembled a hospital more than a collecting station.



THE DISPLAY GROUND OF A BOWER BIRD

This structure of twigs, which is about two feet high and two and a half feet in diameter, has been erected by a single male of the species *Amblyornis inornatus*. Around this bower the bird dances and makes his display

Few people can realize what a strain it was for me to have to overcome alone all these difficulties, with no companion to talk to. Every situation was new to me and required careful consideration, especially the handling of the natives, who are very touchy and have many taboos that must be respected. On the other hand, they showed amazingly little imagination. I remember a little incident that happened during an eclipse of the moon. The moon became more and more covered by shadow, it grew darker and darker, but the natives showed no signs of interest or excitement. I asked them if they had no myth about it. I told them the myths of our own country and the myths believed by the Chinese and Javanese, and asked them what they considered as the cause of the sudden darkness. Not getting any response to my questions, I really became quite excited in my efforts to get some information about their belief.

Suddenly one of the men slapped my

shoulder in a fatherly fashion and said soothingly:

"Don't worry, master, it will become light again very soon."

That cured me and I never again tried to acquire any information that was not given willingly. Their realism toward the mysteries of nature was sometimes quite appalling.

After my foot was better I started out again on excursions, but did not do much collecting. My main interest was to get some data on the habits of the New Guinea birds. Aside from the marvellous displays of the birds of paradise, which have been described in *NATURAL HISTORY* by R. H. Beck and Lee S. Crandall, there are many things in the New Guinea forest to arouse the interest of the naturalist. There are the cassowaries, large ostrich-like birds, that run along the mountain slopes with an amazing agility. The male is less brightly colored than his mate, and apparently hatches the eggs as well as rears the young, rather unusual



A GROUP OF NATIVE "BOYS" AT MOMI

These natives acted as carriers for Doctor Mayr on his journey from the interior back to the coast

for birds, although this reversal is common to several other species. There are the megapodes or brush turkeys which bury their eggs in large heaps of leaves where the fermentation of the organic material incubates them, and the pigmy parrots (*Micropsitta*), not longer than one's thumb, which climb on trees as woodpeckers do and feed on termites. There are a score of beautiful doves and splendidly colored parrots. Once in a while I found a flowering tree where dozens of birds were feeding on the nectars. Here I found some of the rarest birds—birds that I had never seen before nor saw again. Exquisite colors are found not only on the birds, but all the orders of animals seem to compete for the prize of beauty. Butterflies and beetles show unsurpassed splendor of coloration, and the plants also deserve

mention. There is no place on the earth where so many species of orchids have been found in a given area as in New Guinea. However, all this beauty is hidden away in the luxury of plant growth, and the real loveliness of these creations of this strange island continent becomes apparent only when in the hand of the collector.

After many weeks of hard work that continued until a late hour every night, I succeeded in getting a fair representation of the fauna and flora of this hill region, and the desire grew to penetrate farther into the interior, higher up in the mountains. To accomplish this was no easy task, and I was not yet sure what dangers



SIWI VALLEY

Except in the neighborhood of the native villages, the jungle growth covers the mountains in a dense and almost impenetrable mass. Even from the mountain tops it often prevents any view whatever

and difficulties would await me. In this region, more than in any other place in New Guinea where I collected afterward, there were many rumors in circulation about the dangerous mountain people who are quiet and peaceful during the daytime but go out to kill during the night. Even in recent years several police boys had been killed during government expeditions, and I had been most earnestly warned not to go too far inland. I personally did not take much notice of these warnings, but it was a difficult task to persuade my companions to follow me.

I arranged with Basi to call carriers from the Misemi district, but just after the messengers had gone, I fell ill with

influenza and was in bed for several days with high fever. The carriers finally arrived and we broke up our camp, but after I had gone a few steps, I fainted, weakened by the fever. I was in a rather desperate situation, as my carriers wanted to go ahead, and I did not know if I ever could get them again if I let them go to their villages now. We finally agreed to a two-days' rest and I departed on the 25th of May. On the first day we had to climb the 4200-foot high divide between the Siwi and Ninei valley, and every step was a struggle for me, my heart being very weak. I arrived in Ninei (2800 feet), more dead than alive.

The next day we followed the Duga River up to the foot of Mt. Moendi, and then I camped, not being able to climb that mountain the same day. On both banks of the river were signs of former floods and I therefore decided to establish my camp not less than fifteen feet above the river. Some of my carriers laughed about my caution and made their camp closer to the water, only about ten feet above its normal level. In the late afternoon it began to rain, and after darkness the rain increased to a downpour of such violence as I had never witnessed before. The river had a very strong fall, and at low water fell in cascades over the boulders and rocks. But this rain changed the peaceful creek into a boiling torrent.

With the thundering noise of cannon tremendous rocks were torn away from their foundations and carried down stream. The night was pitch dark. Suddenly I heard a terrific yelling and screaming, and then a score of trembling and soaking wet natives rushed shouting into my tent.

"Master," they cried. "Our camp is flooded, and all our belongings have been carried away by the water."

I was worried lest the flood should damage my expedition outfit, and rushed outside to inquire the state of affairs.

When I reached the camp of my carriers, I found to my surprise that the water level was now about five feet below the camp. The only explanation I can think of is that the camp had been swept by a "tidal" wave caused by the breaking of some dam built by fallen trees farther up the river. Fortunately, nobody had been drowned.

The "gang" was the biggest I ever had. All counted there were about 120 natives and many more carriers than loads. This never happened to me again. A large percentage were women, who are much stronger than the men. They have to do all the carrying of the firewood and field-fruit and are therefore trained for this job. It was a strange experience for me until I got used to it, to see the women carry my loads while their husbands accompanied them with the babies in nets on their backs.

The next morning the difficult climb up Mt. Moendi began. The lower slopes are covered by alang-alang, growing on wide stretches from which the natives had burned the original mountain forest in order to make their fields. Higher up at an altitude of about 5000 feet the moist mountain-forest began. All trees, shrubs, and vines were covered by a stratum of moss several inches thick, and in places on the ground the moss was more than a foot thick. Most of the trees in this moss forest are rather small, but grow close together. Several birds not encountered on my former collecting stations were found here.

Approaching the summit, we found the trees gradually being replaced by shrubs and open grassland spots, a formation which I will describe in connection with the visit to Mt. Hoidjoseru, where I found it much better developed. The summit of Mt. Moendi, at 6300 feet, is the watershed. The valley into which I was descending belonged to the system of rivers that flow into the McCluer Gulf

on the south coast of New Guinea.

My path led gently down along a crest into the Ditchi Valley. This was not my original intention. I wanted to descend toward the northwest, but the natives claimed that there were no villages in that region, at least none occupied at that season of the year. So we turned southwest, and finally reached the bottom of the Ditchi Valley at about 3500 feet altitude. At 4000 feet altitude on the other slope of the valley was the village of Ditchi consisting of a few scattered houses, where I established camp on May 22.

This village had never before been visited by a white man. Behind the village two mountains (Mt. Wamma and Mt. Lehoema) rose to an altitude of approximately 6000 feet. These two mountains were my chief collecting grounds during the next weeks. As in Siwi, I wrote down a list of all the native names of the birds, and as soon as I received specimens I was able to identify them by their scientific names. By this method I was sure not to leave out any. At the same time I secured fine collections of plants.

In spite of all the intensive collecting I could not procure all the species in the Ditchi region that were known from the Arfak Mountains. I therefore desired to penetrate still farther inland and establish a collecting station in a higher place. The area that I fancied was the Anggi Lakes, which are situated at an altitude of more than 6000 feet and had been visited by several naturalists previously. But their bird-life had never been studied and I expected some interesting discoveries. The difficulty, however, was how to get there! All the previous parties



A JUNGLE WATERFALL

The luxuriant vegetation of the interior of New Guinea makes photography difficult. Here the opening in the jungle about the waterfall permitted enough light to enter to make a clear picture possible

were accompanied by a troop of soldiers, as the Anggi natives were reputed to be great warriors and anything but friendly toward whites. I heard many stories of murders that had been committed in late years, and I was trying to find a safe way to reach their villages, when chance finally came to my assistance. It turned out that one of the Siwi-men had a sister married to one of the Anggi chiefs. So I sent him up to get an invitation. I reckoned that their curiosity to see a white man would be greater than their suspicion and fright against me, the usual root of all fights. And I knew that I would be perfectly safe if I came to their village as a guest.

On the evening of the 8th of June, Wakil, my messenger, came back from the

Anggi lakes and brought with him the chief and ten carriers. After an exchange of the usual formalities, we agreed to start for his village the next morning. As I had only ten carriers (except for Wakil and my fourteen-year-old interpreter Kapal, who spoke five languages, nobody from Siwi or Ditchi wanted to go with me), I had to cut down my luggage to the most necessary items. I left two of my Javanese behind me, but one of the bird skimmers accompanied me.

The road was bad as always in New Guinea. First we had to climb down to the Ditchi River, then up again 1500 feet on the opposite slope, and as soon as we had reached the ridge we went down another valley. In all, we crossed about six or seven such valleys, tributaries of the Issim River, and when we finally reached the "village" (two houses) of Dohunsehik in the late afternoon, I was thoroughly tired from climbing, although the net gain of altitude was only about 600 feet.

We were now directly at the foot of Mt. Hoidjoser, which we had to climb before coming down to the lakes. I decided, therefore, the next morning, to give out cartridges to my hunters to secure some specimens in the alpine zone. But when I opened the cartridge-load I noticed to my horror that I had packed the wrong case and left all the small cartridges for my bird-guns in Ditchi. What to do? The only solution was to send back one native to fetch the cartridges and join me later on at Anggi. I would spend the first two days, until this boy arrived, in shooting large birds and collecting plants.

At 7:30 we started, for Anggi while one boy left for Ditchi. We gained altitude rapidly and the forest soon took on a very mossy character. Above 5000 feet we reached the ridge, and here there became evident a plant formation like that I had encountered already in a lesser degree on Mt. Moendi.

The forest opened up and was replaced by a brushy heather mixed with low conifers. Many of the shrubs, especially the rhododendron trees, were in flower and made this day's walk a very pleasant experience. On the other hand, the bird-life was disappointing. I did not meet a single species of bird that I had not met already in lower altitudes. There is a decided change of faunal zones at 4500 feet altitude, and as I had collected in this higher zone on Mt. Lehoema and Mt. Wanna, it was perhaps only natural that I did not make any new discoveries on this mountain. About noon we reached the summit of Mt. Hoidjoser, which means in the Manikion language: "The place where the pig fell." Despite much questioning, I was unable to learn the story on which this name is based.

From the summit I had a magnificent view, as it was unusually clear. In the west stood Mt. Lina (about 8600 feet), the highest summit of the Arfak region. To the south was the Issim Valley, which sends its waters to the south coast of New Guinea, and to the north were the two Anggi lakes, the male and the female, as the natives call them. The two lakes are separated by a ridge approximately 1400 feet in height, and are two entirely different basins; one is the origin of a river that flows to the north coast, and the other of a river that flows eastward to the Geelvink Bay.

After a quick descent I reached the shore of Anggi gidji (the male lake) about two o'clock, and established camp in the village of Koffo. Shortly after five o'clock the boy I had sent back for the cartridges arrived. I could hardly believe my eyes as he handed the cartridges to me. In one day he had made the three-days' march, including at least 8000 feet of actual climbing. He said he had been running hard for most of the day. I cite this case as an example of the marvelous stamina and climbing ability of these

mountain natives. In the lowland, however, I had no difficulty in keeping pace with them.

The five days I spent on the lake easily surpasses all my New Guinea memories. The beauty of the landscape, the splendid scientific success (I discovered in the reeds and grasslands on the edge of the lake several species of birds either new to science or at least new for New Guinea) and the hospitality of these primitive and supposedly savage natives made me very loath to leave. When my party departed, all the women and girls of the village were lined up along the road, shedding copious tears, according to a custom widely distributed over New Guinea. However, as it was the first time that I experienced this proof of hospitality, I was deeply touched, and felt almost like joining in.

We returned the way we had come and after a short stay in Dohunsehik, where I wanted to get a specimen of the rare long-tailed bird of paradise (*Astrapia*), I arrived in Ditchi. Here I found my Malaysians in good health and spirits, much to my relief.

In order to meet the next mail steamer, I returned to the coast immediately, where I left my Malaysians, while I took a canoe to Manokwari.

After thirty-five hours of continuous paddling I was back in civilization. Tired, unshaved, dirty, and sunburnt, I was invited immediately on my arrival to board the Dutch marine survey ship, the latest word in European luxury, to tell about my adventures. What a contrast!

Looking back on my first expedition, I value more than the discovery of many specimens and facts new to science, the education that it was for me. The daily fight with unknown difficulties, the need for initiative, the contact with the strange psychology of primitive people, and all the other odds and ends of such an expedition, accomplish a development of character that cannot be had in the routine of civilized life. And this combined with a treasury of memories, is ample pay for all the hardships, worries, and troubles that so often lead us to the verge of desperation in the scientific work that takes us into "the field."



A VIEW OF ANGGI GIDJI LAKE

KANGAROOS AND THEIR YOUNG

How the Offspring of the Largest of Existing Marsupials, Hardly More Than One Inch in Length at Birth, Develops in Its Mothers' Pouch

By W. HENRY SHEAK

IN all my experience with wild animals in zoölogical gardens and circus menageries, I have never found anything that attracts so much attention among the great majority of people, as does a baby kangaroo, unless it be one of the great man-like apes—the orang-utan, chimpanzee, or gorilla. I have seen the crowds pass the giraffe enclosure with a pause of but a minute or two and then stand enraptured for a quarter of an hour before a cage of monkeys. But a baby kangaroo, with its head protruding from the mother's pouch, will hold them longest of all. The peculiar method of carrying the young is, of course, the feature of leading interest.

The interest, however, is not confined to the lay mind. Indeed, the birth and development of a young kangaroo is a subject full of concern even to the trained naturalist. There is still much to be learned in this relation.

The young are born in a very immature condition—tiny, blind, and naked. Hunters have told me that they have found them in the pouch of the mother, clinging to the nipple and no larger than a mouse, which agrees with the statements of the books that when first born the young of the largest species is scarcely more than an inch in length.

It is now known that this tiny mite is *not* placed in the pouch by the mother, immediately after birth, but, undeveloped as it is, finds its own way there. The pouch is formed by a fold of skin on the abdomen of the mother, with the opening at the front, in about the vicinity of the navel of the placental mammals. It includes the mammary or milk glands

and is almost bare, being very sparsely covered with hair. One case is known of twins being born, but one is almost invariably born alone.

The mother kangaroo keeps her pouch clean by the use of her front feet and her tongue, though the young are not always immaculate. After the youngster is able to come out of the pouch, the mother uses her tongue in making his toilet.

The baby remains in the pouch till he is able to come out and take care of himself. As is well known, it is no unusual sight, when a herd of kangaroos is feeding, to see the head of the baby protruding from the mouth of the pouch, nibbling grass. I have seen the young eating this way in captivity. The young one continues to retreat to the pouch about as long as he can get back. Even when quite large he will rush into the pouch, when alarmed or frightened, as to a place of shelter and protection, much as a child takes refuge in its mother's arms.

Just how long the young kangaroo remains in the pouch of the mother before beginning to venture out, I am not prepared to say. A great red kangaroo (*Macropus rufus*—Zimmermann) was born in the Barnum and Bailey circus menagerie a short time before I became their naturalist and lecturer. When I went there it was just beginning to put out its head. Mr. George Conklin, the superintendent of menagerie, insisted that he had then known of its presence in the pouch for two months and thought it must have been a month old when he first discovered

it. About a month after I joined the show, the little fellow began coming out. (Four months seems rather long for the young to remain in the pouch in view of their very rapid growth after beginning to protrude their heads, but the period cannot be less than two months, and is probably three or even more). A month after his first emergence, he would still rush back on the slightest provocation, going in head first and turning round, but leaving his tail and hind legs protruding eighteen or twenty inches. In this position he presented a very comical picture.

There are thirty-five or more species of kangaroos, varying in size from a rabbit to a man. The larger species are more than eight feet in length, including the long tails. They are all natives of Australia and the near-by islands. The typical species are characterized by the small and comparatively feeble fore limbs and the very long and powerful hind limbs and tail. In traveling rapidly across country, they do not touch their fore feet to the ground, but progress by great jumps, as much as eighteen feet at a jump. They have been known to jump over a wall eleven feet high. When moving slowly, as in feeding, they do put their fore feet on the ground. The smaller species are often called wallabies and rock wallabies, as they commonly live in rocky regions. There is also an aberrant group, known as tree kangaroos, the members of which have the fore limbs and hind limbs more equal in size, owing to their tree-climbing habits. The kangaroos are timid and prefer to run away rather than fight, but when cornered and forced to defend themselves,

they will do so quite vigorously. If possible, they take a position before a tree or a large rock, then strike forward with the hind foot. One of the four toes (the fourth digit) on each hind foot, is much longer than the others and is armed with a long, sharp claw. With this they can easily rip open a dog or do great damage to a man. They try to get their arms around the antagonist. When pursued by dogs in the neighborhood of a river or pond, they will jump into the water and, if the dog follows, will sometimes take the offensive when he is beyond his depth. Instances are known in which dogs, under such circumstances, have been drowned by kangaroos.

The great red kangaroo is about the



GREAT RED KANGAROO
(*Macropus rufus* Zimmerman)

He is jumping across his yard. Observe that all four feet are off the ground. Photograph by Newton H. Hartman, official photographer of the Philadelphia Zoological Garden

same size and the female about the same slaty-gray in color as its cousin the great gray kangaroo (*Macropus giganteus*—Shaw), but the male of the species under consideration is distinguished by the rusty or brick-dust red color of his back and sides. The females may be easily distinguished from the fact that in the great gray the upper lip is covered with hair, while in the great red there is a naked muzzle. The fur of the great red is woolly, dense and soft, and very much resembles a rich plush.

The kangaroos, in common with the other marsupials, are of a very low order of intelligence. The brain case is remarkably small in comparison to the size of the head, and the head is small when compared to the bulk of the body. They never show any attachment for their keepers. Yet the kangaroo mother we had in the circus was very solicitous for the safety and welfare of her son. At first she gently objected to his coming out, holding him in the pouch with her fore paws. But his budding curiosity and growing activity could not be suppressed and his excursions into the outer world became more and more frequent. At first she would restrain him with her paws

from going to the far side of the cage, keeping him close to her side, but as he grew older he ventured farther and farther from her.

Some hunters say the mother kangaroo has no love for her young, because when hotly pursued by enemies she will sometimes throw the baby to one side into the bush and continue her flight without it. But I think this is a libel. She realizes that with the weight of the baby she will be unable to escape, but by hiding the baby in the bush, she may be able to do two things, namely, draw the enemy away from her offspring and, relieved of its weight, eventually make her own escape, when she can return and recover her loved one.

The father of our menagerie baby was permitted to share the cage with the mother and offspring, but never made any attempt to harm him. On the other hand, he showed no affection for him. His attitude was one of indifference. The family made a very interesting group and during exhibition hours there was always a crowd in front of the cage. More questions were asked about the kangaroos than about all the other animals in the menagerie.

Photograph by E. R. Sanborn
Courtesy New York Zoological
Society



A SAFE SHELTER

Immediately after birth a young kangaroo finds its way to its mother's pouch where it remains for about three months



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

OTTLEY-ANTHONY VENEZUELA EXPEDITION.
Early in January Mr. Gilbert Ottley and Curator H. E. Anthony of the department of mammals of the American Museum, left for a short expedition to northern Venezuela. Mr. Ottley, who has on two previous occasions generously supported museum expeditions to the West Indies and to South America, is a volunteer assistant on the trip to Venezuela, where a collection of mammals will be made, principally in the Merida district.

The Merida region, which is a mountain area running up to the line of perpetual snow, is important biologically because it is the type locality for a number of species. Merida is one of the regions from which early collections of South American mammals were received, and while it is doubtful whether the present expedition will secure specimens of anything new to science, they should be able to collect series of mammals valuable because they will be known species which have served as the basis for a great deal of the later studies. The American Museum has only a few mammals from this vicinity which were collected by resident natives.

Messrs. Ottley and Anthony will be equipped for working this region with tents and pack train, and expect to spend about two months in the undertaking.

Because northern Venezuela now offers exceptional facilities for travel by motor car, it may be possible also to investigate sections less well known than Merida, with a consequent chance for new species, provided the collecting in Merida can be completed in time.

SCARRITT-PATAGONIAN EXPEDITION.—In *La Nación*, leading Buenos Aires morning newspaper, there appeared on August 1, 1931, an account of a lecture by Dr. George Gaylord Simpson, leader of the Scarritt-Patagonian Expedition of the American Museum, who returned to New

York on October 27. This was one of several lectures given in the Argentine on the results of this Museum expedition. On the occasion of the last lecture, before the Sociedad Argentina de Estudios Geográficos "Gæa" (principal Argentine society devoted to all the earth sciences) Doctor Simpson was made an honorary Corresponding Member of the society.

The preparation of the numerous specimens found by the Scarritt-Patagonian Expedition is in the hands of Mr. C. S. Williams, assistant on the expedition, and is now well under way. Doctor Simpson has begun the long task of identifying and describing the fossil mammals and reptiles, while special collections of fossil plants, fossil birds, rocks, etc., are being assigned to other specialists for study. The scientific results promise to be exceptionally important.

The account in *La Nación* may be translated in part as follows:

A meeting was held yesterday in the National Museum of Natural History in honor of Dr. George Gaylord Simpson. In addition to the scientific staff of that institution, there were present the Ambassador of the United States, representatives of various Argentine scientific bodies and North American cultural societies active in this city, as well as a great number of students and professors.

The director of the Natural History Museum (Museo Nacional de Historia Natural, in Buenos Aires), Professor Doello Jurado, opened the meeting by greeting his North American colleague and expressing the satisfaction with which the students of this country observed the productive and serious activity of the paleontological expedition of the Museum of Natural History of New York in Patagonia, by which it will contribute effectively to the better knowledge of the extinct faunas of the lower Tertiary of that part of Argentina. He added that in spite of the important similar work which Argentine institutions have done and are doing, within the limits of their scanty means, foreign expeditions are to be well received, especially when, as in the present instance, they come from a famous institution. . . . Professor Doello Jurado then said that the New York Museum had just sent as a gift to that of Buenos Aires, at the special request of Doctor Simpson, several specimens of a new genus of mammals similar to those of Patagonia, the so-called *Paleostylops* of the Eocene of Mongolia, discovered there by an expedition of the American Museum and forming invaluable comparative material.

As an introduction to Doctor Simpson's talk, Professor Doello Jurado briefly reviewed the North American expeditions which had previously come to Patagonia with paleontological aims, namely: that of Hatcher, 1896-99, of Princeton University; that of Loomis, 1911, of Amherst College; and more recently that of Riggs, 1925, of the Field Museum of Chicago.

Dr. Simpson began by pointing out that he came to the Argentine Republic with the aim of studying the most primitive forms of mammals of South America, the remains of which are found in Central Patagonia in the *Notostylops* beds.

He said that he spent more than seven months in those regions studying the exposures of that formation, and at the same time making an important and extensive collection of its fossils. With this end in view, he visited a great number of deposits, emphasizing for the aims of his studies those situated north and south of Lake Coli-Haupi, those found on both sides of the upper course of the Rio Chico del Chubut, and the region of Puerto Mazaredo. As is well known, these sites are in the region of the Gulf of St. George.

Doctor Simpson illustrated his talk with a large number of views taken during his expedition to Patagonia and showed several specimens from the Florentino Ameghino Collection.

The work was carried out with the aim of determining more exactly the origins of the great extinct animals of the Argentine, the ancestors of which are found in the geological horizons of that region.

The present opportunity has permitted the lecturer to make a detailed study of the classic Ameghino Collection, preserved in the National Museum of Natural History of Buenos Aires. . . .

THE FRANCO-ANGLO-AMERICAN EXPEDITION TO MADAGASCAR.—Mr. J. Delacour, associate, French National Museum of Natural History, corresponding member, American Museum of Natural History and leader of the expedition has sent in the following brief summary of the activities of the now completed expedition.

In 1928 Dr. L. C. Sanford, whose enterprising spirit had organized so many important expeditions, and Dr. P. R. Lowe, of the British Museum of Natural History, approached me to know if the Paris Museum, and myself personally, would be interested to support a joint expedition to Madagascar.

In a few months, all details were settled and I left Marseille in March, 1929, as leader of the expedition, together with Messrs. R. Archbold, J. Greenway, Jr., W. L. Lowe, and A. L. Rand, in order to make a thorough survey of the birds and mammals of the great island. Dr. J. C. White joined us a few weeks later, with the object of collecting fossils.

We arrived in Madagascar on April 19, 1929; at once, I made arrangements for the exploration of various districts in which it was desirable to collect methodically, either because they were zoologically unknown, or particularly important. It must be remembered that, although many specimens from Madagascar had reached various museums in the past years, and in spite of the wonderful work of Alfred Grandidier, no extensive systematic collecting had ever been done in the country; therefore, no good series existed; consequently geographical variations and distribution of many forms were poorly known.

The localities visited during the two years that the expedition was in the field are numerous and varied: center (Ankaratra), east (Lake Alaotra), southeast (Ivohibe, Vondrozo, Farafangana), southwest (Ihoso, Lake Iotry, Tulear, Lake Tsimanampetsoa, Ampotaka), and northwest (Tsiranomandidy, Ankavandra, Tsiandra, Maintirano, Namaroka, Lake Kinkony, Loalala, Majunga), north and northeast (Anorontsanga, Tsarakibany, Montagne d'Ambre, Vohemar, Andapa, Maroantsetra), all were thoroughly searched in turn by some of us, Messrs. R. Decary and P. Du Mont having joined the expedition after the departure of Messrs. Archbold, Greenway, Lowe, and myself. The results have been quite satisfactory; large numbers of practically all birds and mammals known to exist in the island, including many of those so far considered as rare, were secured, together with numerous field notes and observations. A good many new forms were found, and we have now sufficient material and data upon which to base a definite revision of this part of a most interesting fauna.

The birds have been studied by myself personally, but N. J. Berlioz, of the Paris Museum, Messrs. Archbold, Du Mont, and Rand assisted me greatly in sorting out the specimens. The mammals have been named by Mr. G. Grandidier, and Mr. Archbold, who will publish a list, while Dr. P. R. Lowe is working on the anatomy of alcoholic specimens. The collection of birds contained a new genus, *Randia*, a new species, *Neutonia archboldi*, and ten new subspecies. Descriptions, critical notes, field notes and a complete list will be found in *l'Oiseau et la Revue Française d'Ornithologie* for 1930, 1931, and 1932, with maps and colored plates of new or hitherto unfigured birds.

I should like to express here our gratitude to the late Mr.

John F. Archbold, whose generosity made the expedition possible. We are also under deep obligation to Mr. Richard Archbold, who not only added to the large sum contributed by his father but personally assisted as a mammalogist and collector; also, to Mr. A. S. Vernay our hearty thanks are due for his generous contribution.

Mr. A. L. Rand is responsible for the greatest part of the success of the expedition; his uncommon ability and energy, and his experience in the field have been of the greatest possible value, and I am glad to express publicly to him my complete appreciation and gratitude, in giving him full credit for excellent work.

Besides the capital progress achieved by the expedition in the knowledge of Madagascan birds and mammals, it is gratifying to prove that coöperation between naturalists from the three countries not only could be carried out in perfect harmony, but also could produce remarkable results.

BIRD STUDY.—Dr. Frank M. Chapman, curator of birds at the American Museum, sailed late in November for Barro Colorado, Panama Canal Zone, where he will spend the winter engaged in research at his laboratory on that island.

ASTRONOMY

THE Amateur Astronomers' Association announces the following lectures to be given in the auditorium of the American Museum of Natural History, on alternate Wednesday evenings during February and March, at 8:15 P.M..

FEBRUARY 3—Mr. A. E. Backman, representative of the National Better Business Bureau—"Astrologers and Astronomical Fakes";

FEBRUARY 17—Mr. Sydney Helprin, assistant curator of geology, American Museum of Natural History—"Glacial Climates and the Sun";

MARCH 2—Dr. S. A. Mitchell, director of the Leander McCormick Observatory, University of Virginia, "With An Astronomer to Tin-Can Island";

MARCH 16—Dr. John A. Ingham—"The Total Eclipse of 1932."

These lectures are open to the public and anyone interested is cordially invited to attend.

The 1931-32 series of Radio Talks over WOR, under the auspices of the Amateur Astronomers' Association, began on December 19, when Dr. Clyde Fisher spoke on "Earth and Neighbor Worlds." These talks are broadcast from 4:40 to 4:55 P.M. every Saturday.

EDUCATION

NATURE STUDY COURSE FOR CITY TEACHERS.

On February 10 the department of education of the American Museum is instituting a new course in nature study for the teachers of New York City, under the direction of Miss Farida Wiley, staff assistant in education. The aims of this course are: to acquaint teachers with the common forms of plant and animal life about this region; to enable them to recognize specimens in the field; to learn about the life, habits, structure,

interdependence, and importance of our wild life; to use such knowledge in presenting the subject of nature study to city children, and to foster in these children a love for living things and the desire to conserve them.

In all, fifteen sessions will be held, five of which will be conducted as field trips to emphasize the interdependence of plant and animal life, and to aid the students in identifying these objects in their natural environment.

While this course is primarily intended for teachers, and thirty hours credit will be allowed for it by the Board of Education, others wishing to take the course may do so upon payment of a fee of ten dollars.

Registration should be made before February 10, 1932.

PARENTS' DAY.—On November 17 the American Museum held its third annual Parents' Day, which was attended by parents of school children from all New York boroughs except Richmond.

Dr. George H. Sherwood, director of the Museum, greeted the guests at 2:30 o'clock, and gave a brief talk on the founding of the Museum, its organization, expeditions, and other phases of its work. A motion picture was then presented showing the process of taxidermy employed in the preparation of an Indian elephant for exhibition in a Museum group. The parents were then divided into two groups and conducted behind the scenes to see the laboratory and taxidermy work. At the close of this program tea was served.

Parents' Day is of great value in increasing the service of the Museum to the public schools, for, after being introduced to the Museum's work, parents are always eager to have the school their children attend make use of the Museum's school service and to have their classes visit its halls. A number of requests were made for speakers from the education department to address Parent-Teacher meetings on the Museum's school service work.

MARIONETTE SHOW AT THE AMERICAN MUSEUM.—As a special holiday feature to replace the usual Saturday afternoon entertainment for parents and children, at the American Museum, the Rufus Rose Marionettes gave a performance of "Dick Whittington and His Cat."

The Rufus Rose Company, consisting of Rufus Rose, Margaret Skewis (Rose), Isham Chappell and Donald Cordry, generously presented their marionettes at the Museum for the benefit of the school children and their parents who visit the Museum.

Preceding the show there was a short talk on the history of puppet shows in the different countries of the world.

CONSERVATION

RESTORATION OF THE WISENT OR EUROPEAN BISON.—Last summer the New York Zoological Society appointed Dr. W. Reid Blair, director of the New York Zoological Park, to visit the various private collections of bison in England, Germany, and Poland, with the view of ascertaining just how the Zoological Society might be of service to the International Society for the Preservation of the European Wisent, in its efforts to preserve these almost extinct animals.

Doctor Blair in his report on the results of his trip says he found the keenest interest manifested in Poland, where the Government is making preparation to reestablish the species in the famous Forest of Bialawieska, comprising more than 250,000 acres of forest lands, where the bison were once abundant until the Great War. The Polish Government has ordered all the bison in the Zoological Gardens of Poland to be sent to this Forest, where winter shelters and feeding stations have been erected in a 70-acre enclosure. Provisions are being made to enlarge the bison range as fast as the needs of the animals require. Game keepers patrol the Forest to prevent poaching, and every effort is being made by the government to restore and preserve the bison as a patriotic duty of its citizens.

Recently the Zoological Society offered the International Society for the Preservation of the Wisent substantial financial aid in its efforts to save the wisent or European bison from extermination. The only stipulation placed upon the grant was the provision that the money put at their disposal should be used exclusively for the furthering of pure-blood wisent breeding within suitable park or forest areas, and not in zoological gardens where conditions are unsuited to their successful propagation.

His Grace the Duke of Bedford of Woburn Abbey has the best herd of pure-blood wisents in existence in the world today. His Grace's intelligent breeding and control methods are meeting with success. This herd now numbers 27 specimens, several calves having been born this year.

In the 25,000-acre Park of the Prince of Pless, located in Southwest Poland, Doctor Blair saw the wisents in a wild condition, just as they appeared one hundred or more years ago when the species was hunted as a sporting animal. During the winter when there are heavy snows,

the wisents are provided with hay at several feeding stations, but during the greater part of the year the animals roam through the Forest where they must be carefully tracked in order to get a glimpse of them.

In Germany the last remaining wisents, consisting of ten animals, are owned by Count Arnim-Boitzenburg in his Forest Park, located about eighty miles north of Berlin. This is the only place in Germany that offers any prospect of successful breeding of the wisent.

During Doctor Blair's visit to the scattered collections in Germany and Poland he was accompanied by Dr. Kurt Priemel, president of the International Society for the Preservation of the Wisent and also by the secretary of the Wisent Society.

He is convinced that there are still enough pure-blood wisents in England, Poland, and Germany to insure the success of a number of breeding colonies.

After the formation of a small international committee for the administration of the funds, it will be decided in just what manner the money made available by the Zoological Society can be used to the best advantage.

HONORS

ON November 7, 1931, on the occasion of the re-opening exercises of the University of Paris (founded in 1215) the degree of Doctor of the University was awarded to Professor Henry Fairfield Osborn, president of the Board of Trustees of the American Museum of Natural History. The degree, together with the insignia of the doctorate and the white-bronze medal of the University of Paris, was accepted on Professor Osborn's behalf by Williamson S. Howell, Jr., Charge d'Affaires of the Embassy of the United States. The awarding of the degree followed a brilliant address by M. Maurain, the dean of the Faculty of Sciences, in which Professor Osborn's signal contributions to science were admirably outlined.

"Under his vigorous impulsion," said the Dean, "the Museum at New York has become a sort of model institution; by virtue of the richness of

its accumulated documents, by the order and method of their arrangement, by the excellence of their exhibition, by immense scientific labor recorded in publications of all kinds, finally by the radiation of explorations, which, beginning in North America now extend to vast regions of the globe."

After mentioning some of the most arresting

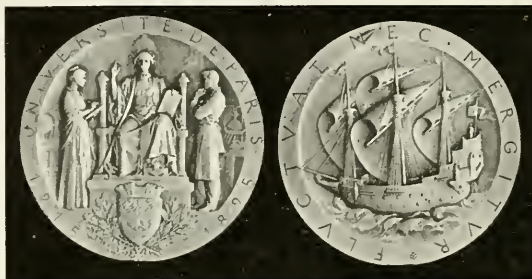
of Professor Osborn's contributions to palæontology, such as his monographs on the fossil rhinoceroses, titanotheres, and proboscideans, Dean Maurain said:

"Osborn is a familiar of our country. Since his first sojourn here in 1869, he has returned on many occasions. 'These voyages,' he has written in the

French translation of his work on the *Origin and Evolution of Life* 'have taught me not only to know and to admire France, but to draw my inspiration from the illustrious work of your savants, from Descartes to Curie, from Buffon to Claude Bernard and to Pasteur. . . . In this work I hope to repay at least in some small measure my debt of gratitude, both to those great masters of thought and to France, our beloved ally.' This debt of gratitude has been repaid by Osborn in still another way, for during the war his four children served among us. In inscribing the name of Henry Fairfield Osborn on the list of doctors *honoris causa*, the University of Paris is happy to salute one of the greatest scientists of contemporary America, whose magnificent work is accompanied by his preponderant part in the development of the American Museum where the naturalists of the entire world may well wish to labor with incomparable profit."

FOSSIL VERTEBRATES

NEW AURIGNACIAN CARVINGS.—Mr. Edwin H. Colbert, assistant to Professor Osborn in his researches on the Proboscidea, is making a tour of the European museums with reference both to Proboscideans and fossil mammals of the Siwaliks of India, a group on which he is preparing his doctorate thesis. He reports through Professor von Huene of Tübingen a recent discovery of great importance made within the past month. In a cave near Tübingen, associated with two



OBVERSE AND REVERSE OF THE MEDAL OF THE UNIVERSITY OF PARIS

Awarded to Prof. Henry Fairfield Osborn when the degree of Doctor of the University was conferred upon him on November 7, 1931

human skulls of Aurignacian type and with Aurignacian flints, were found several statuettes in ivory. They are beautifully carved—as well as any of the things from France. The carvings include a woolly mammoth, a horse, a lion, and another animal, probably a rhinoceros. Doctor Hennig is preparing casts of these new examples of upper Palaeolithic art, a set of which he will present to the American Museum. Moreover, in this cave were discovered many elephant grinding teeth. Doctor von Huene is arranging to have some of these teeth sent to the American Museum for sectioning and for study by the new goniometric method. They may prove to be of great importance, for it is known that they are positively of Aurignacian age. By cutting these grinding teeth, a check on the enamel length may be made as a means of computing their geologic age.

In the Stuttgart Museum is the newly discovered *Elephas antiquus germanicus* from Steinheim. This cranium is complete except for a portion of the frontal bone. Doctor Berckhemer is making a scale restoration of one-fifth natural size of the head of this extinct upper Pleistocene species as it appeared in life. It is an excellent model; the anatomy is correct and the appearance is quite lifelike. Doctor Berckhemer is kindly exchanging this model for one of the Proboscidea models in the American Museum collection.

OTHER MUSEUMS

TITANOTHERES GROUP IN THE FIELD MUSEUM.—Following upon the great success

attained in recent years by various museums with habitat groups of present-day animals and birds, the Field Museum of Chicago is inaugurating groups of extinct animals, the animals being modelled to life size and placed in cases with painted backgrounds and modelled foregrounds. A group of the great titanotheres which reached their culmination during Oligocene times in North America is one of the first of its sort and was placed on exhibition in the Field Museum last summer.

The animals were modelled by Mr. Frederick A. Blaschke, with the advice of the two great authorities on titanotheres—President Henry Fairfield Osborn and Dr. W. K. Gregory of the American Museum. The work was done at Mr. Blaschke's studio at Cold Spring-on-Hudson, New York. The animals were transported to Chicago in trucks, and considerable difficulty was encountered on the road because of the great size of the models—the old bull standing more than eight feet in height at the shoulder.

The group represents an adult male of one of the largest species of titanotheres, a female and a calf. While the difficulties and expense in the preparation of groups of this kind are great, their value in teaching palæontology to museum visitors can hardly be overestimated.

—WALTER GRANGER.

CHARLES WILLSON PEALE

THERE has recently been discovered in the possession of the Peale family a beautiful self-



Photograph by the Field Museum

A RESTORATION OF TITANOTHERES

One of the first of a series of habitat groups of extinct animals which are being prepared and installed in the Field Museum, Chicago

portrait of Charles Willson Peale. In addition to its interest as a portrait of himself, it portrays Charles Willson Peale holding in his arms the large leg bone of the mastodon which he excavated from the clay pits of the Hudson Highlands. This mastodon was afterward exhibited in Peale's Museum in Independence Hall, Philadelphia. The portrait has been in the possession of the Peale family since it was painted by their illustrious ancestor. *NATURAL HISTORY MAGAZINE* has received permission to reproduce a photograph of the painting for the benefit of those of its readers who are interested in the life and works of this American portrait painter of a century ago, whose artistic talent was inherited by three of his five sons, Titian Ramsay Peale, Rembrandt Peale, and Raphaëlle Peale.

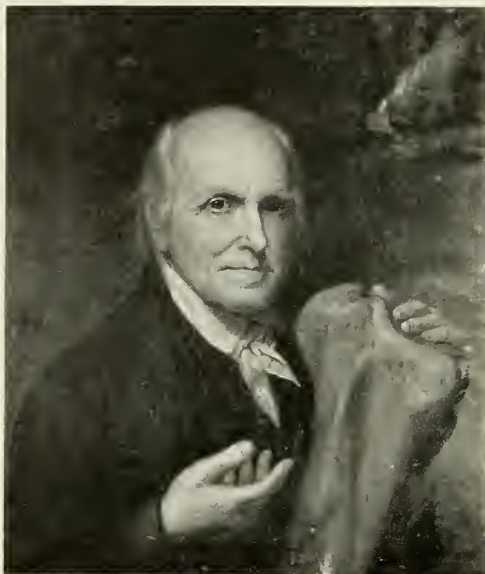
In 1801-02 Charles Willson Peale, at his own expense, undertook the excavation of the skeletons of two mastodons in Ulster and Orange County, New York, which event was depicted in the historic painting by Rembrandt Peale, now in the Museum of Fine Arts, Boston, Massachusetts.

HISTORY OF THE EARTH

ALBUM OF THE CAÑONS OF THE GREEN AND COLORADO RIVERS.—Mr. Julius F. Stone has recently presented to the department of geology of the American Museum an album of remarkable photographs containing more than 1200 scenes along the cañons of the Green and Colorado rivers, extending from Green River, Wyoming, to Needles, California. The album is beautifully bound in sheepskin and all the photographs are velox prints. These photographs, taken on Mr. Stone's voyage in small boats down the Green and Colorado rivers from September 12, 1909, to November 19, 1909, record a remarkable experience somewhat similar to that of Major Powell's party in 1869. This superb collection of views in nineteen cañons, doubtless the most complete ever made along these rivers, is a splendid gift—invaluable to the student of

geology. As an excellent reference volume for the staff of the geology department of the American Museum it is without an equal.

The donor, Mr. Stone, whenever opportunity has afforded, has stepped outside his intensely active business career to interest himself in the field of exploration and to delve into the romance and science of things geologic and topographic. For many years he has been a student of astronomy and of zoölogy. He was a member of a recent scientific expedition to the Galapagos.



CHARLES WILLSON PEALE
A recently discovered self-portrait of the artist

RECENT donations to the department of geology of the American Museum include a thirty-pound block of sylvite, potassium chloride, KCl , from the United States Potash Company mine near Carlsbad, New Mexico. The specimen was obtained from a bed 10 feet in thickness and of considerable extent at a depth of 980

feet below the surface of the ground. The large, milky-white crystals in the specimen are practically pure sylvite. The pink crystals are also sylvite, but discolored by mineral water.

Another gift is one coiled Ammonite shell, diameter 14 inches, collected by Mr. Kenneth McDonald (now deceased) from his ranch on Willow Creek, Wyoming, gift of Mr. Harold D. Flautt, Casper, Wyoming.

MAMMALS

THE HALL OF NORTH AMERICAN MAMMALS.—Plans have been formulated for a fine new hall of North American mammals at the American Museum, and the details are now being worked out in a small-scale model. In an early number of *NATURAL HISTORY MAGAZINE* a full account will be given of the new hall, with illustrations of some of the outstanding features which it will exhibit. In this connection it is very gratifying to report that the new hall will have the benefit of an active coöperation with the Boone and Crockett Club. In their annual report published recently the following appeal to the membership is an evidence of their interest:

The wild life of the world is fast vanishing. The Boone and Crockett Club at its annual meeting in January, 1929, adopted a resolution urging on the authorities of the Museum the necessity of portraying the great mammals of America in scale commensurate to those of the monumental habitat groups of the larger mammals of Africa and Asia now being erected in the new galleries of the Museum devoted to those areas. In reply our fellow member, President Osborn of the Museum, has designated the magnificent hall forming the ground floor of the new Akeley wing as the Hall of North American Mammals, and has requested the Boone and Crockett Club to take this hall under its special care.

The American Museum of Natural History is without specimens of nearly all the larger animals suitable for mounting in the new exhibition hall, and lacks adequate study series of many of the smaller forms. The needs of scientific study today require a representation of all forms sufficient to exhibit the more outstanding variations of local races and differences of sex and age. The American Museum, because of its prominence and situation in the City of New York, is expected by the world at large to have such representative collections of the wild life of North America.

The plans for the finished hall of North American mammals provide for:

- (1) Some twelve major and minor habitat groups representative of the more outstanding mammals in settings typifying the major topographic areas of North America.
- (2) A complete series of the outstanding species of North American mammals.
- (3) Fossil skulls of the lately extinct contemporaries of the recent fauna—mastodon and mammoth, giant bison and deer, horse, camel, lion and sabre-toothed tigers, etc.
- (4) Reliefs of the major Indian tribe types.
- (5) Backgrounds and accessories to portray the more prominent geographic and ecologic features and those intimately associated with the early development of the West—the importance of the North American mammals to the Indian and white settlers, and the explorations of Daniel Boone, Pike, last campaign of Custer, etc.

It is hoped that those members of the Club contemplating hunting trips will communicate with the Secretary and obtain a copy of the Prospectus for the new hall of North American mammals and a detailed list of the animals of the particular district to be visited most desired by the Museum, together with Museum's directions for care and preparation.

The wild life of North America is fast vanishing and members of the Club will confer a lasting benefit to posterity and science by aiding in this public cause.

Committee for the Boone and Crockett Club,

CHILDS FRICK, *Chairman*
 BAYARD DOMINICK
 ALFRED ELY
 PRENTISS N. GRAY
 E. HUBERT LITCHFIELD

Ex Officio
 MADISON GRANT
 KERMIT ROOSEVELT

WILSON A. BENTLEY

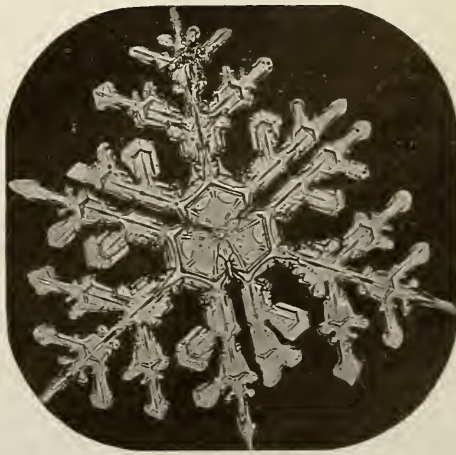
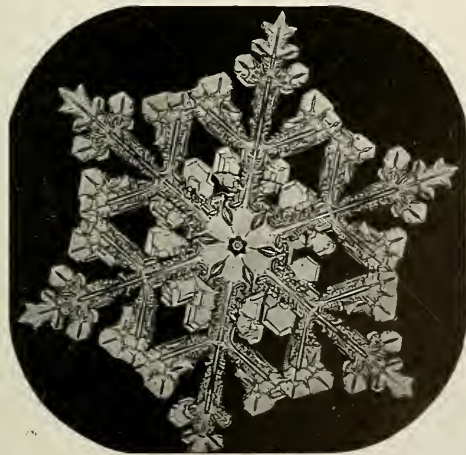
ON December 23 Wilson A. Bentley, widely known for his beautiful photographs of snow crystals, died of pneumonia at his home in Jerico, Vermont, at the age of sixty-six years.

In the spring of 1919 and again in 1925, NATURAL HISTORY published a series of Mr. Bentley's unique photographs of snow crystals in connection with articles by Mr. Herbert P. Whitlock on "Art Motives in Snow Crystals," and "The Mimicry of Minerals." Two of these photographs are reproduced herewith.

Mr. Bentley's interest in snowflake photography began when, as a youth, he noticed the beautiful formations of the crystals under a microscope put at his disposal by his mother. As his interest deepened into a hobby, he developed a camera to meet the special requirements of high magnification of from 64 to 3600 times, necessary for the portrayal of the intricacy and beauty of nature's geometrical designs expressed in these tiny jewels produced by the crystallization of water. For forty-six years Mr. Bentley devoted himself to his hobby, and during that time he accumulated more than 5300 examples of snowflakes, no two alike. He also made pictures of frost crystals, ice, ice crystals, and hail, as well as of dew, clouds, and raindrops.

Among Mr. Bentley's many publications on the subject are the articles on ice and snow in the Encyclopedia Britannica and the Americana. He was also co-author of *Snow Crystals*, with W. J. Humphreys of Washington.

Mr. Bentley was a fellow of the American Meteorological Society and a member of the American Academy for the Advancement of Science.



COMPOUND STELLATE SNOW CRYSTALS

Two of the many snowflake studies made by Wilson A. Bentley during his long career as a photographer of nature's handiwork

MINERALS AND GEMS

EDMOND DE GONCOURT'S OPINION OF MUSEUM COLLECTIONS.—To our honored member, Mr. I. Wyman Drummond, we owe the following citation from the writings of the famous French litterateur, Edmond de Goncourt. The extract, which is popularly known as "de Goncourt's will," is taken from the auction catalogue of his collection, sold in Paris in 1897, the year after his death. The catalogue itself bears no comment on this "volonté."

Ma volonté est que mes dessins, mes estampes, mes bibelots, mes livres, enfin les choses d'art qui ont fait le bonheur de ma vie, n'aient pas la froide tombe d'un musée, et le regard bête du passant indifférent, et je demande qu'elles soient toutes éparpillées sous les coups de marteau du commissaire-priseur et que la jouissance que m'a procurée l'acquisition de chacune d'elles, soit redonnée, pour chacune d'elles, à un héritier de mes goûts.

This passage may be translated as follows:

My wish is that my drawings, engravings, trinkets, books—in a word, all my objects of art which have lent happiness to my life, shall not go to the icy tomb of a museum and the stupid glances of indifferent passersby. I demand that they shall all be scattered under the strokes of the auctioneer's hammer, and that the enjoyment which the acquisition of each article has rendered me be given in turn, for each piece, to an inheritor of my tastes.

Our American Museum wish is that it were possible for Edmond de Goncourt to come back to life and visit the Morgan Hall of Minerals and Gems and see how these priceless objects of art and of nature are not for a moment hidden in "the icy tomb of a museum" but are radiating their beauty to hundreds of thousands of joyous visitors from every part of the world, with most intelligent and carefully drafted inscriptions in the way of artistic of scientific direction.

—H. F. O.

SCIENCE OF MAN

A FINE feather headdress from the Cheyenne Indians was presented to the Museum by Mr. Darwin P. Kingsley. All Indians are now thought of as wearing picturesque waving headgear of eagle feathers, but a hundred or more years ago, such headdresses were worn by certain tribes of our western plains, particularly by the Sioux, Cheyenne, and the Crow. Further, such headdresses were worn by chiefs and distinguished men only. We are told that originally each feather represented an achievement and also that the whole acted as a charm to protect the wearer in battle, but this was many years ago. For the past fifty years or more, headgear has been merely a matter of dress, to be worn by anybody. Feathers of the eagle, only, are used, and carefully selected to match in size and beauty. The headdress presented by Mr. Kingsley contains a series of thirty feathers encircling the head and a streamer hanging down behind carrying twenty-eight feathers.

"VANISHING INDIA"

THE remarkable series of paintings of East Indians by Hubert Stowitts which was on display at the American Museum during last April, and which attracted so much interest among NATURAL HISTORY readers when black and white reproductions of the paintings were published in the September-October issue, with a cover in color, have since been exhibited at the Royal Colonial Institute, Amsterdam, Holland. They will go from there to the Royal Museum at Brussels for the month of February.

BOOK REVIEWS

A Year on the Great Barrier Reef. The Story of Corals and of the Greatest of Their Creations. By C. M. Yonge, 1930. Putnams, England and U. S. A.

THE Great Barrier Reef of Australia is one of the natural wonders of the world and the most remarkable achievement of the combined activity of living creatures known. Extending, as it does, for more than twelve hundred miles along the tropical eastern coast of Australia, it forms a continuous coral rampart, the turreted summits of which rise to the ocean surface in overlapping series of living reefs.

Between the outer barrier and the Australian mainland, five to two hundred miles away, there is a tortuous channel navigable to ocean liners and dotted with small islands.

On one of these islands, Low Isle, the main portion of the British Great Barrier Reef Expedition established its headquarters, and for over twelve months during the years 1928-1929 conducted an unusual series of explorations, observations, and experiments with the object of increasing scientific and economic knowledge of the Great Barrier Reef, and the life and habits of the coral animals that formed it. While the technical results of this work are being published in various English scientific journals, a remarkably interesting popular narrative has appeared in book form under the authorship of the leader of the expedition, Dr. C. M. Yonge, with the title mentioned at the head of this article.

The expedition was divided into two main sections devoted respectively to biological and geographical investigations. While the geographical section made extensive cruises throughout the length of the Barrier, the biological section occupied quarters built for them by the Queensland authorities on Low Isle and organized a personnel of fifteen investigators to make careful studies of the ecology of the reefs; the breeding, development, and growth of the coral animal; the feeding and digestion both of the corals and the associated animal forms; the microscopic organisms of the open waters; and

the chemistry and hydrography of the sea water.

Doctor Yonge, in describing the activities of the expedition, and the every-day life on beautiful little Low Isle, utilizes an interesting and rapidly moving method of presentation, and gives a vivid and fascinating account of the varied and unusual experiences of the expedition.

The book, however, proves to be a much broader work than the word "narrative" implies, for it is introduced with a concise but adequate account of the history of our knowledge of the Barrier Reef, and the problem of reef formation, followed by a lucid chapter devoted to the geography of the Barrier, and, during the course of the work, to clear and full descriptions of the anatomy and life history of the coral animal and other reef-building and reef-destroying organisms. The remarkable variety and diversification of the multitudinous forms of life associated in this coral reef are vividly presented, while the author at times becomes eloquent over the beauties of coloration of reef life and the remarkable commensal associations recorded.

An interesting account is given of the experiments formed to shed new light on the growth rate of corals and the peculiarities of their methods of feeding. Dredging and trawling expeditions were undertaken to obtain specimens from deeper waters, and the diving helmet was utilized to more adequately observe actual living conditions of the corals, and to aid in the experimental work.

Finally an extended cruise was made through the more northerly regions of the reef to Torres Strait and Thursday Island to investigate the pearl fisheries and other industries based upon the natural resources of the Great Barrier Reef.

The book is profusely illustrated with reproductions of photographs taken by the expedition, many of which are of unusual character. Some of the photographs of living coral associations and expanded individual polyps are particularly noteworthy.

As a whole, this work is a definite contribution to the literature of the coral reef.

—ROY W. MINER.

Snakes of the World. By Raymond L. Ditmars. The MacMillan Company, New York. XI-207 pp.; 84 pls.

FOR many years Doctor Ditmars' reptile books have been authoritative and stimulating reading. As curator of reptiles at the New York Zoological Park he has had unrivaled opportunities for obtaining first-hand information on the habits of reptiles from all parts of the world.

This latest book of Doctor Ditmars maintains the high standards set by his earlier works.

After several introductory chapters the harmless and poisonous serpents are considered in detail and under separate headings from a geographical standpoint. Such an arrangement makes the book a valuable guide for naturalists in foreign countries. Doctor Ditmars' description of his experiences with snakes in the field, especially in the Carolinas and the Berkshires, is vivid and informative. No less valuable are his detailed accounts of the serpents which have come under his care. Doctor Ditmars has measured the distance that spitting cobras can spray their venom. We learn that these cobras had to be removed every five or six days from their cage in order to clean the glass which they continued to spray so generously with poison that the visitor was unable to see the source of this venomous barrage.

The illustrations are from photographs made in the field and laboratory. They alone would make the volume an important addition on the shelf of any naturalist. Doctor Ditmars is a skillful photographer, a trained observer, and an attractive writer. He is to be greatly congratulated on this new contribution to the natural history of a little understood group of animals.

—G. K. NOBLE

The Earth, Our Ever-Changing Planet. By Chester A. Reeds. The University Society, Inc. 1931. New York, Svo.

DOCTOR REEDS's book constitutes the second number, "Geology," of the first unit of a series of booklets on science now appearing under the imprint of the University Society. The entire series is to include practically all sides of science and to make modern researches and present conclusions regarding them available to the man and woman on "Main Street." This plan, which is considered thoroughly practical in its economic aspect, is another significant sign of the awakening of people in general to the universe around them, and their fast growing appetite for facts regarding it.

Doctor Reeds's book eminently meets the requirements of such a plan. It combines an enormous amount of factual data with clearness of exposition, giving the reader not only the facts but the associations that make them easily remembered. For example, in illustrating the extremes of variation in the earth's surface, he tells us that if the highest point of land, Mt. Everest, could be placed in the deepest oceanic trough, the Swire Deep east of the Philippines, the summit of the mountain would still be one and a quarter miles below the surface of the

Pacific, while the two together make the maximum variation of twelve miles. Yet, on a twelve-inch model of the earth the greatest height would protrude but the hundred and twentieth part of an inch, and the lowest depth would be but the hundredth part of an inch below its surface. This shows how very deceptive is the appearance of schoolroom globes, with mountains in relief thousands of times too high in relation to the model as a whole.

Chapter One opens with a striking panoramic view of the earth's history, a period of probably three thousand million years, condensed to the time of once around the clock, in which each hour represents two hundred and fifty million years, each minute, fifty million years. According to this time estimate, the age of man begins just twenty-one and three-fifths seconds before the hour hand again comes to twelve, and only in the last one-seventh of a second has man acquired his scientific knowledge of himself and the world around him. The inference may be either that man has learned a great deal in a short time, or that he does not yet know very much. In any event the review of past ages on this time scale is enlightening to man's egotism and stimulating to his ambition.

The structural plan of the book is broad and sound. After a brief historical résumé of the science of geology and a short chapter on the three chief hypotheses of the origin of the earth, the author treats his subject under the four natural divisions: the atmosphere, or gaseous "thermal blanket," extending to a possible maximum of three hundred miles above the surface; the hydrosphere, or water envelope, covering 70.8 per cent of the surface; the lithosphere, or rocky crust, varying from a possible ten miles to sixty in thickness; and the centrosphere, the inner mass of the earth, extending from the lower limit of the crust to the center and consisting of a basalt layer, a peridotite layer, a transition zone and an inner core of iron, either fluid or gaseous. A chapter on volcanoes, one on

earthquakes, and a brief discussion of the geologic record and its bearing on palæontology, conclude a history of the earth from the swirling of the primæval nebula or the enormous single star that constituted the matrix of the solar system, up to the present age of aviation. The book is illus-

trated with one hundred and six figures, including many important diagrams and charts.—W. K. G.

The Butterfly Book. By W. J. Holland. New and thoroughly revised edition. A popular and scientific manual, describing and depicting all the butterflies of the United States and Canada. xii + 424 pp., 77 plates, 198 text figures. Doubleday, Doran and Co., Garden City, N. Y.



THE FIRST PICTURE OF AN AMERICAN BUTTERFLY

It is our common tiger swallow-tail. Concluding his interesting "aside" concerning this illustration in the *Butterfly Book* Doctor Holland wrote: "What is clear is that the first picture of an American butterfly was painted by John White, the leader of Sir Walter Raleigh's third expedition to Roanoke, in the year 1587, less than one hundred years after Columbus had made his first landfall in the New World, twenty years before Captain John Smith and his associates reached Virginia, and thirty-three years before the Pilgrim Fathers disembarked at Plymouth. The artist was the grandfather of the first white child of English parentage born on the continent of North America, Virginia Dare."

IN his long, busy life Doctor Holland has done many things and done them well. His interests have been most varied, ranging, in the scientific field, from fossil vertebrates to living insects. Which of these accomplishments is the most important? The spectacular dinosaurs are largely responsible for the long list of foreign honors noted on the title-page of the new edition of his *Butterfly Book*, but it may be that the *Butterfly Book* itself is a greater and more lasting honor than all of those foreign titles. Nothing that Doctor Holland has done, unless it be his writing of the *Moth Book*, has so largely fostered an interest in, a love for, and a knowledge about Nature as Nature is when and where we are living.

When the *Butterfly Book* was first published in 1898 it seemed that there was little room left for improvement. Practically every species which the amateur was likely to find in the United States and Canada was faithfully illustrated in color; the essential facts, so far as known, of each species were clearly told in the text; and there was a well-selected scattering of "asides" that pleasantly seasoned the whole. The new edition is more than a reprint. It adds so many of the less common species that it might fairly be called a Monograph of the Rhopalocera of America North of the Rio Grande. However, unlike most monographs, it is of interest to and will be used by more than a scant score of specialists; it will be "My Butterfly Book" to

hundreds of "average" adults and to thousands of boys and girls on whom, in a few years, scientific research and conservation must depend for support. Yes, the *Butterfly Book* is probably the most important thing Doctor Holland has done.—FRANK E. LUTZ.

The Riddle of Migration. By William Rowan, Department of Zoology, University of Alberta. Williams and Wilkins Co., Baltimore, 1931. 8vo., pp. xiv, 151, 11 figures.

SINCE the days when swifts were believed to hibernate in mud and cuckoos to change into hawks before the coming of winter, the study of bird migration has made great strides in advance. The roads mainly followed have been those of field observation and speculation—as Professor Rowan points out—while those leading through the more technical departments of biology have been little explored. Bird banding has furnished a valuable refinement of the observational method, but the truly experimental method alters the conditions and tests the outcome.

Professor Rowan's little book is written around his own original experiments on the physiological conditions in juncos and crows which have so intimate a connection with their migratory movements. In northern climates where the breeding season is necessarily brief, each bird undergoes annually a great enlargement of the sexual organs, and a surprising diminution in their size after nesting. These organs, the gonads, are known to liberate secretions into the blood which affect both structure and behavior.

Some species of birds are able to find sufficient food in the north during winter, and do not migrate. Others would perish if they tried to remain, so they migrate southward. The regularity of arrival and of departure shows migration to be an inherited faculty among birds, not dependent upon intelligence. Comparison of the avian with the mammalian brain accounts for the relative deficiency of mental discrimination among birds. Their topographic memory is sufficient for shorter voyages, but the nature of the "sense of direction" required in many migrations is still obscure.

Professor Rowan favors Natural Selection as the principal influence in building up inherent migratory behavior, but leaves the door slightly ajar for a gradual fixation of acquired powers. This part of his treatise is admittedly still within the field of speculation. Given the migratory instinct with its predetermined routes and goals, one must still seek the stimulus which starts the individual bird on its way from or back to the breeding area. Conditions which necessitate migration are failure of the food-supply, cold, and possibly deficiency of ultra-violet radiation;

but these are not immediate stimuli. The only seasonal change properly timed and stable enough to provide birds with their calendar is the varying length of daylight. At Edmonton, Alberta, where Rowan worked, daylight reigns for 19 hours on June 21st, and less than 9 hours on December 21st. Mental recognition of the change over short periods would require more intelligence than a bird possesses; but might not this variation, he asked, exert a physiological control?

To test the theory, numbers of juncos were kept during the early winter in cages where their day was gradually prolonged by electric lighting. About five minutes of illumination were added each evening, until in January the lighting continued to 11 P.M. Such treatment induced an increase of the gonads to maximum size. Males sang in midwinter in unheated cages, temperature had no share in the process. "Control" birds in cages with ordinary daylight remained in non-breeding condition.

It was suspected that the additional illumination acted by keeping the juncos awake and active. So a cage was built with moving bars that obliged the birds to move frequently. This kept them awake for the same length of time, although lighting was reduced to a minimum. Again the sexual organs were stimulated to full activity.

When released in winter, neither the birds with gonads of maximum size nor those with the organs wholly quiescent showed any tendency to leave the experiment station. Birds normally migrate when their gonads are in a transition stage, and at such times the "interstitial" cells in the sexual organs are found to be especially numerous. Although only indirectly concerned with sex, the interstitial cells appear to secrete an important hormone, and in this internal secretion Professor Rowan sought the physiological stimulus to migration. When "experimental" juncos with gonads in a state either of recrudescence or of regression were released in midwinter, 40 to 80 per cent of them disappeared.

In order to determine whether such liberated birds traveled in a definite direction, the experiment with increasing artificial light was repeated with crows. They reacted as did the juncos, and in November sixty-nine "experimental" crows were released with bands on their feet. Of sixteen recovered more than ten miles away, one half were taken to the northward, and one half to the more settled region southward. It seemed likely that a majority had moved northward, whereas of fourteen "controls" with wholly reduced gonads none was recovered to the north-

ward, and four were killed by hunters to the southward.

These results, while not conclusive, offer great hope for the future of the methods employed. It seems certain that changes during the development and regression of the sexual organs are intimately related to the stimulus to migrate. That length of daylight and consequent activity are always responsible for these physiological changes may be doubted.

Many birds breeding in the north migrate to countries beyond the equator, and it is difficult to explain why their annual reproductive rhythm is not upset by the new increase of daylight experienced there. Birds breeding within the tropics, where variation in day-length is minimized, likewise exhibit an annual rhythm; and

some of them perform regular migrations, as reported by this reviewer in *NATURAL HISTORY*, XVI, 1916, pp. 541-545. A few even nest at the season when they experience their minimum duration of daylight.

So while day-length may sometimes be the regulator of the yearly cycle of birds, there are other cases, especially near the equator, where it must be replaced by different factors. It may be governed by rainy or dry seasons of the year, with their changes in vegetation entailing alterations in feeding, or for some aquatic birds by the water-levels in rivers. Professor Rowan wisely admits that in such parts of the globe other stimuli than length of day may act upon migratory birds. His valuable work points the way to a new attack on the problem.—J. P. CHAPIN.

ASSOCIATE MEMBERSHIP

BY action of the Executive Committee of the Board of Trustees of the American Museum, the residence barrier with regard to associate membership in the Museum has been removed. This class of membership has always been restricted to persons residing fifty miles or more from New York City, and the new ruling now makes eligible for associate privileges the very large number of people interested in the Museum who live in the metropolitan area.

An associate member is entitled to a yearly subscription to *NATURAL HISTORY Magazine*; a copy of the President's annual report, on request; an annual pass admitting to the Members' Room; two complimentary tickets admitting to the Members' Room for distribution by members to their friends; the services of an instructor for guidance when visiting the Museum.

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SIXTY-ONE 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	annually	\$3
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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.

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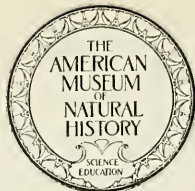
Series of illustrated lectures held on alternate Thursday evenings in the autumn and spring of the year are open only to members of the class of \$10 annually or higher or to those holding tickets given them by members.

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



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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 have been constantly in the field for years, gathering information in many odd corners of the world. During 1931 twenty-three expeditions visited many distant portions of the globe. In 1932, however, owing to the limitations of funds, expeditions will necessarily have to be eliminated except as they are financed by gifts. In this work of exploration, consequently, the American Museum especially needs the generous help of its many friends in order to further the scientific work of the institution. Contributions to this phase of the work of the Museum are of more than usual value, and the Museum will be glad to discuss any angle of its delayed program of exploration with anyone interested in aiding this work financially.

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 108,000 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 coöperating 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 augment greatly the Museum's work, not only in New York City public schools, but also throughout the United States. More than 27,945,076 contacts were made with boys and girls in the schools of Greater New York alone, and educational institutions in more than thirty-three states took advantage of the Museum's free film service during 1931. 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
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BLAZING THE TRAIL

WILD animal photography has done much to acquaint the public with the accurate facts of nature, and among the pioneers in this branch of nature work Major A. Radclyffe Dugmore stands high. His photographs of the game animals of British East Africa still rank among the best ever taken, although his first work with a camera on the East African plains was done more than twenty years ago. But Major Dugmore is more than a photographer. He is a painter as well, and *NATURAL HISTORY* is fortunate to be able to publish, in the next number, not only an article by him on art and animals, but numerous reproductions of his paintings, made in Africa and in North America.

RECENTLY *NATURAL HISTORY* published an article on the Nomads of Tibet, written by Suydam Cutting. In the next number it will publish an article on the agriculturists of the same harsh land, written by the same author. Mr. Cutting, a trustee of the American Museum, is one of the outstanding modern travelers and museum collectors. He has covered innumerable out of the way corners of the earth, few of which, however, are more interesting than Tibet, lying as it does, high up behind the giant Himalayas.

PROF. T. D. A. COCKERELL, of the University of Colorado, is an entomologist of unusual ability and experience. Already *NATURAL HISTORY* has published a number of his articles, and now is planning another for the coming issue. This time the article has to do with a collecting trip to South Africa, and Professor Cockerell's experiences in studying the insects (particularly the bees) of the formerly "dark" continent.

MR. WILLIAM H. CARR's numerous contributions to *NATURAL HISTORY* are often associated with the Bear Mountain Nature Trails. For the next number, however, the Nature Trails are only incidental. Mr. Carr's subject this time is "Crows," and he tells of the surprising intelligence of these appealing birds when they are tamed.

IN southern Georgia lies the great Okefinokee Swamp, an area in which the wild life is more than usually interesting. Mr. Francis Harper knows as much, perhaps, as anyone ever has known of the life of this region, and, for the next number of this magazine has written an article entitled "A Voice from the Pines" in which he gives a fascinating account of the all but invisible tree frogs of the Okefinokee.

On this page in the last number of *NATURAL HISTORY* we announced a coming article by Myron Ackland also on Okefinokee Swamp. Unfortunately, however, Mr. Ackland has gone to Russia where, for the time being, he is somewhat beyond reach. As a result it is impossible for us to publish the article we announced.

THE greatest coral reef in the world is the Great Barrier Reef of Australia, which, for a thousand miles or more, parallels the eastern coast of the island continent. Mr. C. M. Yonge of The Laboratory, Citadel Hill, Plymouth, England, has recently spent a year on the Barrier Reef, and, following the publication of his important book *A Year on the Great Barrier Reef*, has written for the next number of *NATURAL*

HISTORY an account of the giant and burrowing clams of this most amazing reef.

ZANE GREY, it is well known, is as successful a fisherman as he is an author. A large part of his time is spent aboard his big sea-going yacht, fishing for some of the most difficult of the deep-sea fisherman's prizes. He has written an article for the next number of *NATURAL HISTORY* describing his experiences in fishing for dolphin off the coast of New Zealand.

MRS. MARY L. JOBE AKELEY is well known not only as the wife of the late Carl Akeley and as an explorer in Africa, but also for her highly successful mountaineering in western Canada, where Mount Jobe stands as a permanent and official recognition of her prowess. Her experiences in the Canadian Rockies will be told in two articles. The first will appear in the next issue.

COVER OF THIS ISSUE

THE cover painting of this issue is by Francis L. Jaques, of the American Museum department of preparation. It shows the great gannet rookeries on the cliffs of Bonaventure Island, situated three miles offshore from Percé, at the end of the Gaspé Peninsula. This is one of the famous bird islands of the world. The island slopes gradually upward from the landward side, terminating in gigantic cliffs where it faces the turbulent waters of the Gulf of St. Lawrence. These cliffs form one of the few American nesting places of the gannet.

The painting depicts the rookeries bathed in early morning light, while, far below, the restless sea is wearing away the huge cliffs. The gannets, snowy white, with a wing spread of six feet, are the most spectacular sea birds of the region. Their meteor-like plunges after fish must be a thrilling adventure for the birds, and are adventure, in fact, to any observer.

Mr. Jaques visited this rookery in September of last year.

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NATURAL HISTORY

MARCH-APRIL
1932

The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor



A. KATHERINE BERGER
Associate Editor

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Photograph by H. C. Tibbitts

IN A PRIMEVAL REDWOOD FOREST OF CALIFORNIA

The great, fluted column at the left is "The Big Tree of the Russ Grove," a matchless 166-acre tract dedicated in 1923 to the pioneers of Humboldt County. It was the first unit to be preserved as part of the California State Park System in the Prairie Creek region

See "The Prairie Creek Redwoods," Page 148

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A MID-SUMMER RECONNAISSANCE OF OLD GASPÉ

Through A Wonderland of Unusual Scenic Beauty—The Great Sea-bird
Sanctuaries of the Province of Quebec

BY JOHN F. KUERZI

THE Gaspé headland extends into the Gulf of the St. Lawrence for a distance of more than 170 miles. This extreme northeast point of land on the southern shore of the St. Lawrence River is situated between that river and the Baie des Chaleurs, and comprises an area of approximately 12,000 square miles. Much of its interior is a high, mountainous table-land and a forest-clad wilderness, though its shore line is literally dotted with an almost unending series of small, but, for the most part, prosperous fishing posts. It embraces the four provincial counties of Bonaventure, Gaspé, Matapédia, and Matane, which in turn are divided, or divide themselves, into numerous parishes, villages, and towns.

Despite the early date of discovery and the relative proximity of large industrial and cultural centers such as Quebec, Gaspé has remained until very recently, practically unknown to the traveler and tourist, owing chiefly to difficulties of transportation. Biologists consider isolation an important factor in the development of new races of plants and animals. Psychologists have always recognized this factor to be of equal importance in the

preservation of an old individual culture. It is beyond dispute that Gaspé has been and is one of the principal centers of French culture in America, and its inhabitants have remained virtually unchanged for centuries because of their being far from the madding throng.

Overland travel has been difficult and arduous, and has tended to discourage tourists from entering this picturesque Old-World quarter of America. Up to 1925 transportation was confined to water travel and to relatively slow and, for the most part, one-track railroads. True, there were a few short stretches of road such as the colonization road "LeMieux" on the south shore, but the north side, particularly east of Ste. Anne des Monts, was practically without continuous roads. Here and there were to be found a relatively few miles of dirt road running perilously up hill and down dale, but such roads merely connected near-by parishes which were in turn quite isolated from the interior of the province.

In 1925 the department of highways of Quebec undertook to improve the condition of existing roads and to link up and make continuous the all too short local

stretches. The completion of that highway, now known as Perron Boulevard,—a circuitous route of about 550 miles, comprising one of the most interesting and scenic journeys through the province, and a tour perhaps unique on the whole continent,—ended the self-imposed isolation of the Gaspéans.

The fiercely tenacious provincialism of the French, particularly of the peasantry, is well known to travelers, and it is pleasurable to realize that, despite the present accessibility of Gaspé, its inhabitants will probably cling for many years to their charming Old-World simplicity and naiveté. Even yet the picturesque native dog-cart vies unsuccessfully with modern high-powered machines for a place on the highways! Lest we become over-optimistic, however, it is an unfortunate fact that the demands of

tourists for modern improvements have rapidly wrought inexorable changes elsewhere, and consequently if one would know Gaspé as it really was and is, let him go at once, and if possible seek out the byways which are still practically untouched by modernism. The artist, writer, poet, and naturalist will fall quickly under the spell of romantic Gaspé. Even the casual tourist is, before long, slowed in his mad career with a sense of the closeness of past to present which characterizes this Acadia.

It was our good fortune to travel the Perron Boulevard from end to end during the early summer of 1930, with numerous stops at points of scenic beauty, historic, or natural-history interest. An extended visit was made to Bonaventure Island, hallowed in history and at present the nesting place of countless sea birds. A



Photograph by Compagnie Aérienne Franco-Canadienne

LAC AU SAUMON, WHERE THE MATAPEDIA RIVER EXPANDS INTO A LAKE

The winding rivers of the Matapedia Valley, abounding in salmon and trout, are a never-ending source of delight to the angler, and as moose, deer, bear, and other smaller game are plentiful, this valley is fast becoming a rendezvous for sportsmen



Photograph by Compagnie Aérienne Franco-Canadienne

THE MEETING OF THE WATERS IN THE MATAPEDIA VALLEY

The Matapedia River, renowned for its magnificent scenery and picturesque rapids, is, owing to its present accessibility, one of the most delightful camping grounds to be found anywhere. This lovely valley is an artist's, tourist's, and sportsman's paradise

trip was made on foot to the highest point in southeastern Quebec,—the Tabletop Mountains,—and the remainder of our time was spent in leisurely reconnoitering the north shore of the Peninsula.

The personnel of our expedition consisted of a rather motley array of youth, ranging from undergraduate to professional scientist. It included Messrs. John F. Barry of Syracuse, New York, T. Donald Carter, Richard Herbert, Irving Kassoy, the writer, and his brother Richard, all of New York. We were equipped alike with field-glasses and cameras, and clad for a summer holiday in the north woods.

On a memorable Saturday afternoon in early July, the whole party and its equipment were crammed into an ancient and battered car, and we were off on the grand adventure,—as gay and care-free a random collection of youthful enthusiasts as one could hope to encounter.

From New York, our itinerary followed

"Route 1" to Bangor, Maine; across the border at St. Stephens, where Canadian customs officials extended to us every courtesy, and thence to Fredericton, Bathurst, and Campbellton, to Ste. Flavie, and through part of the pleasant Matapedia Valley to Matapedia, practically the starting point of Perron Boulevard. From there the road skirts an edge of the Gaspéan highlands and then runs leisurely along the delightful Baie des Chaleurs, (Chaleur Bay) frequently known as the Mediterranean of North America.

This, the south side of the Peninsula, is far more developed and populated than the north shore. The tourist encounters a succession of small but prosperous towns and villages, such as Bonaventure, Port Daniel, Newport, and Anse-du-Cap. Agriculture is a more thriving industry here than elsewhere, though its possibilities are still largely unknown.

A comfortable morning's run from Matapedia brought us, via a detour of five



Photograph by T. D. Carter

GANNETS OF BONAVENTURE

The most conspicuous bird of Bonaventure Island is the gannet, a large, striking, and superb bird of black and white which, so far as is known, nests on only a few other islands on our coasts. At least 14,000 of these birds make up the present nesting quota of old Bonaventure



GANNET PORTRAITS

Gannets, on their nesting grounds, are garrulous birds. Their harsh cries resemble the syllables "Karr-ack, Karruck"

Photograph by R. Herbert



A LEDGE OF BONAVENTURE

The severe, rock-bound cliff rises precipitously and to a great height out of the ocean, each ledge etched with the gleaming bodies of innumerable gannets

Photograph by R. Herbert



GANNET NESTING GROUNDS

The ledges are so overcrowded that often a careless incoming bird will force several nesting gannets off the ledge by its precipitate arrival

Photograph by T. D. Carter



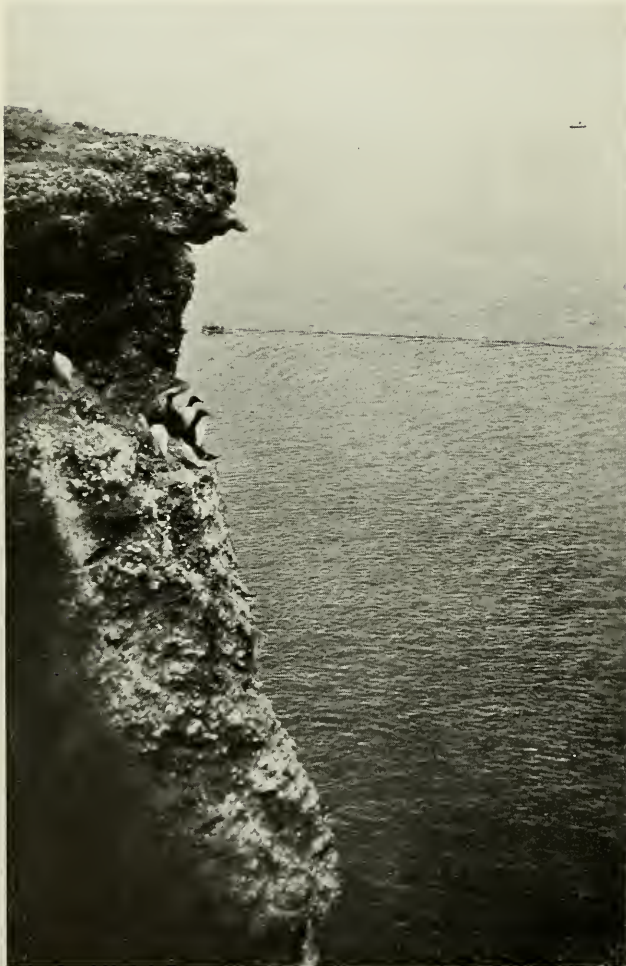
or six miles east of the Boulevard, within sight of a charming little fishing village facing a scenic marvel of giant rock,—two arches “which create the illusion of an immense bridge built by a race of titans to join the isle of Bonaventure and Mount Joli.” (Abbé Ferland). Just back of the village of Percé, Mount Joli rises to an elevation of 1200 feet above sea level and, we were told, it can be seen from a distance of more than thirty leagues at sea on a clear day.

The view from the highway a few miles south of Percé constitutes an incomparably grand panorama. Here we loitered for a while, glorying in the grandeur of this natural scenic marvel, and reverently wondering not a little at the gigantic forces of nature that had combined to produce so magnificent a work.

In due time we repaired to Percé for a well prepared and much needed luncheon, after which we ran the car into a neighborly yard and locked it for the first time since leaving New York,—some three days, or 1200 miles back.

Our next step was to secure a boat, and in so doing we did not fail to be impressed with the business acumen of the native Gaspeans. After some shrewd bargaining carried on in two tongues, we secured the services of a native boatman, who transported us in an ancient but still staunch little craft, of much the same vintage as our automobile. Running close to Percé rock, we stirred off innumerable cormorants of two species, auks, murres, kittiwakes, and herring gulls, all of which were nesting in large numbers on this picturesque old monolith. As we approached Bonaventure Island, we began to encounter some black guillemots.

As soon as we had reached our destination, we became acquainted with some of the good island folk, most of whom have lived their entire lives with only infrequent trips to the neighboring mainland. For days, simple



Photograph by R. Herbert

AUKS AND MURRES

Small editions of the flightless and now extinct great auk, which at times rather suggest the penguin in appearance and mannerisms, are very plentiful on the ledges of Bonaventure Island in summer



Photograph by T. D. Carter

INSPECTING THE GANNETS

The cliffs of Bonaventure have been for centuries among the more famous bird rookeries on the north Atlantic coast. Here countless sea birds congregate annually to nest and raise their young

and cordial French-Canadian hospitality was lavished upon us by good Mrs. Maloney, who administered to our every want.

Upon our arrival we lost no time in getting down to the cliffs of Bonaventure Island, one of the most renowned rookeries for nesting sea birds on the North Atlantic.

The island is relatively small,—perhaps three miles in length, and a mile in average width. It is comparatively low on the landward side, but rises continuously upward toward the ocean, and then abruptly terminates, so that a high, clifflike formation is presented to the roving mariner. The interior of the island is grown over with small, scrubby spruce; the ground is strewn with blossoms of the flowering bunchberry, and many other equally delightful plants.

We spent hours that memorable first evening, and literally days thereafter,

studying the almost countless sea birds which annually repair to the friendly ledges of Bonaventure to nest. Always the most conspicuous bird is the gannet,—a large, striking, and superb species of black and white,—which, as far as is known, nests on only a few other islands on our coasts. The Bonaventure ledges are even more over-crowded than are those of down-town Manhattan; so much so in fact, that a careless incoming bird not infrequently forces several others off the ledge, upon his precipitate arrival. Gannets on their nesting grounds are garrulous birds, and they keep up their hoarse, discordant cries far into the night. They are incessant and tireless fliers, and hundreds are constantly in the air or far at sea and diving spectacularly from a great height. At least 14,000 gannets make up the present nesting quota of old Bonaventure, and at the time of our visit their offspring were in every stage of



Photograph by Compagnie Aérienne Franco-Canadienne

AN AÉRIAL VIEW OF PERCÉ

Percé, a scenic marvel with its giant rock, is situated near the extremity of Gaspé Peninsula, five miles east of Perron Boulevard. Back of Mount Joli (in the foreground) nestles the charming little fishing village of Percé

development, from partly incubated eggs to perhaps half-grown "young hopefuls."

Other smaller but none the less interesting species of birds are found on these island cliffs. Auks and murre, —small editions of the flightless and now extinct great auk, and which at times rather suggest the penguin in appearance and mannerisms,—are very plentiful, and the comical, clownlike puffin is also there in force.

Handsome, glistening black and white guillemots, known to Gaspéans as "pigeons de mer," are plentiful and, with the delicate and exquisite grace of kittiwake gulls, add not a little to the beauty of the place.

Leach's petrel, the northern relative of the "stormy petrel," or "Mother Carey's chicken" familiar to every seafarer, nest in numbers on the island, though it is difficult to determine their precise relative abundance, since at this season they are quite nocturnal in habits, and are seen

in the daytime near the nests only in stormy or cloudy weather.

The old birds alternate at the nest and one is far at sea while the other is taking care of domestic matters. Their single egg is deposited in a burrow in the soft earth at the top of the cliff, and if one would see this little nocturnal sprite, he must needs explore all likely holes in the ground, (this rather ungracious task devolved upon the writer) and eventually he may extract a gentle, unresisting, grayish bird which emits a pungent odor.

On the wing, these petrels bear a superficial resemblance to our familiar nighthawk. At night we occasionally heard the eery notes of this species, which in cadence somehow suggest a distant, springtime chorus of robins.

Some ravens, a duck hawk or two, and a few grouse, and other smaller land birds, make up the summer avian population of Bonaventure Island. White-winged crossbills are by far the most abundant land-

bird on the island in July. The sea birds here are of strongest appeal to the naturalist, however, and it is a constant delight to recline at the top of the cliffs and literally revel in the striking beauty of these birds, and in the poetry of motion of their tireless and seemingly unending flight.

These Bonaventure days were crowded with vivid impressions,—the view to seaward from the top of the cliffs,—blue sky and sparkling ocean gradually merging in the dim distance, a tireless throng of beautiful sea birds continually on the wing, and always the air filled with their complaining cries. Or the mariner's view of Bonaventure,—a rock-bound cliff rising precipitously and to a great height out of the ocean, each ledge etched with the gleaming bodies of thousands of gannets, the air filled with flying birds,—gulls,

gannets, auks, and murre,—a never to be forgotten sight.

Our delightful sojourn on the Island of Bonaventure was rather abruptly terminated by a sudden change in the weather, which until now had been beautifully clear and cool. A north-easter suddenly set in, and we were obliged to quit the island hastily, though with reluctance.

That afternoon we drove through a blinding downpour to the prosperous village and growing summer resort of Gaspé. Our car was turned over to an uncommonly obliging mechanic, who courteously volunteered to work on it most of the night for the paltry sum of five dollars. That evening we dined amid splendor on moose steaks and ale, though our personal appearance (being very nearly that of a native woodsman on a



Photograph by Courtesy of Dept. of Highways and Mines, Quebec

THE FAMOUS PIERCED ROCK AT PERCÉ

This 40,000,000-ton monolith affords an excellent nesting-site for innumerable sea birds,—cormorants, kittiwake and herring gulls, murre and auks



Photograph by Courtesy of Dept. of Highways and Mines, Quebec.

FRONING HEADLANDS AND SILVER STRAND AT PERCÉ

The bay of Percé, in the foreground, forms a fine, natural harbor for the many fishing boats, entering and leaving its waters

spree) caused us to be eyed askance by guests and waiters alike.

Gaspé, strategically situated at the mouth of the York River, is the most important commercial, tourist, and historical center on the peninsula.

The following morning was fine, and we were off at an early hour. The north shore of the peninsula on which we were now traveling is bordered with high cliffs and has neither bays nor harbors, in marked contrast to the southern side, which is noted for its fine, sandy beaches and navigable waters. A spur of the Shickshocks Mountains extends up to and along the St. Lawrence. The Shickshocks represent the extreme northeastern edge of the Appalachian Mountain Range, which passes through Vermont, (where it is known as the Green Mountains) crosses into the Province of Quebec near Lake Champlain, and continuing in a general northeasterly direction, develops into these highlands of Gaspé. The most

elevated portion of this table-land constitutes the Shickshocks Mountains, the highest summits of which,—Tabletop Mountain and Mount Albert,—rise to heights of 4450 and 4000 feet above sea level, respectively. From the summit of Mount Albert, the lesser of the two peaks, on a clear day, a good view of the north shore of St. Lawrence, easily sixty miles away, may be obtained. Tabletop Mountain is the highest point in all of south-eastern Canada. The deep valley of the Ste. Anne River separates these two superb peaks.

The Perron Boulevard skirts the northern edge of these mountains, occasionally runs along the face of one and even over the top. Here there is a unique combination of high, mountainous cliffs shelving abruptly into the St. Lawrence which give rise to scenic effects that are as superb as they are unique. The highway now runs for miles perilously up hill and down dale,—there are frequent sharp and

long descents and equally severe ascents, which acidly test the stamina of any vehicle and the nerves of the less stout-hearted passengers. Time and again one grinds along in second speed or worse, but the grand panoramas on every side more than compensate for any inconvenience experienced.

It has recently been suggested that the tourist would do well to approach the Gaspé Peninsula from the Quebec side and negotiate the north side first. This plan has the obvious advantage of affording him the inside half of the road,—a very real benefit at all times, particularly should any unforeseen mishap occur in the braking or other mechanism of the car.

We now felt justified in employing every possible excuse to loiter. It generally mattered little whether we were bent

on photography or merely desirous of stretching our cramped limbs. Almost invariably an extended stop would be greeted with the tinkling, bell-like song of the winter wren,—so tiny a bird that it seems incredible that it can produce such a volume of rich, liquid, bubbling, and gurgling music. Often the quiet charm of some forest glen would be pleasantly relieved with the wild, canary-like song of the white-winged crossbill,—a handsome, rose-colored finch, very plentiful in parts of the Gaspéan headland from Bonaventure Island north. Occasionally this charming chorus of bird song would be augmented by the cheery and exquisite though simple, whistled lay of the pine grosbeak,—a larger relative of the crossbill and to our minds the finest bird songster of the north woods. Sapsuckers were usually quite plentiful and much in evi-



Photograph by T. D. Carter

EMBARKING FOR BONAVENTURE ISLAND

The island is a few miles offshore, a very pleasant sail in fine weather. Above, from left to right, are Mr. Herbert, the author, and Messrs. Barry, R. Kuerzi, and Kassoy



Photograph by T. D. Carter

THE NORTHERN ARM OF BONAVENTURE ISLAND

Bonaventure Island,—comparatively low on the landward side,—rises continuously upward toward the ocean so that a high, cliff-like formation faces the sea. The white specks in the center of the picture and over the sea, are gannets,—the most plentiful of the nesting birds of this island

dence. The pleasing songs of white-throated sparrows, hermit and olive-backed thrushes, and the loud, whistled notes of the olive-sided flycatcher were frequently heard, and added their share of charm to this natural woodland symphony. Even the familiar robin,—previously known to us as a bird of the parks and lawns,—through force of circumstances becomes in this region a typically woodland species. About every settlement and village on both shores of the peninsula cliff swallows are conspicuous and plentiful.

The almost indescribable grandeur of countless mountain vistas, and the magnificent solitude of spruce and forest fastnesses could not fail to create in us a desire for closer contact. We therefore decided upon an overland trip afoot or on horse-back through the interior of Gaspé. We had frequently noted a large area in the interior of the Peninsula, blocked out

and known on the maps as Gaspé State Park, but our inquiries concerning it and the possibility of reaching it were met with indifferent results. The oldest inhabitants had apparently never heard of any such place, or at any rate did not know it by any such name. They were all agreed, however, that any trip through the outer interior was bound to be more or less arduous and had to be accomplished on foot unless pack-mules or horses could be obtained. Considering these weighty problems in all their ramifications, we finally reached the charming, pastoral, and Swiss Alpine-like hamlet, Rivière à Claude, on a Saturday evening in mid-July.

We explained our plans to our sympathetic host, Henri AuClair, who like the others knew nothing of Gaspé State Park, but who, to our joy, assured us that we were within easy reach of Tabletop Mountain,—the highest peak on the

peninsula. Almost immediately after a delicious dinner of fresh-caught salmon, we began to put our plans into operation. As a result, forces were divided and a delegation sent in search of a guide. After much discussion they succeeded in enticing a worthy Frenchman, who, we were told, was an able woodsman, away from the village dance then in progress, long enough to present our proposition. He received it with the average Gaspéan's unfeignedly slight display of emotion, but we eventually had his assurance that he would be on hand in the early morning.

Meanwhile, the others had succeeded in rousing the proprietor of the general store, and were securing necessary food stuffs and supplies. With uncommonly good judgment we had sent our best linguists and interpreters in quest of the guide, and it so happened that the others

were driven to employ the most ingenious sign language in dealing with the rustic proprietor of the store. The climax was doubtless reached when, in order to obtain a small quantity of tinned milk, our worthy delegation was forced to resort to the intriguing diversion of personally reproducing sundry bovine-like sounds, at the same time pointing to any piece of canned goods in sight. The shrewdness of this store-keeper was well attested by the fact that the desired article was produced after only one unsuccessful forage, when he offered us a can of "corned willy."

Early the following morning we set out through the mountains. Our understanding had been that the Tabletops, our destination, were within easy reach, and we had consequently decided to abandon our camping equipment and travel light. It now appeared that there had been



Photograph by Courtesy of Bureau Provincial Du Tourisme Ministère de la Voirie, Quebec, Canada

ST. MAURICE DE L'ECHOUIERIE

A typical settlement of Gaspé. The most prominent and imposing building in these little villages is invariably that of the Church

some slight misunderstanding, and that the mountains were at least twenty-five miles off, and hard going and much climbing at that. Our food was adequate for a two-day trip, and none of us particularly relished the thought of spending a cold night on the hard ground. We consequently reconsidered, and decided to hasten and make for the mountains and their comfortable cabin, come what may.

We were now traversing crown lands of which the Province still possesses large areas, though some are occasionally sold at a nominal price to *bona fide* settlers. The trail was at first broad, well-marked, and easy to follow, and our progress was correspondingly rapid. We were going through delightful forest glens,—their brooding silence only occasionally broken by bird song, or the roaring music of some rapid, sylvan mountain stream.

From time to time we flushed spruce grouse,—a magnificent bird of slaty-gray-blue, and so tame owing to lack of contact with man that it can frequently be killed with a stone. Its flesh is reputedly bitter and it is not generally so eagerly sought for food as the ruffed grouse, which fact doubtless contributes to its tameness. Our sharp-eyed guide soon discovered a young pileated woodpecker, or “log-cock,”—a large, crowlike bird of contrasting black and white plumage with a conspicuous red crest,—which permitted a close approach. This species is common in all primeval country from Florida to Canada, but has become rare near civilization, though there is reason to believe that it may eventually become reconciled to the changing conditions of our country (it evidently has become thus adjusted in our South). Soon after, we heard and



Photograph by Compagnie Aérienne Franco-Canadienne

THE EXTREME POINT OF THE GASPÉ PENINSULA

History records that Gaspé was among the first known regions of America. Jacques Cartier, French navigator and explorer of Canada, made a ten-day stay at Gaspé Harbor in July, 1534, and Norsemen and vikings probably visited the Peninsula at a much earlier date



Photograph by Compagnie Aérienne Franco-Canadienne

THE SHICKSHOCKS MOUNTAINS

These mountains extend up to and along the St. Lawrence River, on the north shore of the peninsula. They represent the extreme northeastern edge of the Appalachian Mountain Range, which passes through Vermont, crosses into the Province of Quebec near Lake Champlain, and eventually develops into these highlands of Gaspé

saw the Philadelphia vireo, a charming little bird of soft plumage, which breeds in the North, but is strangely rare, and seldom observed during its migrations in New York and New England.

The trail presently became less smooth and before long we encountered some very steep up and down grades. In order to reach the Tabletop Mountains from the north side of the peninsula, it is necessary to cross several mountain ranges and consequently our progress was somewhat delayed.

Shortly after noon, the party stopped at a mountain lake,—the half-way point, our guide assured us. After a hasty lunch we were again under way, the trail becoming increasingly difficult to follow, and all of us thanking our stars that we had secured a guide who never appeared to be in doubt as to the proper route.

The trail gradually deteriorated into a mere trace, and we found ourselves

alternately sinking into the soft ooze of spruce bogs and stumbling over boulders and fallen trees, mostly concealed by the dense undergrowth. Occasionally our excellent guide, with a few swift and skillful strokes of his hatchet, would remove some particularly stubborn obstruction in the trail. Our mammalogist and ardent amateur ornithologist, Donald Carter, presently found the fresh tracks of moose, and later a few of the caribou, which bore mute testimony to the unspoiled nature of this wilderness.

Three-toed woodpeckers were seen, and an occasional Canada jay,—the latter familiarly known to the down-east lumberjack as “whiskey jack,” and made to bear the brunt of his virile jokes.

The death pall of the north woods gradually was felt, and we found ourselves conversing almost in whispers, often not at all. Even bird song was only infrequently heard. Brown-capped chick-

adees, Tennessee warblers, white-throated and fox sparrows, hermit and olive-backed thrushes were fairly plentiful, but not over-vociferous. An occasional large flock of crossbills or siskins flew chatteringly overhead. Once, as we passed a lake, several solitary sandpipers flushed suddenly and, whistling shrilly, flew about overhead. Otherwise, except for our infrequent conversational efforts, all was quiet and brooding.

Late in the afternoon we sighted our destination, still far in the distance, and with the aid of powerful binoculars could just discern a small speck on the bald summit of a tremendous mountain, the mere speck,—the cabin which was to house us for the night; the mountain,—Dunraven, the highest of the Tabletop Mountain Range.

With renewed vigor we hastened along and after several hours slowly and lamely began the tortuous ascent to the summit.

The timber gradually thinned out until toward the top it became sparse and stunted, though its monotony was relieved with countless alpine flowers of variegated hues,—many of which we were at a loss to name. Soon after, we crossed timber line. Patches of snow could be distinctly seen on distant mountains. Pipits and horned larks were presently encountered,—previously known to members of our party as fall and winter birds near New York. The birds occasionally essayed a flight song, but, unfortunately, it was perhaps too late in the season, as well as in the evening, to hear the birds at their best. Hobbling over the bowlders and stones which make footing uncertain at the tops of these mountains, we finally gained the summit, just at dusk,—the grandest and most inspiring moments of the day, which here are of decidedly longer duration than to the southward.



Photograph by Compagnie Aérienne Franco-Canadienne

AUSE-À-CLAUDE IN AN ALPINE SETTING

To reach the Tabletop Mountains from this point, one must cross several mountain ranges.



Photograph by Compagnie Aérienne Franco-Canadienne

LAKE MATANE, AS SEEN FROM THE AIR

Matane at the mouth of the river of the same name, comprises part of the Seigniory of Matane which was granted to *Sieur D'Amours* by *Intendant Talon*, November 6, 1662. Today, a terminus of the Canada and Gulf Terminal Railway, Matane is a progressive industrial center and a growing summer resort. In the surrounding district are many beautiful lakes

The sun went down in a blaze of glory over a panorama of mountainous grandeur. In every direction a wilderness stretched to the horizon, and not a single sign of encroaching civilization was visible. A few lakes and ponds could be seen, and a mere slice of the *St. Lawrence*, twenty miles away, through a gap in two huge hills. A fresh breeze was blowing, and the air grew colder as the sun lowered. The interior of the cabin beckoned invitingly, as did the now almost over-powering aroma of black coffee and beans. We all felt a sense of remoteness from civilization, which was, however, presently somewhat shattered by hearing our guide quietly and unemotionally calling the chief forest ranger on the telephone, and reporting our presence.

We gave ourselves with the least possible delay to the soothing influence of *Morpheus*, nor did anyone bother to complain very extensively about the hardness of

our bed,—the floor. } Toward three in the morning we awoke shiveringly to hear a gale lashing the cabin, and a driving mist somehow managed to penetrate to us. Several of the more community-spirited undertook, with fitting imprecations, to light a fire, and presently we ceased to shiver and again resumed snoring in earnest.

We arose late in the morning, and looking out from the cabin over a fog-bound and desolate mountain-top, several of us were heard to remark that it felt more like late autumn than mid-summer. In due time we left for the coast, and traveling light, managed to cut down our time by a few hours, owing to the fact that most of the grades were now in our favor. Our speed increased as the soreness gradually worked its way out of our muscles and joints. It rained intermittently all day, and the stately spruce forests, yesterday so inviting, were now dreary, chill, and

foreboding. In the early afternoon the keen eye of Ted Barry discerned a fine bull moose all but hidden on the edge of a small lake. As this proud forest beast was to our windward, we were able to watch him leisurely and satisfactorily until he moved slowly out of sight.

The remainder of our trip back to civilization was relatively uneventful. Rain fell off and on during the early part of the day, but by afternoon a steady downpour developed and we returned to St. Claude a sodden and weary mass of humanity. Our guide, who had at the start tactfully expressed his scepticism concerning our powers of endurance, was by now thoroughly impressed with the utter lack of even a trace of the outdoor dilettante about us. As soon as that worthy woodsman was reimbursed for his arduous efforts, he nonchalantly sauntered off to spend his money in some immediate form of diversion.

The remainder of our time was spent in leisurely reconnoitering the north shore of the Peninsula and gradually working in toward Quebec. Much of the north shore is characterized by its magnificent scenery,—high mountains which slope rapidly into the St. Lawrence.

The greater number of the settlements on the north shore, as has been said, are fishing villages, but as Quebec is approached, summer resorts such as Riviere du Loup become more frequent. The north shore is also less agricultural than the south, and here the French language is spoken almost exclusively.

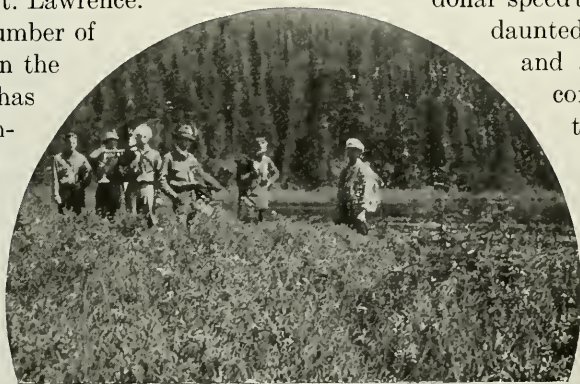
The country gradually flattens out as

Quebec is approached. Still traveling along, or near the St. Lawrence, we occasionally saw eider ducks in large flocks which are obviously composed of several adult female birds and a merger of their respective broods,—a habit resorted to, we are told, for their mutual protection against the herring gulls, their very formidable enemy. A quite black, stout animal ran across the road, which we were at a loss to identify, but our capable mammalogist, Donald Carter, again came to the rescue and proclaimed it to be a black woodchuck,—a very rare color-phase of our common and familiar ground hog. Blackfish which, owing to their tremendous size, are often not incorrectly reported as whales, were once or twice observed offshore.

A few more memorable days in this idyllic and dreamy Old-World quarter of Quebec, and we found ourselves returning to the Twentieth Century by leaps and bounds. Late one afternoon we were rushing with all available speed for the Quebec boat, only to be overtaken by a mounted gendarme ferociously gabbering patois. He admonished us for undue recklessness in traveling through towns ("vitesse: speed 20") to the tune of a ten-dollar speed ticket. Only a little

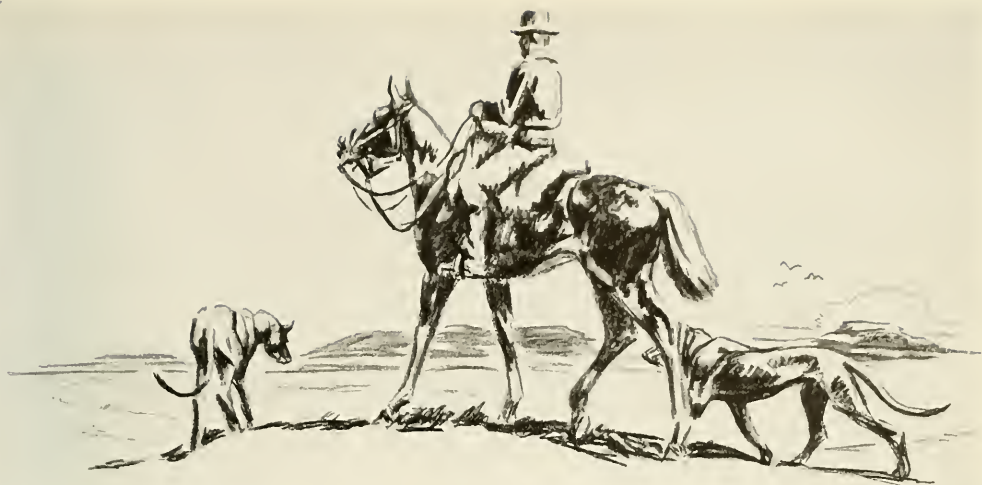
daunted by this unforeseen and almost incredible contingency, we hastened on and just made the proper connections with the ferry. A few minutes later and the transition was complete; after weeks of life among these pastoral Acadians, we were actually

joining a honking and screeching line of automobiles inching its way to the center of Quebec,—the Chateau Frontenac.



Photograph by T. D. Carter

SETTING OUT TO CROSS THE MOUNTAINS
A permit to trespass must be secured before entering the forest



A Patagonian Hunter

CHILDREN OF PATAGONIA

Playmates of the Field and Camp on Desert Wastes

By GEORGE GAYLORD SIMPSON

Associate Curator of Vertebrate Paleontology, American Museum

WITH SIX DRAWINGS BY E. S. LEWIS

In 1930 and 1931, Doctor Simpson spent more than seven months in Patagonia as leader of the Scarritt-Patagonian Expedition of the American Museum. With his assistant, Coleman S. Williams, he collected fossil specimens of the earliest known South American mammals, and studied the geologic beds in which these specimens occurred. Notes appearing in previous issues of NATURAL HISTORY have reported the important collection made by this expedition.—THE EDITORS:

THE vast plains of Patagonia are a barren and savage waste in which man seems an interloper. Here in the far south of South America nature never smiles. Here are no grassy dells, no fertile gardens, no pleasant streams nor shady woods. In few places does the earth bear such an aspect, not merely unsuited to human beings but actively, almost spitefully, inimical. Yet Patagonia has its own children, living in constant fear and combat, but somehow contriving to flourish and finding in this desolation a home suited to their own wild temperaments. They are as essential a part of the Patagonian scene as are the eternal wind, the gravel-strewn pampas, and the scattered thorn bushes.

The favorite child of Patagonia and the sentinel of its peaks and plateaus is the

guanaco. These beasts, of about the size of our deer or a little larger, formerly traveled in that region in large herds of hundreds of individuals. Although greatly decreased in numbers by human persecution, they still are abundant. Hardly a day passed without our seeing many of them, and herds of fifty or more are still not uncommon.

The guanaco is a most improbable creature, apparently put together in haphazard fashion and in questionable taste. Zoologically he is a camel, but to most laymen he suggests more a misshapen and hornless deer, lacking the hump that we think of as characteristic of camels and having a rather deerlike head. His smaller size, more rangy build, and usually different coloration distinguish him from his better known cousin



BARREN PATAGONIA

This is a sterile land covered with pebbles and scattered thorn bushes, swept by almost constant wind, yet supporting a large variety of animal life

the llama, which is a formerly wild species of the same genus surviving only as a semi-domesticated animal. The guanaco's neck and legs are long. His tail is a short brush which he holds curved in a perky and impertinent manner somewhat like the handle of a jug. The upper parts are covered with wool of a yellow to reddish brown color, soft and silky in the very young but soon becoming coarse, matted, and scabby, while his under parts are covered with hair almost pure white. The forehead is usually gray, but in one famous individual that lived for at least twenty-five years near the upper course of Rio Deseado (River Desire) the forehead was snowy white and glistened in the sunlight. The fame of this animal spread and a zoo offered a substantial reward for his capture alive, but this was never effected. Unusually light and even almost pure white individuals, albinos, have been seen. The guanaco's eyes are large, liquid, appealing, and utterly stupid, the

hairy, flexible lips admirably adapted to the vulgar habit of spitting enthusiastically at all comers.

This unlovely, uncouthly miscellaneous exterior contains a personality in harmony with it. When we were working on a great cliff, or barranca, south of Lake Colhué-Huapí, in central Patagonia, a lone guanaco used to visit me every day at about the same time. He would stand on a pinnacle across an impassable crevice from where I was working and swear at me for about an hour, until sheer hoarseness compelled him to give it up. The guanaco's yammer (I can think of no other word for that sound) can be faintly imagined as something like a horse whinnying in a loud, liquid, and insulting manner, if one also imagines that the horse's vocal cords have been subjected to rust and corrosion for years. It is a scurrilous, nastily expressive sound suggesting that the guanaco holds the entire human race, and paleontologists in

particular, in contempt almost too deep for words. By his inability to keep his feelings to himself the guanaco often betrays his presence when it would not otherwise be suspected. When we heard one yammering, we could be sure that he was within sight and looking at us, even when he himself was far off and hard to see.

His curiosity is less satiable than that of the elephant's child. Everything that moves is the immediate subject of his close scrutiny and opprobrious expressions. When faced by some danger, real or fancied, he almost invariably retreats along a ridge or cliff where he can keep his enemy in sight. Since he is seldom hunted with a rifle, I imagine this to be the safest means of protection, but if so, I am convinced that it is due to no reason so sensible but to his unreasonable curiosity—he simply cannot bear to tear himself away from the strange person or animal.

On that same cliff south of shallow, turbulent Lake Colhué-Huapí, we first learned to take advantage of the guanaco's trails and highways which mesh the whole surface of Patagonia. Many are aimless and unoriented, winding up and down the very steep barrancas, for the guanacos seem to like these naked, foodless tracts and to use them as playgrounds. We used to see them dashing up and down apparently from sheer *joie de vivre* and so effortlessly that they excited our bitter jealousy as we toiled laboriously after them. In other places the trails are definitely engineered. This same great cliff is many miles long and divides the lake basin from a higher, large, brush-covered but waterless plain or plateau, the Valle Hermoso ("Pretty Valley"—although it is neither pretty nor a valley). From the browsing lands of the plain, innumerable trails converge to the point where the cliff is lowest,



UNEARTHING AN EXTINCT PATAGONIAN BEAST

Buried in the rocks of Patagonia are innumerable extinct animals millions of years old and unlike anything living today. Here a skeleton is being taken out in blocks of hardened volcanic ash, first treated with shellac and carefully bandaged to prevent damage to the hard but very brittle bones

whence a wide, deeply beaten main highway winds down to the lake basin. But I think these more reasonable routes are not considered really sporting or good form by able-bodied adults unless they have some definite end in mind, which must be seldom, considering the quality of their minds.

Vast numbers of guanacos have been slaughtered in the last thirty years and they seemed in real danger of extinction a year ago when the government took the unusual step of declaring a closed season on them. The hunters and natives, who naturally scorn such measures, pointed to their still great numbers as showing that they were real-

ly in no danger, but this was, I think, due to special circumstances which I will explain presently.

Sheep herders detest the guanacos because they use up some of the very scant pasturage that might go to the sheep, and these sheep men harry the adults a great deal. The method is usually the rather futile one of merely chasing them with dogs until they run on to the property of a neighbor, who then chases them back again the following week. Whatever it may do to his nervous system, this obviously is not very dangerous to the guanaco's life. The galgos, very mongrel greyhounds or wolfhounds, are kept especially for this purpose in addition to the sheep dogs, which are not allowed to hunt. They do kill a few guanacos, but too few to be a real menace to the species. The adult guanacos have no commercial

value. Plaited leather ropes are made locally from the neck skin, but aside from this the flesh and hide are not ordinarily employed in any way.

The great destruction of guanacos is due to the hunting of the young, the skins

of which were formerly exported in great numbers. These are prized as relatively cheap and very attractive furs because of their silky woolen texture and the pleasing white and tan or reddish brown color markings. Under what guise the exported furs have appeared in our shops I do not know. Locally they are usually made into blankets, quilangos, fifteen or twenty skins mak-



A CHULENGO

This baby guanaco, chulengo, one of the most typical of Patagonia's children, is less than a day old

ing a robe or blanket of real beauty and great comfort.

In the late spring, when the young, called chulengos, are born, numerous hunters scour the country, running them down on horseback and securing them with boleadoras. Parenthetically, these boleadoras deserve brief description. Invented by the prehistoric Indians, borrowed by the Spaniards, and in daily use at the present time, the boleadora is as typical of Patagonia as the lasso is of our West. It consists of two, or more often, three weights—stones, leather sacks of shot or pebbles, even billiard balls—each attached to a leather cord and these cords all united at their ends. In use, one of the weights or bolas, especially shaped for that purpose, is held in the hand and the others thus whirled rapidly above the head of the user and then launched at the prey.

They whirl through the air, the bolas separated like chain shot, covering a path about six feet in width. If any part touches the animal, the whole apparatus winds about him and effectually stops his flight. Boleadoras are not only used for hunting all sorts of game, but also, like the lasso of our West and of the northern Argentine, for catching horses.

Returning to the luckless chulengos, only during the first week of their lives are the skins considered worth taking, and most are killed on the day of birth or that following. In some regions hunting was so intense that hardly one survived its first week. The result is not an immediate diminution of the herd. Guanacos live to be at least twenty-five years old, so that individuals born before hunting was so widespread live on and by their numbers give the impression of a flourishing species. But the herds now consist very largely of old animals many of which will reach their life span within the next few years, when a great and sudden decrease would occur, reducing their numbers to the critical point. It is greatly to the credit of the Argentine government that protection was given before this point was actually reached. Some killing will certainly continue, but the prohibition of the fur trade should give the species a new lease on life.

Next to the guanaco, the most conspicuous child of Patagonia is the ostrich. For the benefit of bird-students I may

add that I am well aware that these are not really ostriches but rheas of the species *Rhea darwini*, named for the great Darwin, who was one of the first explorers of Patagonia. They differ from the true, African, ostriches in many ways, most obvious of which are the absence of commercial plumes and the possession of three toes instead of two, but they look like ostriches and have similar habits. The local inhabitants never heard the word "rhea" and to all who know them well, the birds are ostriches, or avestruces in Spanish.

The ostrich, then, is a very conspicuous Patagonian, and hardly cedes anything to the guanacos in being ridiculous in appearance and actions. We were made almost helpless with laughter the first time we saw one of these anomalous birds going full speed ahead, gawky neck bobbing

about, flabby, useless wings fluttering in the wind, picking up its feet high from the ground and planting them again vertically. The leg motion is especially strange in a biped, because what appears to be the knee (although actually corresponding rather with the ankle) bends in the opposite direction to our own knees and gives the observer an uncomfortable feeling that anatomy is playing weird tricks.

The tracks are remarkably similar to those of some dinosaurs, preserved in rocks many millions of years old.

Our most pleasant contacts with ostriches were gastronomic. The meat



PATAGONIAN HARE

The Patagonian hare is not really a hare but a big cousin of the guinea pig. It progresses by rapid leaps, as if on springs, and is easily recognized by its bobbing dark rump. Two, male and female, are almost always seen together



CHARITA LEARNING TO SCRATCH

Charita, the pet ostrich chick, had an unfulfilled ambition to scratch his head. He would take his stance with feet well braced, then lift one to scratch and promptly fall on his beak

itself is edible, but it is tough and strong in flavor and to me is more of an experience than a meal, although the natives prize it highly and we found it an acceptable occasional change in the universal mutton diet. It is the eggs to which I would pen a pæan of praise. Each equal in volume to a dozen hens' eggs and of fine, even though somewhat full, flavor, they can be used in the same ways as any other eggs. After the first shock of encountering a wholly new flavor, we came to prefer them in the native way. This is to cut off one end carefully, remove part of the white, pour in a quantity of sugar, stir vigorously, and then cook in the shell by piling hot ashes around it. This is surely Patagonia's richest and most pleasant contribution to diet.

The nest is a slight hollow scooped in the earth or sand, and several hens lay in one nest provided by their mutual lord and master. Clutches of thirty or forty eggs are usual, and they may rarely reach nearly twice that number. Having laid, the female has made her whole contribution to family life, and she then wanders off and forgets the affair. The male does all the work, making the nest, setting on the eggs, and bringing up the young, an unfortunate social system to which mankind has not yet fallen.

At the beginning of the summer, when

we had been in Patagonia about two months, the ostriches began to hatch. We learned this one day when we passed an old ostrich that did not run away as usual but circled about waving his wings and making loud, solicitous, clucking noises. As we came nearer, we saw that the harassed parent was surrounded by a milling mob of thirty or more babies, each the size of a small chicken, swarming around their father, running in circles, tripping over themselves and one another, and whistling plaintively.

We caught one of the babies and christened him Charita, which is the local name for ostrich chicks in general. Charita soon forgot his brothers and sisters and lived with us contentedly, a silly creature with feet much too big for it, its body the size and shape of the egg from which it came (where the neck and legs fit in I do not see), covered with soft down, dark brown and striped with white like a skunk. His idea of heaven was to wedge himself tightly between two hot pans beneath the camp stove. When deprived of his sensuous pleasure, he divided his time between trying to crawl into our pockets and trying to scratch his head, laudable ambitions neither of which was ever wholly achieved.

His efforts to scratch his head were especially ludicrous. He would plant both

feet firmly and wide apart with an air of sober determination, then pick one up to scratch, promptly landing on his beak with a loud plop. He used to sleep with one of us, and soon became a real member of the family. His cry was a sad whistle, slurring down the scale and ending with a pathetic tremolo. Later, acquiring greater virtuosity, he ended with a distinct chord, whistling two notes at once. We never achieved this more complex call, but became expert at the simpler tremolo, and he would come running whenever we called him and would carry on long conversations with us.

Charita met an untimely end. He developed an unwholesome appetite for kerosene and, one day, finding a whole pan of this delightful beverage unguarded, he overindulged. All afternoon he wandered about vaguely as if something was very much on his mind, or stomach, and next morning he was dead.

We had only a little better luck with

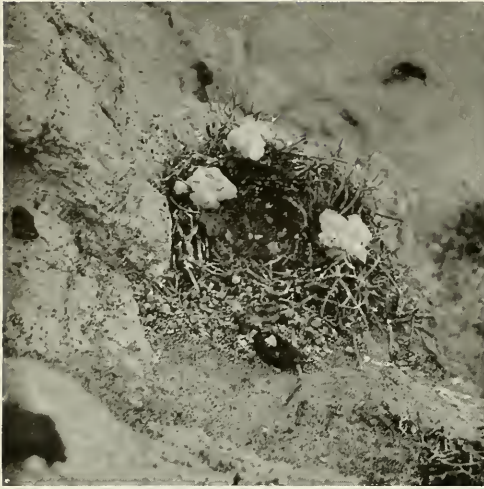
our other camp pets, most important of which were several armadillos. The first ones we caught could not be induced to eat, and ended either by being released or by being eaten themselves. Finally, in desperation we offered one a bit of meat from a noisome ostrich carcass several weeks old. She tore into it ravenously and we never again had trouble keeping our armadillos alive. We slowly accustomed them to a diet less obnoxious, including fresh meat, cold potatoes (not very well received), condensed milk, and live ants, of which they were all passionately fond.

These armadillos of central Patagonia are of the small, hairy sort, *Zaedyus pichyi* to scientists and strangers, and to friends simply "pichi," an Indian word meaning "small." They are generally about a foot long, encased above with scaly armor from the interstices of which protrude coarse bristles. They are quite unable to curl up into a ball. Only one



SENTINELS OF THE PAMPAS

Guanacos, wild cousins of the llama, are ungainly beasts dominated by curiosity and given to voicing unprintable opinions of interlopers in their savage haunts



BABY EAGLES

In this eagle's nest, stuck on the side of a vertical cliff and photographed from directly above, are three eaglets, gorged with armadillo meat and too sleepy to move

sort of armadillo can do this, but it has so caught popular fancy that all the many sorts are supposed to perform this trick. When pichis are pursued they make for a thorn bush and dig into the soft ground beneath it, disappearing so rapidly that it is very difficult to get them before they are beyond recall. If caught away from good digging ground, they simply hold on to the ground with their sharp claws, pulling the edges of the shell down tightly against the earth so that it is very difficult to pry them loose. Once actually caught, they make no real attempt to defend themselves.

Our long favorite was a pichi named Florrie who lived with us for several months, until crushed to death by accident. She came to tolerate us as servants but never displayed any demonstrative affection. One can no more pet an armadillo than one can pet an egg or, more aptly, a tortoise, and her own attitude was always one of vapid selfishness. Yet she fully earned her keep. As she wallowed in a saucer of condensed milk we laughed more at than with her. She never

learned to lap it up cleanly with her long tongue, but must always get her sharp, flexible snout in it too, so that attempts to breathe resulted in convulsive coughs and a mighty blowing of bubbles. She would start to wander off, then suddenly remember the milk, dash back to it in the most business-like way and start drinking again, only to lose interest, wander off again, and repeat the whole process several times.

There was always something vague about Florrie. Her thick skin seemed to be an index to her mentality and emotions. Almost the only real emotion she betrayed was when first captured. Then, if touched, she would suddenly jump, at the same time emitting a convulsive wheeze, a maneuver as disconcerting as the explosion of a mild cigar. Later she ceased to bother. If she wandered off when let out, it was rather from absent-mindedness than from any active dislike for our society. She seemed to think with her nose, and when thus let out for exercise she would trot busily from bush to bush, poking her nose hard into the



CHARITA

This baby Patagonian ostrich, otherwise known as a Darwin's rhea, had a body shaped like the egg it came from and was covered with down, rich brown and white, striped like a skunk

ground beneath and sniffing violently. Once she got away altogether and for several days we mourned her for lost, when one morning she wandered back into camp with her usual air of preoccupation. The cook, whose special friend she was, swore that she returned for love of us, and another said she had returned for free meals, but I maintain that she had simply forgotten that the camp was there two minutes after she left it, and stumbled on it again quite by accident in the course of one of her sniffing parties.

After Florrie came into our lives, we ate no more armadillos, but less, I fear, from nicety of sentiment than from the fact that we naturally had lost the little taste we had for the meat. In this few Argentines would agree with us, for great numbers of armadillos, of three species, are to be seen hanging in meat markets in Buenos Aires, and the flesh, roasted in the shell, is considered a great delicacy, at least among the country people and lower classes. The flavor really is agreeable, not unlike pork or even chicken, but it is so intensely oily as to be cloying and



PERDIZ COLORADA

The so-called "red partridge" of Patagonia is a species of tinamou living on the more barren pampas, where its neutral, spotted coloration blends almost perfectly with the soil and gravel

finally unpalatable. Nor is the mode of serving it, with head, tail, and feet attached, calculated to whet any but a hearty camp appetite.

In Patagonia's too keen and too rapid air attention is thus likely to be divided between contemplation of the living animals and a more earthly appetite for their flesh. This is especially true of the martineta, a bird equally inviting to contemplation and to the table. It also is the subject of confusion as to its name. In books it is a tinamou and English-speaking residents call it a partridge, but martineta is the universally used Spanish name. It does resemble a partridge more than any other bird familiar to us in the northern hemisphere, but is without close relationship to true partridges. As food it deserves the highest praise, hardly qualified by the fact that the meat is very dry unless skillfully prepared.

Having paid appropriate tribute to appetite, one turns with satisfaction to the bird itself, in size like a large partridge or small chicken and similarly flecked in neutral browns and white. This coloration



AN OSTRICH NEST

The nest of the Patagonian ostrich is a mere hollow scooped in the ground. Several hens lay in each nest until there are thirty or more eggs, which are then incubated by the male

blends so perfectly with its surroundings that it is extremely difficult to see the bird when motionless, as it well knows, and I have more than once almost stepped on one before seeing it. When frightened, it runs rapidly and only takes to flight as a last resort, flying noisily for a few hundred yards. This single effort seems to exhaust it and, if still pursued, it seldom flies again but "throws itself down," in the Spanish phrase, and remains motionless, trusting to the last in its protective coloration. The people take advantage of these habits in various ways. A horseman may ride around a covey, which becomes confused as to a safe direction of retreat, throws itself down, and may be despatched at ease. Still more commonly, they are driven along the ground and do not venture to fly until too late to escape low nets set for them.

The martineta is so reluctant to fly that it can almost be called a running bird, like the ostrich, even though the power of flight is not totally lost. The reason for this habit is to me wholly speculative. It does not seem likely that it is less exposed to enemies on the ground than in the air. In the special climatic conditions of Patagonia, it is tempting, although possibly fallacious, to suppose that the wind, blowing almost constantly for some nine months in the year, is responsible for the flightless habit. I have repeatedly seen geese and other supposedly strong fliers struggling with no success at all to make headway into

the wind, when the martinetas and ostriches were well able to go in the same direction on the ground. Whatever the cause, the martineta seems beautifully to show a stage in the evolution of large flightless birds, like the ostrich, rhea, cassowary, emu, and several extinct

forms. It never flies far or from choice and lacks little of losing the habit altogether, when degeneration of the wings and increase in size would readily follow. It is interesting, too, that the martineta's foot is almost exactly like that of the South American ostrich, or rhea, in miniature, and still more curious that its domestic habits are said by the natives to be the same, the polyga-

mous male hatching out the eggs of his several wives.

The eggs, slightly smaller than those of a hen, are beautiful objects, olive to bright yellowish-green in color and with a high gloss like finely finished porcelain. They are laid in poorly lined hollows on the ground, hidden among small thorn bushes.

The martineta is no lover of light. They are seldom abroad in the middle of the day, but commonly only in the early morning and toward nightfall. One clear, star-lit night when we were stuck miles from any habitation or from camp and slept in the open, the martinetas could be heard in great numbers whistling loudly around us throughout the night, in volume, but not in tone, like the cries of frogs in a well frequented pond. The martineta's smaller cousin, also a tinamou



FLORRIE BLOWING BUBBLES

The armadillo Florrie had a passion for condensed milk, but greedily plunged her whole mobile snout into it so that drinking was accompanied by convulsive coughs and a mighty blowing of bubbles

in bookish language but popularly a "red partridge," (*perdiz colorada*), has different habits, more often busy during the heat of the day and more commonly found in open, bushless pampas. It lacks the jaunty crest that distinguishes the *martineta* from the several lesser species of tinamous.

Learning that we have been in South America, friends often ask about encounters with boa constrictors or with condors, and feel imposed upon when they learn that we saw not one live snake nor any condor in all of our stay in Patagonia, for the plateau region of central Patagonia is as different from the tropical jungles of the boa constrictor or the alpine crags of the condor as are the deserts of Arizona from the everglades of Florida or the glaciated peaks of the Canadian

Rockies. Condors may occasionally stray over from the Andes, but in general their place as birds of prey is now taken by large eagles, handsome birds, dark brown shading to white and in wing spread probably fully five feet, perhaps more, although I never saw one dead or examined one alive with any leisure. I have, indeed, been uncomfortably close to them, for they resented our invasion of their cliffs. On many occasions one of these fine birds would circle overhead and then swoop for me, banking just in time and hurtling past like a cannon ball, a foot or two above my head. I never fully suppressed an instinctive cringing as they swept past, but none ever really struck.

These great eagles (*aguiluchos*) build nests of twigs and branches in almost in-



A CHULENGO HUNT

During the first few days of their lives guanacos are relentlessly hunted for their skins. They are pursued on horseback and secured with boleadoras, balls tied together with leather thongs which entangle and stop them

accessible places on the cliffs and they lay two or three white eggs. Attempting to photograph a nest with eggs one day, I observed a thrilling combat. The eagle parents abandoned the nest at my approach, which gave a raffish-looking rusty brown tramp of a similar species a coveted opportunity. He lunged for the eggs, but the alert great eagles swept down on him and forced him away, then engaged him in a long aerial battle, repeatedly wheeling and striking until he withdrew in bad shape, with several of his wing pinions gone and a general air of well punished wickedness.

Later in the season I had a rare opportunity to photograph three fledglings by climbing down a narrow crevice in a vertical cliff. The parents were greatly worried, swooping repeatedly and screaming imprecations, but they did not strike even when I handled their infants. The fledglings themselves were too sleepy to pay any attention to the proceedings, being gorged with armadillo, the remains of which lay untidily about. The ungainly little creatures were far from beautiful, their heads already distinguished with the sinister contour of their rapacious kind, even though their bodies were still covered with white down.

Pairs of eagles scan the landscape for prospective food from chosen rocky perches. Any small creature that moves is valid prey, although armadillos seem to occupy first rank in their diet. If

not killed by the first strike, the prey is dropped from a height, the eagle following and striking again immediately. One of us was surprised one day by having a small rodent fall on him from the skies, but the disgruntled eagle did not dare to fol-

low his victim into the dreaded neighborhood of man.

As the eagle in the air, so on the ground the most savage of Patagonia's children is the puma, closely similar to our many-named cougar, mountain lion, or painter. These bloodthirsty cats have now largely abandoned their natural prey, the guanaco, for the less agile sheep, and so have drawn the wrath of the sheep owners, who wage

bitter war against them. Consequently pumas are now less common than even a few years ago. I was told that early settlers, more aware of the enmity of the puma than of the equally disadvantageous competition of the guanaco, killed many "lions" and let the guanacos alone, with the consequence that the latter, relieved from the attacks of their worst enemy, increased unduly and ate much of the scanty sheep pasturage. Then man restored the balance by extending his destruction to the guanaco as well.

W. H. Hudson, in one of his delightful books, argues at some length that the puma has some spiritual link with man and never attacks him even under severe provocation, but will meekly be killed first. This pleasant belief unfortunately is not true, for there are perfectly authen-



A GROUND OWL

This small owl lived with us for a time, but was never reconciled to captivity. When approached, it always spread its wings in an attitude of defiance and hissed with tremendous force

tic records of pumas attacking men, even with little or no provocation, but such cases do seem to be very rare and the puma cannot be accounted an animal dangerous to those who respect his privacy. In fact, like almost all animals, he is something of a coward where man is his opponent.

For some weeks we worked in a region frequented by a family of pumas, mother and two cubs. They used to pass our work place at night, and at a respectful distance, as shown by tracks, and killed sheep in a small, ledge-like valley above, tearing out the brisket, valued by Patagonians both human and feline because it is almost pure fat. Female pumas measure about seven feet from nose to tail tip—males sometimes exceed this by two feet or so. The summer hair is short but thick and smooth, a somewhat tawny gray in color.

Patagonia's family is too large even to list here. It is amazing to find a country so desperately barren and forlorn to our eyes teeming with wild life of all sorts, of which only a few of the more characteristic and obvious birds and mammals have been mentioned.

Swept by tremendous tides, the shingle beaches that were trodden by Drake and Magellan and excited the wonder of Darwin are animated

by thousands of birds, from the omnipresent gulls to the almost human penguins. On chosen stretches congregate great numbers of eared seals, barking defiance at all who disturb their rest. Neat black and white porpoises coast on the breakers, and farther out great whales are hunted. In the inland lakes fishes thrive, and ducks, geese, flamingos, and all manner of water-lovers sport. Along the cliffs the queer parrots, paradoxically suggestive of a more tempered climate, utter their raucous cries. Wild cats and foxes hide among the thorns and innumerable rodents burrow in the earth, from the tiny tucutucus to the large Patagonian hares that are not hares and that run as if on pogo sticks. Back in the cordillera, the southern tail of the Andes, there are deer, large and small, and many other beasts.

And buried in the ash-formed rocks and river-deposited sandstones, laid bare from their deep and long burial by the renewed biting of wind, torrent, and wave, are the petrified remains of ancient creatures now dead for millions of years.

There is a whole series of other animal worlds, piled one above another, dinosaurs and strange mammals such as now exist nowhere on earth.

There is more than enough to keep on drawing men of curiosity to that land of biting wind.



AN OSTRICH FAMILY

The old male ostrich surrounded by a milling mob of his offspring, is like a fussy old mother hen with her chicks



Gabriel Moulin Photograph

In the Heart of the Prairie Creek Region

THE PRAIRIE CREEK REDWOODS

A New Chapter in the Movement to Save the California Redwoods

By GRACE LINDEN

ONE of the outstanding triumphs in the history of American conservation has been the gradual preservation of the finest remaining examples of the primeval Redwood forest of north-western California, notably in southern Humboldt County along the South Fork of the Eel River and in Del Norte County, its northern neighbor, where at the present writing some 20,000 acres of magnificent trees have been preserved from destruction and are now part of California's state park system.

Particularly noteworthy was the acquisition, in the summer of 1931, of the world-famous Bull Creek and Dyerville Flats, with their surrounding woodland totalling approximately 10,000 acres. This was only after a ten-year effort by the Save-the-Redwoods League, which culminated in the formal dedication of this "world's finest forest" as part of the state park system on September 13, 1931.

But there is another great primeval forest wilderness in northern Humboldt County, which is now in process of acquisition by the League and the California State Park Commission. This is the beautiful Prairie Creek region, extending from Orick northward to the county line, and the present park project here represents an area of 10,000 acres. The Redwood Highway, as in southern Humboldt and Del Norte counties, passes through the heart of these Redwoods.

With the purchase of 2280 acres of superb Redwood forest in the heart of the magnificent Prairie Creek region by the Save-the-Redwoods League and the California State Park Commission already an accomplished fact; and with the prospect of a further purchase of 2611 acres of adjacent territory early in 1932 with funds already in hand, the most essential portion of the League's Prairie Creek Park project will have been achieved. Several

privately-owned tracts within the area have also recently been acquired, notably 285 acres at Boyes Prairie, at the southern boundary of the new park area, and the Cottrell property of 160 acres which, together with some 360 acres of park lands previously acquired, including the lovely Russ Grove, the Roberts and Leach tracts, bring the present park holdings in the region to approximately 6000 acres, at a cost of close to \$1,000,000. The primary unit of the Prairie Creek Park will thus extend from Boyes Prairie, about five miles north of Orick, or 342 miles north of San Francisco, northward to the Del Norte county line for a distance of about seven miles; and from the ridge which divides the Prairie Creek basin from the Klamath River watershed on the east, to a minor ridge rising about half a mile west of the Redwood Highway which penetrates the heart of the park for its entire length.

The preservation of this substantial acreage—representing the finest portion of this splendid wilderness—was made possible largely through the generosity of Mr. Edward S. Harkness, who contributed \$500,000 toward this specific project, which was matched in part by Mr. John D. Rockefeller, Jr. (who has given a total of \$2,000,000 toward the preservation of California Redwoods) and by the California State Park Commission to the extent of \$150,000 from the sale of State Park Bonds. (A State Park Bond Issue of \$6,000,000 was authorized by California voters in 1928 for the preservation of some of the State's outstanding scenic and recreational treasures, including the Redwoods.) With the acquisition of this primary unit in the Prairie Creek region, the essential parts of each of the League's four major projects in Humboldt and Del Norte counties have now been preserved.



Gabriel Moulin Photograph

A GLIMPSE OF THE SUPERB FOREST GROWTH

The "Scenic Rambling Route" ultimately planned for the Prairie Creek Park, would provide a leisurely alternate route to the more direct, swift Redwood Highway

Tibbitts Photograph

THE OLD COUNTY ROAD

A picturesque bit revealing the varied interest of the mixed forest along Prairie Creek, combining the noblest of Redwoods with fine growths of spruce, fir, and hemlock



A FERN-CARPETED SLOPE

One of the most beautiful features of the region is the magnificence of the forest "floor." Many species of ferns, some of them man-high, rhododendrons, and other flowering shrubs, combine with the thick carpet of oxalis to create a scene of almost tropical luxuriance

Gabriel Moulin Photograph





Courtesy of the Northern Pacific Railway

ROOSEVELT ELK AT A WATERHOLE

Only a small number of this species of elk now remain, and a group like that shown above, in the Olympic Range of Washington, is seldom seen. A herd of the same species roams the Prairie Creek Park in the region between Orick and the Pacific Ocean

In addition to the lands above mentioned in Prairie Creek, the Save-the-Redwoods League has an option for a year and a half on a beautiful forest tract of 3270 acres in the Godwood Creek basin at a price of \$463,000, and while at the present juncture there are no funds in hand for its purchase, it is hoped that the necessary amount may be raised before the expiration of the option. Godwood Creek is one of the tributaries to Prairie Creek west of the Redwood Highway, rising from the coastal slope, and the surrounding area is a notable example of the unspoiled wilderness type of forest which is one of the outstanding characteristics of the park as a whole.

The forest along Prairie Creek, while of the first magnitude, differs considerably in character from the heavy stands or "flats" of the river banks farther south. There are here no notable stands of the

"flat" or river-bottom type comparable with those in the Dyerville region, but a combination of both the "slope" and "bottom" types, the latter chiefly found in the "benches" lying back from picturesque little Prairie Creek. While the heavily timbered flats along the Eel and the South Fork of the Eel represent, in a great degree, the pure stand—that is, the Redwood where found unmixed with other forest species—the Prairie Creek forest combines heavy stands of outstanding Redwoods with exceptionally fine growths of fir, spruce, and hemlock, while along the borders of Prairie Creek and its tributaries are found the willow, California laurel (locally known as the "pepperwood"), alder, and western maple. Numerous varieties of ferns grow in almost tropical abandon. The sword fern (*Polystichum munitum*) is the most characteristic cover of the forest floor, in some



Photograph by Russell Angel

A MOSS-CLAD OLD MAPLE

Drenching fogs in the summer months and abundant rainfall in winter are responsible for the rich fernery and mosses

places reaching the almost incredible height of five or six feet. There are many other varieties of ferns carpeting the slopes and flats, one of which is the graceful and delicate *Lomaria* which is found clinging to the great, fallen Redwood giants, and which incidentally gives to these great logs a unique and touching beauty. Then there is the lacy "licorice" fern which loves to cling in soft festoons to the lower branches of the spruce and fir. Velvet mosses, green and gray, mantle the fallen Redwood trunks, and enwrap the trunks and branches of the Western maples as they brood above the streams.

Spring paints the forest in incredible loveliness. The rainbow tints of the native flowers, typical of the northern Redwood forest, are everywhere in evidence. The butterfly-like white trillium, the delicate orange-pink trumpets of the azalea, the flamboyant rhododendron—are fairy blossoms all; and with the newborn foliage of the shrubs and young trees running the whole gamut of greens,

make a picture of breathtaking charm. The richly embroidered forest floor, with its ankle-deep carpet of flowering oxalis, its occasional patches of wild iris and purple and yellow violets, contrasts strikingly with the somber, looming bulk of the Sequoias.

The park area just acquired in the Prairie Creek region is so situated geographically as to provide for a great expansion in future, as the population of California increases and demands more and more outdoor recreational acreage. From all present indications the State's population, and particularly that of the cities, will grow rapidly in the coming generation, and it is the part of wisdom to anticipate the recreational demands of that day. The most urgent need in the consideration of a forest preserve was the protection of an area of timber of sufficient extent on both sides of the Redwood Highway, and the remains of the old County Road roughly paralleling it, to insure always a vista of the unbroken Redwood



Photograph by Russell Angel

RHODODENDRONS, REDWOODS, AND FERNS
Along the trail to the Klamath River, through State Park lands recently acquired in the Prairie Creek region

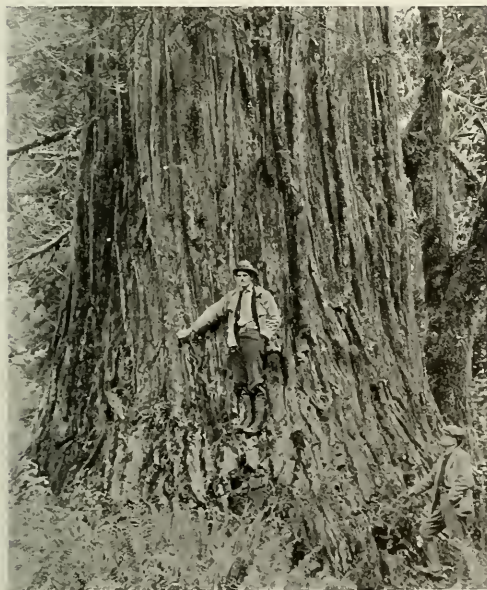
with a "backdrop" of trees. The major part of this ideal has been achieved. A portion of a secondary zone—that of the Prairie Creek Basin—enveloping the Redwood Highway strip, has also been included in the present holdings, and the remaining portion of this naturally drawn park unit provides for an extension of the park boundaries in the future. This secondary strip offers unique advantages when considering a well-rounded and complete forest park.

The Redwood forest is of the finest quality, the timber being found in dense stands, and the individual trees are of outstanding size, clear and symmetrical. While the individual trees, although generally very large, do not compare with the largest specimens to be found in the Bull Creek and Dyerville Flats along the South Fork of the Eel River in the southern part of Humboldt, nevertheless there are some noble giants which do compare favorably with the latter. Perhaps best known of these is "The Big Tree at Elk



UNSPOILED WILDERNESS

A fine example of the beautiful silver fir, which is one of the great variety of plant forms found in the new park



Photograph by Russell Angel

THE BIG TREE AT ELK GROVE

The new State Park boasts some enormous specimens of the coast Redwood, among which the above is well known

Grove," which boasts a circumference of 55 feet at about four or five feet from the ground—a truly magnificent specimen despite its broken crown. Interspersed with the Redwoods, and in contrast with the stands of virgin trees along the flats of the South Fork of the Eel, the forest here is mixed in character, as previously stated, with unusually fine growths of fir, spruce, and hemlock. The natural boundaries of this secondary unit afford full protection for the forest body and for the main streams tributary to Prairie Creek—an ideal wilderness area where trails might be built at some later date to penetrate the remote fastnesses of the woodland.

An enlarged park of the future might well include, too, an outer strip or envelope which extends from the western or coastal slope (the westerly limit of the present Park) to the Pacific Ocean just a few miles distant, which would add about twelve miles of varied coastal scenery, from the rugged and rocky shoreline of the Pacific to the sandy stretches of



Photograph by Russell Angel

SPRING IN THE REDWOOD FOREST

Spring embroiders the forest floor with many rainbow-tinted wild flowers among which are generous patches of purple and yellow violets

beach at the mouths of the seaward streams. This is an area of mixed forest and open meadow and field; an ideal recreational overflow area. This outer strip includes the nine-mile line of vertical gravel cliffs along the ocean south of Ossegon Creek, known as Gold Bluffs. These cliffs have considerable historic interest, for it was in 1851 that gold was found in considerable quantity in the black sands along the foot of the Bluffs. Excitement ran high, a company was floated, people flocked to invest in its shares as tales of the fabulous gold deposits were heard on every hand. While the black sands beneath the gravel did yield gold, it was found that it cost more than it was worth to collect and extract it. And so another South Sea Bubble burst and thousands were ruined. The remains of two old-time mining plants may still be seen along the bluffs—their blind eyes turned pathetically oceanward.

Such are the possibilities for a greater forest preserve in the Prairie Creek district in the future.

There has been formulated, in relation to the Prairie Creek Park plan, a project for the creation of a "Scenic Rambling Route" which would serve as an alternate means of travel to that of the swift, direct Redwood Highway. Several years ago, when the route for the then new State Highway north of Eureka (now the Redwood Highway) was surveyed, there were included in the new road stretches of the old winding County Road which roughly paralleled the present artery through the great Redwoods of northern Humboldt. It is hoped that new links can be surveyed which will connect the remaining stretches of the old road through the most beautiful parts of the forest, and that the "Scenic Rambling Route" will in future years come to be one of the most unique scenic drives in the world. For those whose

esthetic tastes and adventurous impulses will always lead them from the beaten paths into realms of exquisite charm which are hidden from the casual eye; for those who are concerned not so much with a speedy arrival at their destination as with the beauties to be enjoyed by the way, such a scenic route would prove to be a never-ending delight. For the intimate beauties of the forest's innermost heart are revealed along the leisurely windings and turnings of this lovely, woodland byway, where the feverish and crowded life of the cities seems so far away as to be unreal.

Of late years there has been increasing evidence in this country of a growing interest in the protection of what remains of our once numerous native fauna. Familiar to all, of course, is the story of the dying out of the bison, great herds of which roamed the plains a hundred years ago, and which in these days is seen most

often in the zoölogical gardens of city parks, or on the face of the "buffalo nickel." Another nearly extinct species is the California condor, closely allied to the condor of the Andes, and which ranged from Humboldt and Tehama counties southward to Lower California and eastward to Arizona. Now and then one of these great, voracious birds is seen, but the days of its kind are numbered. The grizzly bear is nowadays an almost legendary beast in the State whose emblem it is, and is now considered extinct, at least so far as California is concerned. To this group of fast disappearing fauna belongs the Roosevelt elk (*Cervus canadensis occidentalis*), still found in very limited numbers in the dense forests of the Pacific Coast from northern Vancouver Island through the coastal ranges of Washington and Oregon to northwestern California. A small herd of these animals, estimated at about 200 head, inhabit the



Photograph by Russell Angel

FERNS GROW IN ALMOST TROPICAL ABANDON

The butterfly-like trillium appears magically among the sword-ferns with the early spring months in the Prairie Creek forest



Photograph by Russell Angel

THE PRIMEVAL FOREST

Lordly Redwoods such as these, will be forever protected from destruction in the newly acquired Prairie Creek Park, as a part of California's splendid State Park System

Prairie Creek forest in the region between Orick and the ocean. Timid and gentle creatures, they are seldom seen along the Redwood Highway, but appear now and then to graze upon the open lands along the beach. Says Dr. C. Hart Merriam, research associate of the Smithsonian Institution, who has made extensive studies of American mammalia:

The antlers are large, heavy and relatively short, with the terminal prongs aborted, so that the total length from burr to tip is about twenty inches less than in well-formed antlers of the Rocky Mountain elk. The brow, bex, trez and fourth tine are similar to those of the ordinary wapiti, but above the fourth the antler is flattened and subpalmar and ends in two or three

short points the tips of which reach only slightly above the tip of the fourth prong. Whether the aborted condition of the terminal part of the antler in Roosevelt's wapiti is the result of long residence in the dense Pacific Coast forests, where longer antlers would be inconvenient, or is indicative of closer relationship with the stags of Europe and Asia, which normally carry somewhat similar antlers, is an interesting question.

It is hoped and planned by the League and the State Park Commission, as one of the features of the new park, that this small herd in the Prairie Creek wilderness may find sanctuary in the protected forest area where they dwell—where they may be adequately protected from man and predatory beast. To many, the friendliness and fearlessness of the native animals which have all their lives been

afforded sanctuary in our National Parks, are among the most inspiring features of these preserves.

As time goes on, the magnificent Redwood forest and wilderness of the Prairie Creek region must become increasingly valuable as a recreational area, as well as an inviolable preserve for the lordly, age-old Sequoia, whose ancestry goes back into the dim reaches of unrecorded time when the Redwood's antecedents were contemporaries of the giant saurians that roamed a world the physical aspect of which differed mightily from what it is now. The park is ideally suited to provide future camping units where the visitors

may conveniently spend a week or two. There are numerous open tracts such as the Boyes Prairie—a spacious meadow traversed by the Redwood Highway, with an adequate water supply provided by meandering little Prairie Creek—and provision will ultimately be made, as the park develops, for camping facilities and sanitation. This flat meadowland is at present the southern gateway to the park lands already in State ownership, and is a most attractive introduction to the park proper. A few hundred yards to the west of the Highway are the long, lush grasses, the alders, maples, and willows which fringe Prairie Creek; not far beyond, with a protecting vanguard of spruce, fir, alders, and willows, looms the mighty Redwood host, rank upon rank as it

fades into the distance—imponderable, mysterious beyond words.

Leave your car by the side of the Highway for a little and follow a narrow footpath for half a mile across the meadow to the westward. A few minutes' walk will bring you to the entrance of a fascinating jungle of waterside grasses, undergrowth, and trees, and with a few steps more you will come to a veritable fairy dell. "Dell-o'-the-Woods" is well worth a visit. Around a bend in the creek, where the water, crystal-clear, tinkles over the stones, the creek bank rises perpendicularly about three or four feet. Completely covered with rich ferns, the dell is an indescribable symphony of greens, while overhead bend the alders and willows, casting dappled shadows along the sun-flecked brook.



Tibbitts Photograph

PRAIRIE CREEK

Prairie Creek is beautifully margined with a wealth of plant forms which would delight the heart of the botanist. Maples, alders and willows combine with the charm of varied shrubbery to produce this sylvan scene



QUIET CONTEMPLATION

MESHIE

THE CHILD OF A CHIMPANZEE

A Creature of the African Jungle Emigrates to America

By H. C. RAVEN

Associate Curator, Comparative and Human Anatomy, American Museum

WHILE hunting gorillas in the great forest of the French Cameroun during February, 1930, I had a camp about fifteen miles from the nearest negro habitation. I had just finished a rather late luncheon, and was talking with some of my eight or ten negro companions, when two men walked into camp.

To my companions they said "Embolo" as a greeting, but to me they said "Morning," this being in the Pidgin English of the Cameroun the proper greeting, regardless of the hour of the day or night. One of these men carried in his arms a baby chimpanzee.

The little creature weighed about ten pounds; the skin on her face, ears, hands, and feet, was a rich tan color, but on her body beneath the hair the skin was as white as it is on a white man's scalp. Her hair was black, fairly coarse, straight and rather long, very long on her cheeks, where it grew down like side whiskers below the level of her chin. The

only hairs that were not black were the short, inconspicuous, fine ones about the front part of her lips and mouth, and a tuft of longer coarse hairs that stuck out in the position of a tail. There was a small bald or bare area on her forehead just above the supra-orbital ridges, a character of the particular variety of chimpanzee to which she belonged.

I approached the man who held her and put out my arms. The little animal looked at me a moment, then stretched her arms toward me and I took her. She grasped me tightly as if she feared she might fall. She looked at me curiously for a moment and then stroked the hair on my bare arm. She seemed to sense that I was unlike the black natives, the only other humans she had seen.

I asked the man how he happened to come to my camp, to which he replied that in passing along the road at Djaposten, he had been told that I was looking for gorillas and chimpanzees and might buy the one he had. He had shot the

mother of this baby chimpanzee with a poisoned dart from his crossbow while he was following a trail far away to the east between Yukaduma and Molundu. The mother chimpanzee had been eaten by him and his companions. He had kept the little one for about a month and had fed her on whatever she would eat of their food, including cassava, plantains, bananas, sweet potatoes, calladium, peanuts, maize, and papayas. The little animal was thin, however, and I was not at all sure that I would be able to keep her alive. I bartered in true native fashion for some time, through an interpreter, but as I considered the price too high, I refused to pay it. After the men had left, I heard the interpreter make some remark about the price, and I said,

"Why, that was the sum I told you to tell him I would pay."

He replied, "I thought you meant a hundred francs less than that."

I sent him running after the men and a few minutes later they returned; the baby chimpanzee was given to me; they took the money and departed without a word.

I played with the animal for a short time and she seemed to take a fancy to me, for when I started off through the forest to hunt, she attempted to follow me, and screamed when I turned her over to Samkum. Samkum was a boy about twelve years old, an orphan, who had adopted my camp as his home.

The little chimpanzee was spoken of as "mon a waa," which means in the Bulu language "the child of a chimpanzee." She was never fastened or caged and seemed perfectly happy to play about camp with Samkum. He became her chief companion and they played tag for hours on the tall saplings and lianas that overhung the little space we had cleared in the heavy forest. At this time I had four dogs in camp and I feared they might harm her, but in a few days Opat, the youngest of the dogs, had become well acquainted with her, and thereafter joined the play every day. The older dogs, however, simply growled and walked away when she approached.



CHILDREN LIKE THE COMPANY OF OTHER CHILDREN
African children frequently asked to be allowed to play with Meshie, and she enjoyed their company



PLAY

While Meshie romped about Mr. Raven's African dwelling, she often amused herself with sticks or other objects. Here she is playing with a bit of rag

If she were not given sufficient food, she ate leaves and buds of certain trees growing within a few yards of camp. When we shifted camp, Samkum carried her pickaback, her hands over his shoulders and her feet on his waist. One day when we broke camp, I sent Samkum on ahead with her; an hour later I came up with them, the little chimp sitting in a sapling and Samkum sitting on the ground crying. He said the "mon a waa" wanted to get down from his shoulder and when he did not let her, she bit him on the neck. She was simply tired of being carried, but if he attempted to walk off and leave her she screamed and followed after him. I carried her some distance and then showed him how to carry her in a sling of cheesecloth on his back. After she had been carried pickaback for a considerable length of time, her hands would be so tired that she could not walk on her knuckles in the usual manner, but would either move about resting on her wrists and the backs of her hands or on the whole of her fore-

arms. This fatigue passed off in a short time.

In camp I made her a bed in an empty chop box, but if she were not placed in it at dusk, she would climb up among the branches of some trees above camp and there make a nest for herself. The natives feared she might be lost and, if she did not come down when I called her, one of the natives would climb up and bring her down.

When we returned to Djaposten, she played about the house where I lived and had access to a number of small native houses near by. There were several small negro children with whom she became very friendly. By this time all the dogs, too, seemed to regard her just as they did the human babies, and if she pulled their ears or their tails or their legs, they would



WASHING

Captive chimpanzees like playing in water, washing their hands, feet, or other convenient objects. Meshie will stamp in the water for the joy of seeing it splash

simply whine and walk away. These African dogs were very fond of bananas and papayas, but if a piece of banana were given to one of them while she were hungry, she would whimper and cry and peevishly stick out her lips while holding out her hand in a begging attitude. If this were of no avail and more food were given to the dog, she lost patience and rushed at him, making a scolding noise and striking him with her hands and even attempting to bite. This procedure always succeeded in driving the dogs away.

It was while the little chimpanzee was playing with her many black friends at Djaposten, that I first heard her called Meshie Mungkut. I was told that they had given her that name, which in their language was a nickname for a chimpanzee and was especially applicable to a small



POOR LITTLE EMIGRANT

The weather grew quite cool on the homeward voyage, so Meshie was equipped with a sweater which Mr. Raven fashioned from some heavy woolen stockings



SWINGING FROM A POLE

Chimpanzees have long hands and fingers which afford a much surer grip on a branch than the shorter and proportionately weaker hands and fingers of man

one that fluffed up its hair so that it looked big, though in reality it was very small. The name Meshie seemed a good one and has been hers ever since.

Sometimes I went off on trips of several days, at which time Meshie was left in the charge of one or another woman of the village who had no children of her own to care for. She would take her to her garden early in the morning, carrying her like a child, and Meshie played around while the woman worked. About eleven o'clock the woman returned from her clearing, carrying the day's supply of vegetables and firewood as well as Meshie. Next she would go to a spring or a stream to bathe and to get water, and there Meshie was washed, or at least sprinkled with water.

Just as good care was given to Meshie by these women as if she had been their own child, but her human playmates were all infested with parasites—lice, itch mites, skin diseases, and an assortment of internal ones—and it was inevitable that



ORAL HYGIENE

Meshie willingly opens her mouth and holds it open while her teeth are being brushed and her mouth inspected

Meshie with an almost human constitution should be preyed upon by some of these.

First she developed a scabby skin that apparently caused considerable itching, for she scratched incessantly, and when she was not scratching herself the natives were scratching her, for that is their way of making friends with any animal. Later on, when she was entirely over her skin disorders, she retained the habit of scratching, and even now, though her skin is perfectly clean, healthy, and has been free from parasites ever since she left Africa, she scratches herself from habit, especially when she is nervous, as when she is impatiently waiting for her dinner.

When the time arrived for me to make preparations for my departure from Africa, I had to think of accustoming my little pet to be either tied or caged, and I thought being tethered would be preferable; so one day I tied her to a post supporting an extension at the side of a native hut. The roof was six feet high and the whole structure was fastened together with rattans and covered with palm leaf thatch. Meshie screamed, cried, rolled on the ground, kicked, and

bit her hands and feet. She was simply having a tantrum. Then she jumped up and down out of sheer desperation, scratched the ground with her fingers and stuck out her lips, crying peevishly. She would get hold of the next post or any object within reach and would pull with all her might, only desisting from pain caused by the rope pulling on her neck.



A DOLL INTERESTS HER

She carries it about, undresses it, and, if it is stuffed with sawdust, she will attempt to tear it open to see what is inside

I left her tied like this and, upon returning a couple of hours later, I hardly recognized the place. I called to my boy, "Where is Meshie?"

He replied, "Mon a waa live for kitchen." (The child of a chimpanzee is in the cook house.)

Then he said, "See what she has done."

She had pulled the palm leaves off the roof and had broken the palm stems to which they were tied. These with their fastenings of rattan were scattered about as if a cyclone had hit the place. Eventually, however, she became accustomed to being fastened.

During the last days of my stay in the Cameroun and for ten days after embarking, I was unable to care for Meshie myself, but at Kribi, before sailing, a supply

of tinned milk had been secured for her, as well as some fruit. I persuaded the ship's steward to feed her, and Captain Philips kindly put at her disposal a cage in which he had kept a chimpanzee on a previous voyage. During this time Meshie, too, became ill, and when I was able to get about I saw that she was very sick. I dosed her and in a short time she began to pick up, but it was many days before she would take any food but milk and orange juice in small quantities. She had always been fond of bananas but now she refused them as well as all other solid food. Eventually she began to eat again, stewed fruits such as peaches, pears, and apricots being the first solid food she ate.

From where I kept her on the upper deck of the steamer, she could see a large

This behavior continued until near the end of the six weeks' voyage, when she was again quite well and would eat ripe bananas but not the inner skin unless she were especially hungry.

Sometimes she was tethered on the hatch amidships and there she had a little cup. When, as frequently happened, one of the ship's officers would come on deck with a cup of tea or coffee, Meshie would put out her hand and beg for some or go and get her cup and hold it out. This of course always won her a drink.

During the latter part of the voyage the weather suddenly turned cold. It was necessary to put the six or eight large cages containing several species of West African monkeys and some baboons down in a hold. Meshie was also put down there though she resented it. By this time she had succeeded in breaking the wire of her cage, but she was chained to it so that she was free to go in or out. The cages containing the monkeys were boxes six feet long by approximately half that in width and height and they were piled two deep. It was almost dark down there. The next time I went down two of the cages were upset and monkeys were



AMUSEMENT

Meshie tries to put a piece of orange-peel in a bottle, which she holds with her left hand and both hind feet

locker that had been filled with bananas at one of the ports, as food for eighty-five monkeys destined for Yale University. Everytime Meshie got loose while recuperating, although she refused the bananas I offered her, she made for the locker, chose a green banana, peeled it and ate the puckery inner portion of the skin but would not eat the fruit itself.



Mmmm—ICE CREAM

Meshie is very fond of ice cream and eats it with a spoon as daintily as do human children of her age



A ROASTED APPLE

Of her own volition she grasped the poker and with it pulled the apple from the fire

everywhere. Meshie, though barely able to reach the cages, had pulled two of them down and then removed the cord and stick from the staple, opened the trap door, and allowed the monkeys to escape. Fortunately only a few had escaped to the deck and the rest were running around in the hold.

With a flashlight I looked in Meshie's cage, for she had not come out as usual when I called her. She sat crouched in the corner and looked up pitifully. Then I saw she was holding a baby monkey in her lap. I scolded her and called her to come out. She came, walking on her hind feet and holding the baby against her body. I was surprised to see what appeared to be mother instinct so far developed in a baby chimpanzee. She carried this half-grown baby monkey a whole day before it was put back with the others.

Long before I sailed from Africa, while still in the interior of the Cameroun, Meshie sat beside me during meals at my little table in camp, and when I had nearly finished my soup, I would hand her the spoon but would not let her put her mouth down to the plate. She learned immediately that she was to bring the

food to her mouth with the spoon. I would leave a little food for her in my plate after each course during the meal.

When hungry, she would eat most of the kinds of food that I had, occasionally some meat, though she was not very fond of this. We had soup made of peanuts or calladium nearly every day. Then there were such vegetables as green beans, sweet potatoes, plantains, green papayas, cassava and cassava leaves, and occasionally others. Of fruits she preferred mangoes to all others available there. The only fruit offered her in the Cameroun which she seemed to dislike was the avocado pear, lately introduced and now widely distributed there.

As the weather grew cool on the homeward voyage, I made a sweater for Meshie from some heavy woolen stockings. The first time I put it on her she tore it off, although, afterward, when the nights were very cold, she apparently made no attempt to remove it.

It was the middle of February, 1931, when we arrived at Boston. Meshie was very much excited and interested in all the things she saw and heard. I think



CONCENTRATION

Fitting a slender, flat key into a padlock. 'Note that she uses her thumbs and the fingers of both hands in holding it

the outstanding incident of Meshie's arrival in the United States was her alarm on seeing a team of horses while she was being driven across Boston in a taxicab. She heard the clatter of horses' hoofs on the cobble stones and looked out of the back window. Upon seeing a team of great, dappled gray, draft horses blowing steam through their nostrils, she uttered a little scream and grabbed me around the neck, but her curiosity was stronger than her fear, so a moment later she was again looking out of the window. As it happened, the team followed us on the ferry and drew up just behind our cab. When the horses came so close, Meshie actually got down on the floor once in an effort to get as far away as possible, but a moment later she was back and looking out of the window. Each time thereafter when she looked out, she made a peculiar low sound which might be translated as a very soft "oh-ooooo." This sound I had never heard her make before, but during the past summer I heard her make that same sound again when she saw a snake.

A few weeks after we had reached home, when the weather was warm, I built a



TURNING THE PAGES IN A BOOK

When shown pictures of animals she pokes them with her finger as if to see whether they are real

little house for Meshie on the top of the frame of the children's swing in the back yard, ten feet from the ground. Wild chimpanzees always sleep in trees at night and Meshie seems to feel safer when she is off the ground. I made a sliding door in the house that she could open and close at will. Every night at dusk I carried out her blankets to her and she would lean out the little door and catch them as I threw them up. She would pull each piece into the house, arrange it around her, and then lean out for another piece. After twisting them around her in a kind of nest, she would go to sleep, usually as soon as it was dark. Early in the morning she would open the door of her house and climb out, at first sitting quietly for a few minutes on the crosspiece that supported the house, then doing all her housework for the day by throwing down her blankets one after another to the ground. If it were cool, however, she would wrap a piece of blanket around her shoulders and sit contemplatively on the crosspiece, reminding me of an Indian in his blanket, squatting before his hut in the cool of the early morning.



A NEW EXPERIENCE

It took Meshie less than two minutes to learn how to suck through the straw. Here she is enjoying some grape juice

One morning she was sitting on her

house when we heard her give a sudden scream of terror. When I looked out of the window, she was gazing down at a piece of black cloth which had been torn from the edge of an old coat she had used as a blanket. This piece of cloth had fallen into curves and I believe she thought it was a snake. At a second glance she had apparently realized her mistake, but all her hair was standing up.

Meshie had ridden with me in a motor truck for more than two thousand miles in Africa and, except when the wind blew in her face, causing her to wrinkle it in a most comical manner, she enjoyed it thoroughly. While I drove, she sat on the seat between

me and a black boy. At first she had to be slapped and scolded when she attempted to play with the wheel or other machinery. However, when the car stopped, she would climb up on the steering wheel and, grasping it with both her hands and feet, rock back and forth to the great amusement of the natives.

At home she often screamed when she saw us going out in the automobile, leaving her behind, and when she was allowed to accompany us she would say "uh-uh-uh" repeatedly to show her pleasure.

We hope that Meshie, emigrant from Africa, may continue to grow in health, weight, and knowledge in her new American home.



PLAYING ON THE LAWN



BEDTIME BUT NOT VERY SLEEPY

Next to playing in the water, Meshie enjoys a bedtime romp with the children



Photograph by R. H. Rockwell

Expedition Headquarters on the Gambia

SAILING TO SENEGAMBIA

A Further Account of the Schooner "Blossom" and Her Collecting Expedition for the Cleveland Museum of Natural History

By ROBERT H. ROCKWELL

Taxidermist, Department of Preparation, American Museum

This is the second of a series of three articles by Mr. Rockwell describing the adventures of this expedition. The first appeared in the November-December, 1931, issue of NATURAL HISTORY. It was entitled "Under Sail to the Cape Verdes."—THE EDITORS

MORE than three hundred miles of azure ocean separate the Cape Verde Islands from the African coast. Our stay on the Islands had been prolonged, but having said good-by, we weighed anchor and sailed with no regrets.

Africa still seemed far away. However, the prospect of new adventure gave us a thrill as we headed eastward into the open sea, on our way passing close to the desolate, smoldering peak of Fogo that stands stark and blackened, the straight line that marks its crater cutting the clouds at ten thousand feet.

It was a joyous feeling to be at sea again in the balmy weather of the tropics. After sails were all set on each tack, there was little to do but read and watch the ever-changing moods of the ocean. The

mountains of the Cape Verdes were soon left far astern, and finally we watched them fade and gradually melt away into the golden haze of a setting sun.

Brisk breezes now filled our sails and we rolled on toward Dakar, the most westerly point of the Dark Continent. On the morning of the third day the low-lying coastline came into view and formed a narrow, black strip across the horizon. We were all on deck straining our eyes for a first view of Africa. About four miles offshore we encountered little boats with queer-shaped sails darting here and there across the ocean. They were the native fishing fleet. It was rather rough weather for small craft, but these daring fishermen need nothing more than a hollowed log for a hull and some Gold Medal Flour sacks for a sail. They keep throwing



Photograph by G. F. Simmons

FISHING FROM THE DECK OF THE "BLOSSOM"

Fishing was often good, and while some fished for science, others fished for the pot

water on the muslin to prevent the wind from blowing through it.

Unlike most other ports that we had visited, Dakar presented a thoroughly civilized aspect. French ingenuity has developed a splendid harbor with ample docking facilities for large ships. Dakar is perhaps the finest city between Europe and Cape Town. A well built railroad extends inland and taps the produce of the interior, which consists mainly of peanuts. Mountainous heaps of them were piled high on the docks as we came alongside. We were told that Dakar was the Paris of West Africa and, indeed, we found it quite pretentious in many ways. There is a park with luxurious tropical plants in the center of the city. Smooth macadamized roads lead through and around the town. There are banks and department stores. Antiquated taxicabs dart here and there, manned by dusky drivers who honk their horns even more incessantly than the cabmen of Paris. The Metropole Hotel follows the Parisian custom and diners sip their wine at tables placed on the sidewalk

while watching the colorful parade and listening to the strains of orchestral music.

There was a distinct fascination in observing this strange panorama with its curious intermingling of opposing customs and beliefs. Most of the natives are Mohammedans and belong to the Ouolof and Mandingo tribes. They observed their religious devotions with a reverence that commanded respect.

I recall that one evening as I crossed the park right in the center of Dakar I passed a group of six brawny laborers as they were hurrying home. They were coal heavers who had been coaling a liner in the bay. The smudge of coal had blackened their naturally dark skins to a perfect jet. In the evening light the only contrast of color was the whites of their eyes. Suddenly all six of them fell to their knees almost in front of me. They all faced Mecca in a row and bowed their heads to the dust. It was the hour of prayer and to them for that moment nothing seemed to exist but their supreme faith in the power of Allah.

It required a long time for the French officials to grant us collecting permits. Our leader finally convinced them that we were not pirates, even though some of us may have looked the part. They were exceedingly generous when they understood our mission, and placed no limit on our collecting either in animals or birds, and no fee or license was charged.

We began collecting in the bay, where quite a number of birds were taken. Mr. Allan Moses and Mr. Kenneth Cuyler were the best shots on board and the most successful collectors. Much of my time was taken up in preparing the birds when they were brought to the ship. We hunted in gardens, backyards, and on plantations close to town until irate Frenchmen began to complain in loud language which we could not understand. However, we became aware from their gesticulations that they didn't like it when we shot at birds

in their shade trees, so we were forced to go farther afield.

The reason we had hunted close to town was because the birds were more plentiful there, due no doubt to a good supply of drinking water. New and strange-looking birds were brought in every day. There were pelicans, cormorants, and terns. There were kingfishers the size of one's thumb, hornbills, weaver birds by the hundreds with their apartment-house nests, white-necked crows and lapwings, tree ducks, and an endless variety of others, including the pennant-winged nightjar. One day Allan Moses brought in a Bateleur eagle, endowed by nature with a fierce-looking head but hardly any tail at all.

It was not strange that everyone wanted to shoot, so the birds piled up thick and fast with the result that I was swamped with specimens. At my protest



Photograph by G. F. Simmons

BILL AND HIS ASSISTANT

The members of the "Blossom's" crew were interested in the reaction of their American-born Negro cook to his African cousins. His contempt was obvious. He immediately classed them as "wild men," and announced "Them niggers sure am black"

Photograph by R. H. Rockwell

MARKET AT DAKAR

At the entrance to a modern French market place the primitive native vendor sells his wares, which consist of loaves of bread stacked on the sidewalk



descend stealthily from the crow's nest or the masthead and cunningly sample his appetizing pies. More than once they dodged the thrust of his sharp carving knife as they dashed into the rigging.

an order was given by Commander Simmons that everyone who went gunning had to do, or help do, his own taxidermy. After this the shooting was carried on with more discrimination.

As mascots on board we had four very lively seafaring monkeys. They were not much good as deep-water sailors, but they did know the ropes. They accepted the vessel as their home even when we were in port. The masts were their trees, the rigging satisfied their climbing instincts, and the swaying ropes and cables were trailing vines over which they traveled with as much assurance as in their native forest.

The antics of these amusing creatures created a kind of circus side show that we all enjoyed, except Bill, our cook. To him they were demons incarnate. And Bill had cause for complaint. While his back was turned or when he was working over a hot galley stove, they would

At last the mischievous capers of our pets got beyond all bounds. They had the freedom of the ship and went ashore when they liked over the heavy hawser that bound the vessel to the wharf. We had names for them all. There were Jennie, Georgie, Silly, and Dopey, but of all the group Georgie was the most progressive and enterprising. It was he who discovered our cartridges in the hold of the ship. He made a thorough investigation and played havoc with a lot of ammunition by removing all the shot from the shells. It was fortunate that we discovered the act in time. For this a punishment was devised but only by the

THE WATER FRONT AT DAKAR

Perhaps the most important exports of this African city is peanuts. Here bags of them are shown awaiting shipment

Photograph by R. H. Rockwell



Photograph by R. H. Rockwell

MARKET AT RUFISQUE

Market places the world over bear certain superficial likenesses, but here the costumes and the shining black faces of the natives give it a character of its own

combined efforts of six people in pursuit and sailors climbing each of our three masts were we able to capture the culprit.

We had decided to give him a ducking and, strange to relate, when first striking the water with a rope around his middle, he swam directly downward. We could see him plainly in the clear water for fully twenty feet below the surface as he made for the bottom until we feared he might drown. So we hoisted him back on deck with due baptismal ceremonies.

Six of our shipmates left us at Dakar, and we were sorry to see the boys go. Werner Donberger agreed to stay and superintend carpentry work on the vessel. A sort of friendly attraction had developed among us, prompted no doubt by fighting the elements as a unit on our long voyage across the Atlantic. There had been rumors of a breach for several weeks,



however, so we expected it. Practically all expeditions encounter some discord and discontent, and ours was no exception in this respect. The difficulty mainly concerned the crew. In their complaints they alleged bad drinking water and inadequate quarters.

The water had been bad, stored as some of it was in whale oil casks from which it had absorbed a peculiar odor. It certainly did not taste as water should, but it was no worse than the water of the Tres Pozos sink holes that Dr. Robert Cushman Murphy and I had had to drink for weeks in the desert of Lower California. So, for my part, I was already somewhat initiated and we all had lived through it without any ill effects. It was remedied, of course, and we soon forgot how bad it tasted. The quarters of which the men complained were small, but perhaps no smaller than they would



AT A RAILROAD STATION

A strange looking rabble always milled about the station at the arrival and departure of every train

Photograph by R. H. Rockwell

be on any sailing ship the size of the "Blossom." However, matters had come to a focal point. To all of us they looked bigger then than they do now. A meeting was held between Commander Simmons, the men, and the American Consul, who very diplomatically smoothed over the troubled waters. Details of the case are perhaps irrelevant here, but the scientific staff remained intact, together with da Lomba and Bill, the cook. The men received their pay and returned home by steamship. A black crew was then recruited and carried on for the rest of the trip, commanded by Captain Titti Vanzetti, formerly of the Italian Navy. It was fortunate for the expedition and for all concerned that Commander Simmons obtained the services of Captain Vanzetti. We all liked him from the start and he proved to be not only a good captain but a splendid person with whom to get along. His interest in scientific work and his command of five languages were of inestimable value to the expedition.

After a prolonged period of intensive collecting on the coast and around Dakar the birds became noticeably shy. Each day our bag dwindled to less and less, but

we kept at it regularly, interrupted only by a touch of malarial fever now and then, from which we soon recovered.

Our experience taught us that the best time to find birds was during the hours of early morning. We were up when the voice of the muezzin called all the faithful to prayer from his high perch on the minaret. Then we had a long walk through town to the outlying districts where the sparse thorn bush mingled with shifting sand blown from the margin of the great Sahara. The country was more or less open, although a kind of cactus (no doubt introduced) blossomed among the sand dunes. The heat was almost unbearable. At midday a withering glare of heat waves bounded up to our faces from the bleaching sands. If birds were not found we sometimes hunted until noon, but this was folly. As the hour approached twelve the sun flared up like a furnace. It was then we headed homeward, too tired even to talk. Rumors that came to us of a better hunting field consequently attracted our fancy. It was far inland on the banks of the Gambia. It was said that game was plentiful there. After a careful investigation Commander

Simmons put me in charge of this trip, which was carried out successfully with the able assistance of my shipmate Kenneth W. Cuyler.

We needed help to get to our objective, and right at the start we were fortunate in securing the services of a young negro named Sorie Bah, who spoke a little English, some French, and many African dialects. *Bon jour* and *au revoir* were about our limit in French. This was rather awkward at times, but



Photograph by R. H. Rockwell

THE GOVERNOR'S PALACE

It was here that Mr. Rockwell and his companion were entertained by the governor who aided them on their trip into the interior

once in a while Cuyler's Spanish came to the rescue in situations that seemed hopelessly involved.

On the evening of the seventeenth of June, we loaded our equipment on the African Occidental Express bound for Tambacounda. This nocturnal journey deprived us of observing a new kind of landscape, but such parts of the country as we saw were flat, sandy, and sparsely overgrown with stunted thorn bush.

The scenery and fauna were in striking contrast to the fertile lands and abundant game of the East African highlands. The country looked parched and sterile. We saw no game on the way and even birds were scarce and scattered.

At Tambacounda we were greeted in a most cordial manner. Word had been telegraphed ahead of our entry into the country, and we were met by the Commandant of the Circle, Monsieur Pal. He spoke about as little English as we did French, but his beautiful, fair-haired wife spoke our language with only a slight foreign accent, and she interpreted our aims and transmitted her husband's answers to us with charming diction. Although we were garbed in the roughest kind of hunting clothes this seemed to make no difference to our hospitable hosts. They insisted that we dine with them in their palatial home, and even though our appearance did not measure up to the surroundings, it was, nevertheless, an occasion exceedingly pleasant to remember.

The grounds and garden of the palace were neatly kept. As we entered the gate, a gang of convicts were laboring on the



Photograph by R. H. Rockwell

THE GAMBIA RIVER

This stream flows into the Atlantic about eighty-five miles south of the city of Dakar

walks. They had heavy iron balls shackled to their ankles, while a guard stood over them with poised rifle. On the path leading to the entrance we encountered a tame duiker and a white fox terrier playfully chasing each other among the flowers.

Monsieur Pal greeted us cordially and escorted us through the house. He made us comfortable at once. One of his convicts, a huge, fierce-looking negro, worked an immense fan while we enjoyed a most excellent repast. There were many courses, notable among which were wild guinea hen, papaya, and palm tree salad, washed down by three kinds of wine.

As the evening wore on many interesting topics were discussed—the game, the country, and the natives. From years of experience, Monsieur Pal knew his Africa. Although somewhat frail and small in stature, he exerted a powerful influence over his domain, acting as governor, magistrate, and monarch of all he surveyed. He arranged our trip with a keenness of interest that was amazing. He obtained for us a competent local guide. He insisted that payment for native labor was not to exceed a certain stipu-

lated sum. He spoke entertainingly of the wild tribes we might expect to meet inland, in particular of the primitive Basserie. These are a race of stalwart warriors and hunters who wear absolutely no clothes. He informed us that none of these men have yet submitted to military service in the French Army.

It was hard to break the spell of this tropical night. We retired to the cool upper veranda that overlooked the garden and the dark African bush that lay beyond. Toward midnight the drums that had sounded their mysterious message all evening increased in volume to a quick ominous drone that seemed to fill the air, accompanied by a unison of hand-clapping and a host of high-pitched voices that kept perfect time. These sounds seemed to convey something more than the gay frivolity of a dance. To me they expressed a strong, latent, fanatical power just marking time until some Mahdi prophet would lead them to slaughter and victory. Monsieur Pal declared that these demonstrations were dangerous if carried too far. He allowed such activities only on special occasions. The echoes from these weird rites still rang in our ears as we bade farewell to our hosts and retired for the night.

Within three days we were on our way again, bound for Dialacoto, where we expected to begin our hunt. A dilapidated open Ford truck carried our outfit and

supplies, with our native helpers stretched "spread-eagle" on the peak of the load.

Besides Cuyler and myself there was Bena Corbarie, a light-brown intelligent native who understood tracking and acted as our guide to the game country.

He proved to be an excellent man, with an enormous appetite for meat. When game was killed he had an uncanny way of selecting the best cuts for himself. Most natives with whom I have hunted usually grabbed the tripe, eating it raw and warm as the *pièce de résistance*, but this fellow was a gourmet. He favored nothing less than the *filet mignon* broiled over glowing charcoal embers.

Next among our men was Sorie Bah,

interpreter, cook, waiter, and general handy man, equal to three ordinary servants. While working, he always looked as though he were prepared for bed, garbed as he was in a spotlessly clean white nightgown that hung down to his heels.

Our third man was a dusky motor mechanic who drove us to our destination. When we hired the machine he came along as part of the bargain. Perhaps it was fortunate that we never found out how much he knew about a car, but the roads were good and nothing happened to impede our progress. However, like our swarthy guide, his gastronomic feats were amazing. In fact, all our men seemed to spend most of their idle hours



Photograph by R. H. Rockwell

A BRIDGE NEAR MR. ROCKWELL'S CAMP
Crocodiles were visible now and then in this section, and for this reason the river was always approached with caution

grouped around a large cooking pot that was filled with boiled rice. They would dip in their fingers, scoop out a hot handful and then, after rolling it between their palms to the size of a golf ball, deftly pop it into their mouths. There was something humorous about this primitive but direct mode of eating.

The fourth man among our helpers was a government soldier sent along officially to guard our ammunition while we were away from camp. The job must have been boring to him, for nearly every time we returned to camp we found him fast asleep.

It was late in the day when we came to Dialacoto. (The name means "the houses near the big trees.") There were huge trees around and in the center of this village of conical, grass-thatched huts. Extensive areas of cleared land supported large herds of fat, humped cattle. We arrived amid an uproar of shouting herd boys and the clang of cow bells as the animals were being rustled into their corral.

The chief kept out of sight. We had been advised that he was a big man in more ways than just size. He had studied at a French College, wore the Legion of Honor Medal and several minor decorations. We had been told not to offer him *baksheesh* as this would offend his dignity. A sub-chief greeted us and assigned us to the temporary guest house, asking us before he

left if we needed any chickens or eggs to eat. We declined the chickens but accepted the eggs. On boiling them we observed that three out of the four had been too long neglected to be of any use. Just before dusk three of the chief's younger wives brought us gourds filled with drinking water. They eyed us shyly and then hurried away tittering and laughing among themselves as they went.

In the morning we paid our respects to the chief, Amadou N. Deaye. I am able to remember his name because he gave me his printed card. He had an office in a spacious house the walls of which were seven feet high and made of adobe plastered on woven sticks. The gable-shaped roof was neatly thatched. As we entered,

it was plain to us that this was no ordinary hut. There was a board floor and decorations of native basketry and drums hung on the wall. Above the door hung the mask and horns of the largest eland I had ever seen. With the aid of our interpreter, the secretary of the chief introduced us. The big chief shook our hands, greeted us in a friendly manner, and with the grave expression of a man who had more important work to attend to, sat down at



Photograph by R. H. Rockwell

A TERMITE NEST

This nest stood about fifteen feet high. Termites are often called "white ants" but they are not true ants, belonging instead to the order Isoptera

a flat-topped desk and asked to be excused until he had finished reading his morning mail. We sat and waited. After he had finished fumbling some letters for quite a while he looked up and inquired, "Gentlemen, what can I do for you?"



Photograph by R. H. Rockwell

ON THE WAY TO DIALAKOTO

It was near here that the expedition's motor truck was mired, forcing the party to turn back

We informed him of our plans and he advised us of a better game country farther inland, but as the rainy season was on and the roads impassable, we decided to hunt from a camp on the Gambia River close to Dialacoto.

Before taking our leave we had him pose for us beside the ruling wife of the household. He had other, younger wives, each living in separate compartments of an interior court, but evidently they were bashful, or their privileges were limited, for they seemed to prefer to remain in the background.

Although Amadou N. Deaye had received a European education and consequently had had intimate contact with civilization, he dressed like a Moslem, lived simply, and faced Mecca in pious prayer five times a day. His subjects respected him and he respected the native folk ways and their strange superstitions. An incident that brought this to our attention happened one day when we saw a number of storks that walked boldly about the village. No one seemed to molest them. We thought it a good opportunity to add a few of these interesting birds to our collection.

Several of these birds were flying about the village within easy range of our shotguns, but we mentioned our plan to the Chief before we began to shoot, and it was lucky that we did. He looked at us seriously and said, "Please do not harm any of these birds. They are held in the highest esteem by all the natives of the village. If any of these birds were shot, all the children in the town would die."

Needless to say we retired and *Sphenorhynchus*

abdimii was not included in our collection. I meant to inquire further into this strange myth of children and storks but never had the time.

Birds were not so plentiful, but all that we saw seemed strange and highly interesting. We were fortunate indeed in observing that queer trait of coöperation exhibited by the honey guide. The one that we observed was about the size of a small woodpecker and of a color that appeared somewhat similar, being dark above and almost white on the breast and underside of the body.

As we walked along the trail one day, we were attracted by the chatter of one of these birds as it hopped nervously about in a bush beside the path. We advanced toward it inquisitively, and at once it flew, alighting on a low tree not more than twenty yards away, where it continued its impatient chatter, but all the time kept facing us. This flying back and forth was repeated many times. It knew just where it wanted to take us, so we followed its shifty flight. Then, to test its persistence, we walked away at right angles to the direction it was bent on leading us, but this move seemed to make it only more

anxious. It circled around and alighted right before us again and resumed its chatter. We now began to follow its coaxing actions and as we hurried along it moved faster, too. With only a few more stops it finally brought us right to a hollow bee-tree, while it perched on a branch near the tree, seeming to await developments. There was an active hive here and we could see the bees entering a small hole at the base of the trunk. At once our black boys began work on the tree, but they obtained very little honey and although they worked fast they were hardly compensated for the stings which they endured. Before leaving, they shared a portion of the dripping comb with the feathered friend that had guided us unerringly to the spoils.

On July fourth we were able to celebrate over a waterbuck that supplied fresh meat for camp and another valuable skin to our growing list of specimens. On the day following, the Mandingo tribe staged a dance with plenty of action, so we brought out our motion-picture camera to record it.

The dancers were preceded by a swaying figure clad completely in a grass suit that reminded one of Fred Stone as the scarecrow in the "Wizard of Oz." This animated haystack was led by two men. As he entered the enclosure he uttered wild yells that were evidently intended to create laughter. After this formality was over the drums began to rattle and the dancers filed in to the rhythm of a grand march. Then, with a gradually quickened pace, they circled around in a long serpentine line, waving their arms as they swayed

and sang to the music. Suddenly the dancers retired to one side and made way for an elderly matron, no doubt a belle of dances long forgotten. She was haggard and old but lithe as a kitten. Quickly throwing her shawl to one side she launched into the dance with the assurance of one who knew all the steps—strange steps that had grown grotesque with advancing years. It was funny for a while, but it lasted too long, so we stopped her and distributed some little presents for the show and then returned to our camp on the Gambia.

Instead of using tents we occupied two abandoned huts that were still in a good state of preservation. Our hunting had been fairly successful, considering that the game was scarce and the rains interfered with our progress. However, we collected roan antelope, cob, duiker, warthog, and hartebeest. Among the birds the most outstanding were a beautiful metallic-colored ibis, a large kingfisher, and the ground hornbill.

Among the mammals the most outstanding was a rare Senegambian lion.

On the day of our adventure with the lion the rainy season seemed to have



Photograph by R. H. Rockwell

MIRED

"Hard" roads are not to be found in this region, and it was impossible to drive the truck beyond this point



Photograph by N. Y. Zoological Park

A BATELEUR EAGLE

One of these birds was collected by Allan Moses, of the expedition's party. The species is noted for its exceedingly short tail and the elongated feathers encircling the head

reached its maximum. There had been a continuous succession of heavy showers until around three o'clock, then there was a dubious lull that led us to deliberate whether we should venture forth or not. At four we started in a final effort to wring something out of a day of enforced idleness. Each of us went his separate way, followed by his brown-skinned helper. Although the sun remained behind the clouds the air was clear and cool. It felt good to be abroad again, if only for two short hours before the curtain of night cast its long shadows over the African veldt.

I had followed various tracks over a network of trails that meandered beneath towering palms. The grandeur of the trees was enhanced by the double images reflected in numerous clean pools of rain

water. I was consequently offered a series of delightful vistas but no game. Then, changing my course, I emerged into a parklike country where little stunted trees, spaced at regular intervals, reminded me of some old abandoned orchard in New England. At this point the trail that Cuyler and his man had been following happened to cross ours, so we met and decided that it was useless to hunt any longer, since daylight had nearly gone. A little farther on we came to the motor road and as we agreed that some animal might seek the course of this open lane in the forest, we stood still, watched, and listened.

Presently a loud roar broke the stillness that preceded dusk. Then a long series of guttural grunts proclaimed the presence of the king of beasts. We looked at one another in amazement. For some time an ominous quiet prevailed, and for the moment all creatures of the jungle seemed

to be hushed. The suddenness of this unexpected challenge put us all on edge. While we waited, the lion roared several times. The brush before us was too dense to see through, so we were forced to depend upon our hearing to warn us of his approach. It was evident that he was coming closer, as each time he roared we could tell by the sound that he was nearer. It was an anxious moment, for neither Cuyler nor I had ever hunted lions before. To me it was a strange sensation—a sensation that created a sort of numbness in my knees that required some will power to overcome. Perhaps it was as much to steady my nerves as to steady my aim that I backed up against a stout tree and assured myself that this was the very thing that I had come to Africa to seek and it was necessary to meet the ex-

Photograph by Kenneth W. Cuyler

MEASURING THE LION'S HEAD

This specimen was shot by Mr. Rockwell at a distance of 272 yards. The lion of West Africa is a rarer animal than his East African cousin



perience under whatever conditions might develop.

Had we seen the animal approaching, we would have been better prepared to cope with the situation, but being aware that he was coming toward us and not knowing just where he would burst out of the bush kept our nerves at the highest tension. Presently the roaring ceased. We had waited perhaps ten minutes when my companion looked up the road and spotted the lion a long way off. He was

walking leisurely away from us down the road. Cuyler suggested that I take the shot. There was no time to dicker, so I raised the sights to three hundred yards, and rested the gun on Cuyler's shoulder as he crouched on his hands and knees in the middle of the road.

While this was going on the lion turned around and gazed directly at us. I pressed the trigger, but the shot disturbed him not in the least. I shot a second time, aiming as carefully as I could in the dusk, but he still stared and stood immovable, as though cast in bronze. Judging that these shots had gone high, I then held the tip of the front sight just below his chest and fired once more. At that shot he fell and remained on the ground until we ran up beside him. As I drew nearer he growled, but with two more shots in the side he rolled over dead. The first shot might have eventu-



ALLAN MOSES INSPECTS A HUGE TREE

This tree was quite hollow and was the home of a number of domestic pigs belonging to the local natives

Photograph by G. F. Simmons

ally ended him, but had I failed to fire the other two, there is little doubt that he might have regained his feet and finished us. The first bullet had entered the eye cavity and made merely a hair-line fracture of the skull which would probably not have kept him down very long.

He was a fine specimen of his kind and measured eight feet ten and one half inches and weighed 450 pounds, but like nearly all wild lions, his mane was light and scanty. We deferred skinning him until morning in order to obtain photographs and as the night was cool there was little danger of the skin spoiling. However, we were a mile from camp with no means of getting him there. To have left him alone would have meant that the hyenas would have claimed him as their own. So we sent for our blankets, built

some fires around him in the road and stretched out to sleep beside the kill. As I lay there and dozed off in the cool African night the whole thing seemed so much like a dream that, awaking, I reached out and felt his soft, sleek coat, to assure myself that he was real and still there.

In the morning we made careful measurements on an outline drawing and spent most of the day preserving the skin for mounting. By this time the rains had developed into an incessant down-pour which made it difficult to cure our specimens, and, as our supply of salt was nearly exhausted, we broke camp and returned to the coast, confident that it was better to cure the skins thoroughly that we already had than to stay longer and run the risk of losing them.

*Photograph by R. H.
Rockwell*



A YOUNG FISHERMAN OF
FOGO CARRYING A TUNA



Courtesy of the N. Y.
Zoological Society

HIPPOCAMPUS THE ELUSIVE

Ancient and Present-day Knowledge Concerning the Sea Horse

By ROBERT R. COLES

OF all marine creatures large or small it is doubtful if any other attracts more attention than the elusive little sea horse. It is true that man-eating sharks, colorful flying fishes, and queer denizens of the deep sea have their admirers, but when it comes to a matter of genuine popularity *Hippocampus* undoubtedly heads the list.

Despite its popular appeal it is amazing to note the comparatively meager literature of recent date concerning its interesting life. There are two reasons which may account for this lack of information. Sea horses, swimming from place to place as they do, are hardly accessible for observation in their natural habitat. *Hippocampus hudsonius*, the species commonly observed in Long Island Sound, may be very numerous one year and rarely seen again for a number of seasons. Such habits make the study of the sea horse in its natural environment almost impossible. A second reason for this evident lack of knowledge is the difficulty experienced by naturalists in keeping *Hippocampus* alive in captivity. So sensi-

tive are these fish to changes in environment that unless extraordinary precautions are taken they do not live long in an aquarium.

Probably the most complete account of the habits of the sea horse is that by the late Dr. Theodore Gill, published in the Proceedings of the United States National Museum in the year 1905.

The earliest figures of *Hippocampus* appeared in a work by Pietro Matthioli in 1544 in his commentaries on "Materia Medica" of Dioscorides, according to Dr. Charles R. Eastman, who wrote on the "Olden Time Knowledge of Hippocampus," in the annual report of the Smithsonian Institute for 1915.

The accounts of *Hippocampus* included in the writings of the early naturalists are in themselves evidence of the great scarcity of actual knowledge concerning that creature.

Beginning with Oliver Goldsmith's *Animated Nature*, edition of 1822, this lack of accurate information becomes more evident with each preceding account.



Courtesy of the N. Y. Zoological Society

A CONVENIENT ANCHORAGE

Sea horses clinging with their prehensile tails to the stems of water plants while they suck in bits of food that drift past them

In describing *Hippocampus*, Goldsmith writes:

It is about as thick as a man's thumb, and the body is said, while alive, to have hair on the fore part, which falls off when it is dead.

In his illustration of the sea horse he shows the dorsal fin modified so that it resembles a horse's mane more closely than it does anything else.

As was so often the case with other topics, these early investigators did not allow ignorance concerning *Hippocampus* to stand in their way when it came to writing their learned narratives. Lack of definite information apparently added zest to their endeavors and they wrote at length upon the "poisonous qualities and

medicinal virtues" of the sea horse.

Osburn, in "The Sea Horse in Ancient History," says:

Thus Rondelet (1554) devotes the major portion of four quarto pages (in Latin of course) to a discussion of these matters. He gravely quotes from the Greek writer Dioscorides (First and Second Centuries A.D.) and from the Roman Aelianus (Third Century A.D.) and others, the interesting information that the ashes of the sea horse, administered in wine, produces spasmodic coughing, hot flushes in the head, discharges from the nostrils of a fishy odor, swelling of the abdomen, and eventually death. If perchance any should recover, such persons have ever afterward a strong desire for proximity of the water and for continual bathing.

Used as a medicine, however, ashes of the sea horse mixed with oil of marjoram or liquid pitch and rubbed on cured baldness of the form known as alopecia, while mixed with water it is

a cure for canker and leprosy. Administered internally it counteracts the poison (sic) of the sea hare, and is a sovereign remedy for the bite of the mad dog.

One problem which vexed the writers of the Sixteenth Century was the classification of this queer little beast. Various systems were used by different naturalists with more or less accuracy. It is amusing to read that Gesner in his *Historia Animalium*, 1587, arranged all aquatic animals in a single alphabetical list with *Hippocampus* placed between the fish, *Hepatus*, and the mammal Hippopotamus.

Present-day knowledge of *Hippocampus*, while it may lack much of the romantic fascination of the earlier descrip-

tions is, nevertheless, based upon the observations of competent naturalists and may be relied upon as accurate information.

Although there are still some riddles to be solved pertaining to the life histories of certain species, a great many interesting facts are known concerning the habits of the species commonly observed along the Atlantic coast of North America from Cape Cod southward.

Almost everyone is familiar with this unique inhabitant of the seas which derives its popular name by virtue of its horselike head.

The generic name, *Hippocampus*, is derived from the Greek words, *hippos*, meaning horse, and *kampos*, which means wriggling sea monster or caterpillar. *Hippos* refers, of course, to the head, and *kampos* is descriptive of the tail, which is prehensile. With apparent ease the sea horse can grasp the eel-grass or seaweeds and thus anchor itself wherever it desires.

Comparison of *Hippocampus* with other fishes brings to light a number of striking dissimilarities. In the first place, the sea horse has anything but a characteristic fishlike appearance.

The conventional stream-line form is entirely lacking, and, as a result, the sea horse is not a powerful swimmer. Unlike other marine creatures, *Hippocampus* assumes an upright position most of the time and proceeds through the

water in a very dignified though somewhat comical manner. Locomotion is accomplished by the use of the dorsal fin and the pectoral fins, which are located on opposite sides of the head and appear at first glance to be huge ears. Although this little fish is most often seen in an upright position, it is capable of assuming almost any other position upon occasion.

One cannot watch *Hippocampus* long without noting a marked peculiarity of the eyes. It becomes evident that the little sea horse can move each eye independently of the other and thus may look in opposite directions at the same time. While this accomplishment is in itself interesting, it is not unique in the



Courtesy of the N. Y. Zoological Society

COVERED WITH LEATHER-LIKE ARMOR

The hard outer skin acts as a protection against the onslaught of small predacious fishes. An adult hippocampid averages about 3½ ins. long



Courtesy of the N. Y. Zoological Society

CAPTIVE SEA HORSES

The artificial raising of sea horses presents many difficulties, because of their great sensitiveness to environmental changes such as food, temperature, salinity, and pressure

sea horse, as flounders and other marine fishes may also direct their eyes independently of each other.

Closer observation reveals the singular structure of the mouth and jaws, which are located at the end of the long snout-like extension of the head. In comparison to the size of the head the mouth is unusually small. Here are no powerful, crushing jaws, and no sharp teeth for tearing flesh. *Hippocampus* must necessarily subsist on a diet of small, soft-bodied marine creatures. Naturalists have discovered that its food consists mostly of small crustaceans which abound in countless numbers in the ocean.

Notwithstanding the universal interest shown in *Hippocampus* since the days of the Greek philosophers, it was not until comparatively recent years that any definite knowledge was gleaned concerning the reproduction of these bizarre knights of the sea. In view of the many odd dissimilarities that have already been noted

between these creatures and other marine dwellers, one is not surprised to encounter interesting differences in this important function of perpetuating the species.

As usual among fishes the males are somewhat smaller than the females. Comparing the two, it is noted that the male possesses a sac or pouch which is absent on the female. This is situated on the fore part of the body in the region where the tail begins and is called the brood pouch.

During the season of reproduction the females deposit their eggs in this brood pouch. This transference of the eggs from the female to the brood pouch of the male has been observed by few naturalists. Indeed, the only full description of the process was given by Dr. Filippo Fanzago of Naples, in the year 1874.

Several approaches between the male and the female are required for this transference. Each time the female deposits a small number of eggs in the pouch. The exact number is not known although it is



Courtesy of the N. Y. Zoological Society

ON THE ALERT FOR A MEAL

At the end of the long snout is a little trapdoor-like mouth through which the sea horse sucks its food

probable that often only a single egg is left at each visit. Many females may visit the same male until the pouch becomes greatly distended with its potential burden. It is assumed that fertilization occurs during these acts of transference.

After a period of incubation the young hatch within the brood pouch of the parent and are eventually ejected from the opening through which the eggs had entered. Except that the newly-born hippocampids are much smaller, they resemble the adult in general form. Immediately upon emergence into the world these miniature steeds of the sea learn the value of their monkey-like tails with which they cling to any convenient anchorage.

After watching *Hippocampus* for some time one begins to wonder how these slowly-moving creatures escape the attacks of the many larger and ferocious fishes that roam the seas. As it is impossible for them to defend themselves in combat, they must resort to other means



Courtesy of the N. Y. Zoological Society

CURVES

The graceful curves of the sea horse have inspired artists since early times to make use of them as motifs in decorative design. Its varying poses are always fascinating

for protection. Probably the most effective is their protective coloring, which renders them inconspicuous in their natural surroundings of eelgrass and seaweed. Those familiar with the little brown sea horse of the Atlantic coast are surprised to learn that there are species of a bright red, pink, or yellow color in the Mediterranean; each, of course, in keeping with the vegetation common in the vicinity where the sea horse is ordinarily found. Even within a species there may be a marked variation in shade, as anyone may note upon watching the specimens in a public aquarium.

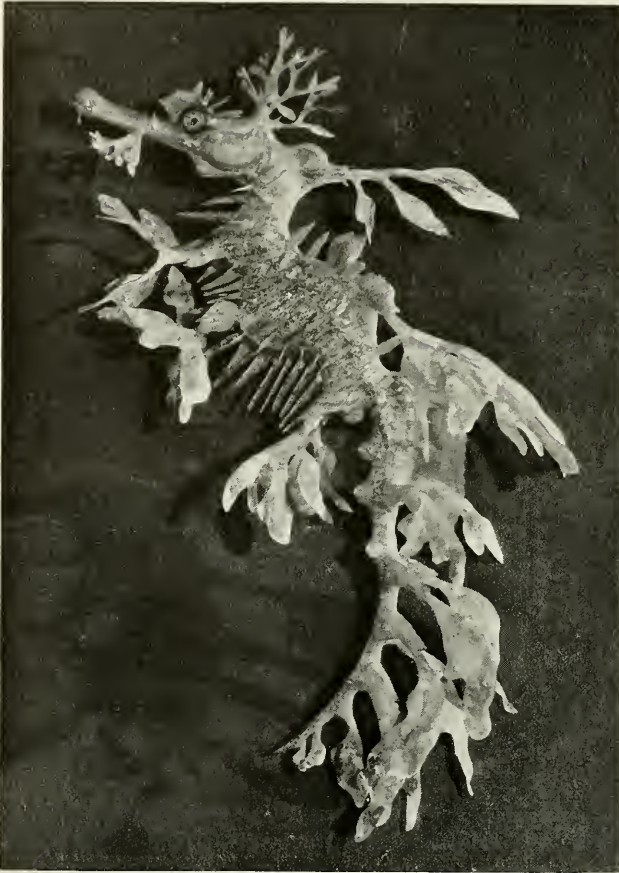
In some species common to southern seas extreme forms have been observed. Probably the most exaggerated of these are the sea dragons (*Phyllopteryx eques* and *P. foliatus*) of Australia. In these species, which often reach a length of twelve inches, there are long, leaflike appendages on the body and tail which closely simulate the seaweeds among



American Museum Photograph

A MALE SEA HORSE

This photograph clearly shows an enlarged brood pouch in which the eggs are incubated, and from which the young eventually escape



American Museum Photograph

AN AUSTRALIAN SEA DRAGON

Showing the grotesque form of *Phyllopteryx eques* which renders it inconspicuous among the seaweeds where it hides for protection

which they are usually found. So nearly do these strange fishes resemble their surroundings that they easily escape the attention of their enemies. The intimate life histories of these unique marine inhabitants remain obscured in mystery to the present day, although their existence was recorded at least a century ago.

As previously mentioned, all attempts to keep hippocampids for any length of time in small salt-water aquariums have to the present time been futile. Sooner or latter the captives succumb in the unnatural environment.

Although every biologist who has attempted to raise *Hippocampus* has his

own notions as to the reasons for his failure in the attempt, it is probable that many factors combine to cut short the natural span of life of these fish. The salinity, pressure, and temperature of the water, as well as the proper food, have much to do with the matter. Living crustaceans suitable for feeding the sea horse are not always available, and as this type of food seems an absolute necessity, any substitute is very likely to promote disastrous results.

In the large public aquariums, where tanks can be supplied with running water and where proper food can be obtained, healthy sea horses may be kept alive for about a year. In a few instances they have been kept alive for from two to three years, although this is very unusual. Specimens for the New York Aquarium are often collected along the Atlantic coast at Atlantic City, and at Sayville on the south shore of Long

Island. Visitors to Long Beach and Jones Beach on Long Island have found sea horses washed ashore in the tangled seaweeds and left stranded by the receding tides.

In public aquariums *Hippocampus* is the star attraction and there is seldom an hour during the day when there is not a group of inquisitive visitors watching the performance of these unique creatures.

Here is displayed all of the pomp and high-spirited dignity of Arabian stallions. As they approach through the water, heads erect and with their feather-like fins vibrating in the radiant sunlight, their very appearance stimulates the

imagination, and one begins to wonder if they may not be responsible for some of the strange tales of sea monsters that originated with the navigators and explorers of the ages preceding science. It would be an easy matter for such accounts to originate and grow with astounding rapidity at each successive telling. Indeed, the accounts of *Hippocampus* become more and more fictitious as one delves into the works of the older writers.

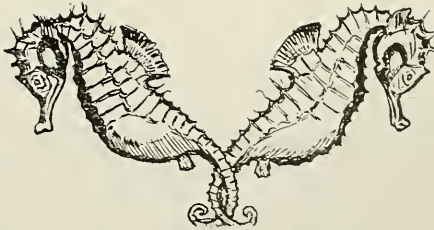
Much that is known regarding the habits of these quaint animals has been learned by observing them in aquariums. It has been noted in such observations that the sea horse is a more or less solitary animal. Unlike many other fishes, hippocampids are seldom found in schools, and when placed together in an aquarium, they show decidedly unsociable traits. Often they will be seen nibbling at each other's tails,—a trait not likely to encourage sociable instincts. It is

true, of course, that many sea horses may be seen grasping the same blade of eelgrass in an aquarium, but this appears to be due to the fact that the eelgrass provides the only suitable anchorage for the sea horses and not to any desire on their part to congregate.

Sometimes they appear in a playful mood, lurking in the cool, green shadows of the depths, and frequently making excursions to the surface. Occasionally a pair of sea horses are seen with their tails interlocked, apparently enjoying a tug of war.

In art the sea horse has long held a prominent place, being used in decorative designs of every description.

Considering the great diversity of attractions of the present day, it is gratifying to find that people still retain a keen interest in *Hippocampus*, the mysterious fish which stirred the imagination of the ancients.



Drawing by Fred Mason

IN PLAYFUL MOOD

SEA HORSES OFTEN CATCH HOLD OF EACH OTHER'S
TAILS AND PULL IN OPPOSITE DIRECTIONS AS
THOUGH ENJOYING A TUG OF WAR



Photograph by D. P. Wilson

Devon Coast, near Wembury, England, an Ideal Collecting Ground for Cowries

COWRIES

The Life History of This Little Marine Animal, Which for the First Time Has Been Induced To Lay Eggs in Captivity

By MARIE V. LEBOUR,

Naturalist at the Plymouth Marine Laboratory, England

COWRIES, sometimes called "black-amoor's teeth" and known by a variety of other names, are so common that a description is unnecessary. Almost everyone has collected them from our sandy and gravelly beaches and made them into necklaces or other ornaments. *Trivia europea*, to give it its full scientific name, is the only British representative of those beautiful cowries, so beloved by collectors, conspicuous in museum collections by virtue of their brilliant colors and polished surfaces. Few have seen them alive, and perhaps not many know that these shells have such a high polish, because in life they are covered by part of the soft animal which lives inside.

A mollusc shell is only part of the animal itself. It is secreted by that animal as a protection for its soft parts and into this shell it can usually withdraw entirely. This is the case with the cowrie; when it is frightened or unhappy, only the shell

can be seen, and it looks exactly like the shell anyone may pick up on the shore. If searched for between tide-marks, however, on many of our coasts the live animal may be found lurking under rocks and stones or creeping on those colonial animals known as compound ascidians. Compound ascidians are sea squirts which live together in masses, often covering stones and sea weeds and varying enormously in their wonderfully brilliant colors.

Pretty as the little cowrie shell is as we usually see it, it is not to be compared for beauty with the living animal. In its natural home the cowrie looks a very different creature from the cowrie shell of the shore. The first thing to be seen is a brightly colored, soft animal, crawling along rather like a snail. It has two thin, pointed feelers, the tentacles, with dark eyes at their bases and, waiving in front, a tubular structure, the siphon, through which it breathes. It crawls along on a

soft, broad foot, and above this is a fold of the body known as the mantle, which rises up on each side of the shell and covers it more or less completely.

The color may be yellow or orange; the body pale or dark; often with bright spots. If crawling on a bright orange ascidian, the body is frequently of the same color with dark spots; if living on lighter colored ascidians, it may be pale yellow with orange and purple spots. On the under surface there are soft processes sticking out, probably sensory.

Between the eyes and below the siphon is the mouth, which is difficult to see. Connected with it is a long trunk which is withdrawn unless the animal is feeding. When feeding, however, this long trunk is very conspicuous and the food can be seen passing along into the animal. The mouth with the trunk withdrawn is shown in the upper right of the drawing at the bottom of page 191, which represents

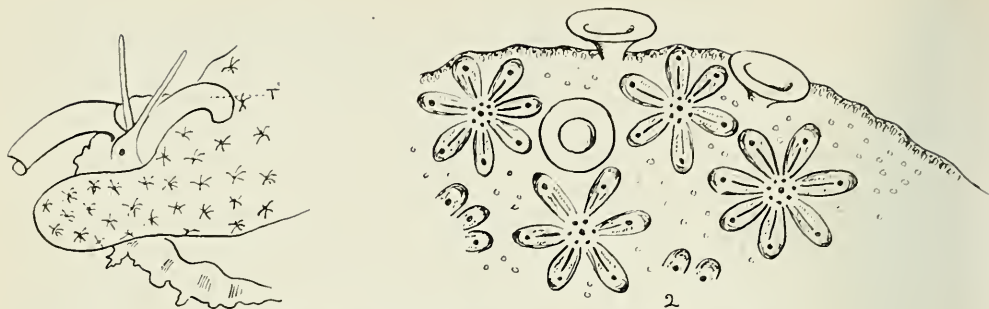
a young animal from the lower surface. Sometimes the cowrie lives in deeper water and can be taken in a dredge. In these cases, also, it is feeding on compound ascidians.

If one touches a live cowrie it immediately withdraws into its shell, and then we can see the shell just as if we had picked it up on the beach. There is no sign of any live animal at all. If we examine the shell, we see that it is oval in shape, rounded above, flat below, narrowing at each end, the slit, aperture, or shell mouth on the under side. There is no coiled part visible in this shell, as there is in an ordinary snail or whelk. This part, known as the spire, is entirely hidden in the adult cowrie. In the young, however, this is not the case. The young shell has a distinctly spiral shell, and it is found that the outer margin of the shell gradually grows up and surrounds it, so that, when the thickened lips which bound



Photograph by D. P. Wilson

THE MARINE LABORATORY AT PLYMOUTH, ENGLAND
Where the life history of the cowrie was worked out by Doctor LeBour



THE COWRIE LAYS ITS EGGS IN A COMPOUND ASCIDIAN

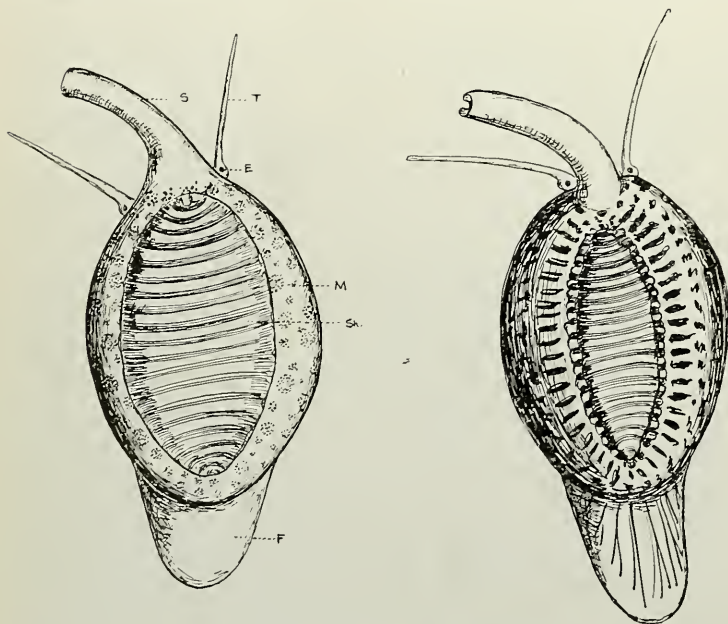
At the left is shown the front part of a cowrie as seen from underneath. It is eating a compound ascidian. A dotted line drawn from the letter T indicates the trunk. The drawing at the right shows several egg capsules laid by a cowrie in a mass of *Botryllus*, a compound ascidian

the shell mouth are complete, they entirely hide the spire.

The life history of the cowrie is very interesting and very little of it was known before this research was made at Plymouth. Before 1926 nothing was known at all as to its eggs and larvæ. In that year Professor Pelseneer discovered on the French coast that the cowrie lays its eggs in compound ascidians. He found

small vase-shaped capsules full of eggs embedded in holes in the ascidians, and these were the eggs of the cowrie which had eaten holes in the ascidian and laid its eggs in it. Professor Pelseneer was not able to persuade the cowrie to lay eggs in captivity, but he hatched out some of the eggs and kept the larvæ for a few days. These larvæ were peculiar in having an accessory shell round the true shell.

Now, most marine molluscs have planktonic larvæ which float in the surface layers of the sea. They are then provided with a winglike structure called the velum or veil, bordered by small hairs, the cilia, by means of which they move and feed. A few cases are known in which this free-swimming larva is provided with an accessory shell which forms a float and which disappears after larval life. This is the case in our cowrie.



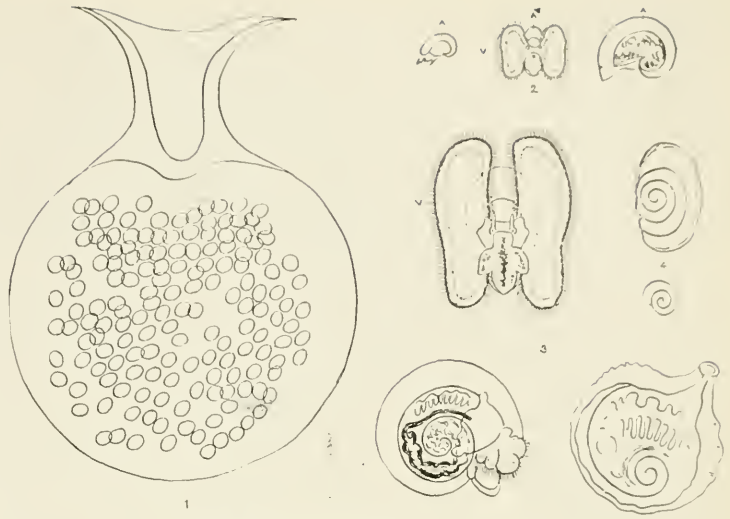
LIVING COWRIES SEEN FROM ABOVE

The letter E indicates the eye; F, the foot; M, the mantle; Sh, the shell; S, the siphon; and T, the tentacle. A fold of the spotted, gayly-colored mantle of the cowrie is shown partly covering the shell. At the right the shell is nearly concealed. Secretions of the mantle give a high polish to the shells of all species of cowries

Attempts were made in the Plymouth Laboratory to induce

cowries to lay their eggs in aquaria and, after keeping several for some months and giving them fresh compound ascidians constantly, some of them in June actually did lay eggs in some of the ascidians. The best for the egg deposition was a common ascidian known as *Botryllus* and one of an orange color was chosen, probably because the cowrie eggs are orange and they would be less conspicuous.

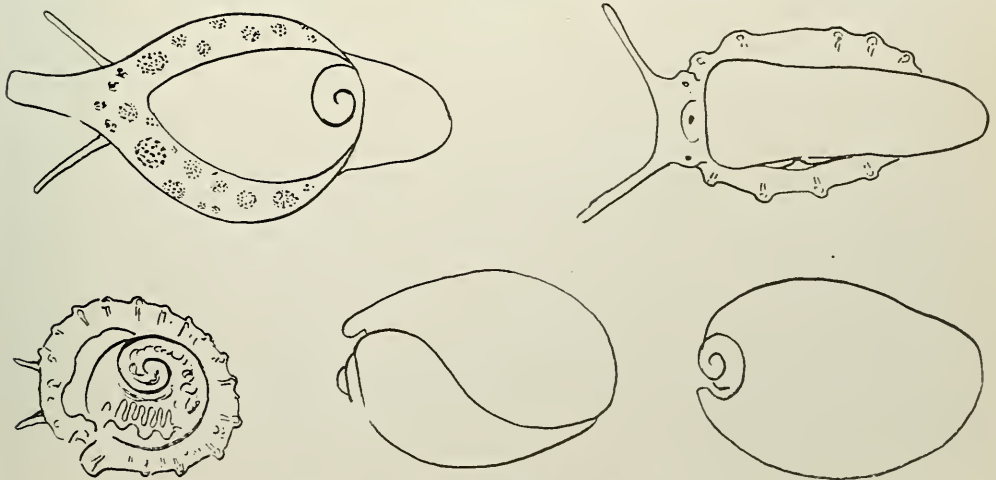
Holes were eaten in the *Botryllus* and egg capsules laid in them. The capsules were vase-shaped, having a main rounded part, completely embedded, containing the eggs, and the mouth projecting from the hole as a wide lip with thickened base covering the eggs. The lips of the capsules are conspicuous as they emerge from the surface of the ascidian.



EGGS AND LARVÆ OF COWRIE

Drawn to scale. The figure at the left shows an egg capsule which was 4.8 mm. long, as laid in a colony of *Botryllus* (as shown on the top of page 190). Number 2 illustrates the early larval stages. The letter A indicates the accessory shell, and the letter V, the velum. Number 3 shows the later larval stages, and Number 4 the operculum (shutter) in old and young larvæ.

It was difficult to keep the ascidian and eggs alive, but by choosing a small piece of ascidian, already attached to some object, some of the eggs were successfully kept alive until hatched and the larvæ reared until they were ten days old. This was enough to show their characters, and similar larvæ could then be picked out of



YOUNG COWRIES AFTER METAMORPHOSIS

The upper figures show the young cowrie from above and underneath. The lower figures show different views of the young cowrie's shell.



LARGE WEST INDIAN COWRIE CLIMBING THE STEM OF A MANGROVE

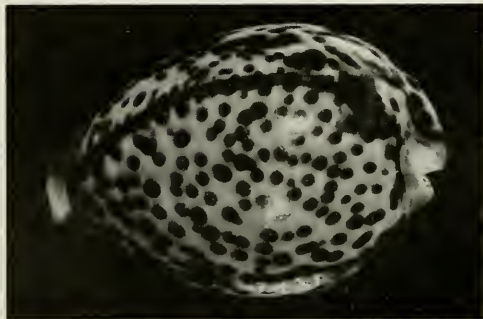
From a group in the Darwin Hall at the American Museum of Natural History. This species is *Cypræa exanthema*

the plankton caught in the tow-nets. It was thus possible to find all stages of larvæ until they were ready to change into young cowries. These later stages could be kept in bowls or aquaria and the metamorphosis from free-swimming stage to crawling stage actually seen.

The newly hatched larva has a conspicuous velum and the accessory and true shells indicated but not completed. In a few days both shells are formed, the accessory shell thin and clear and completely covering the true shell; the velum conspicuous, foot,

mouth, tentacles and eyes all formed.

As the larva grows, the flattened shell becomes spiral, the velum slightly four-lobed and very large. In the later stages the larva looks like a butterfly with wings outspread, the large lobes of the velum coming out from the mouth of the shell—a most beautiful little object. In this free-swimming stage it eats the minute plants of the plankton, chiefly diatoms, which



EAST INDIAN TIGER COWRIE

This beautiful cowrie (*Cypræa tigris*) is highly variable. Its polished, gayly-colored shell shows chestnut-colored dots on a light ground. In certain individuals these dots are united in large blotches, while in others they are so faint that they practically disappear

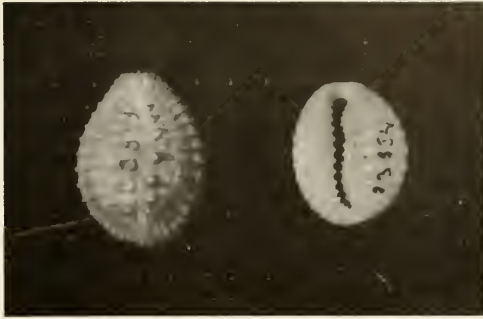
are brought to the mouth by the ciliated groove round the velum.

This planktonic life lasts for some time,

probably a month or more, and then the little animal, only about 1.25 mm. across the shell, is ready to change into the crawling stage. All the time it is free-swimming the cowrie has a little door to its shell, the so-called operculum, similar to the little door in the common periwinkle, by means of which it can shut itself into the shell. When the crawling stage is reached, this door is cast off, the velum disappears, and the mantle which so far has been inside spreads out round the shell, a breathing siphon is formed, the foot

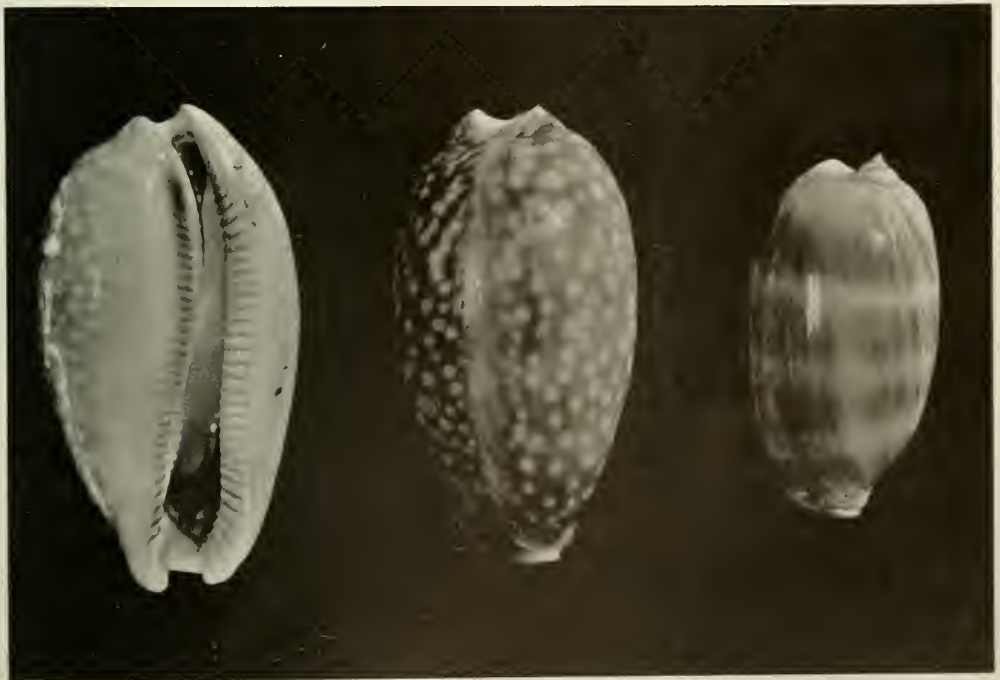
has grown larger and it is now used for crawling.

The accessory shell is now absorbed and only the true shell remains. This shell is spiral, smooth and white with a large aperture. It is gradually covered by the mantle and the cowrie looks like a miniature adult except for the exposed spire. It now changes its mode of feeding and begins to eat compound ascidians in the usual way. As it grows, the shell becomes ridged and the aperture thickened, the spire gradually being cov-



A SMALL WEST INDIAN COWRIE

Shown from above and beneath. This cowrie is closely related to the British cowrie described in this article and belongs to the same genus. It is known scientifically as *Trivia pediculus*



THREE SPECIMENS OF THE LARGE WEST INDIAN COWRIE

Of the species *Cypraea exanthema*. The left figure shows the shell opening as seen from below. The central and right hand figures illustrate two stages of color variation. Usually the color pattern exhibits light dots on a dark background. (Compare with *Cypraea exanthema* on page 192)

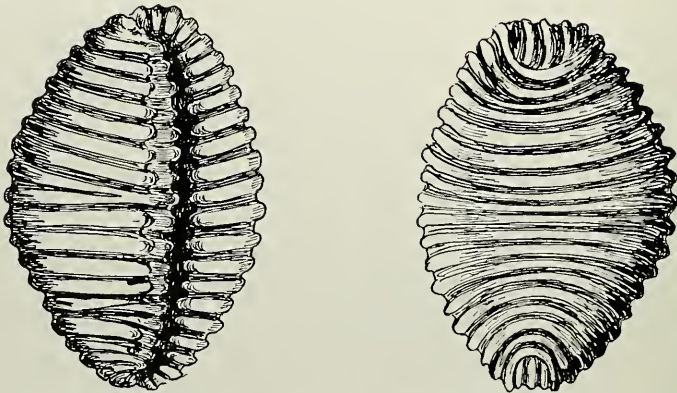
ered up. The cowrie is now fully developed.

The whole process can be watched and a series of growth forms collected. First, the adult cowrie laying her eggs; then the eggs hatching and producing the free-swimming larvæ; its growth in the plankton when possessing a velum; its metamorphosis to the crawling stages; and finally, the change of the form of the shell. A beautiful and complicated life history.

Perhaps one wonders why there are such elaborate changes. It is very usual for animals living on the sea floor to have free-swimming young which float near the surface in the plankton. The advantage is obvious. It takes away the young from their birthplace. If all were to hatch in one small area, the food would probably be insufficient for them, and it is an effective means of dispersal, because all planktonic life is carried about in the sea

by waves, currents, and winds, and is in constant movement. Those larvæ which survive, and they have innumerable enemies always ready to eat them, may settle on the bottom very far away from the parent home. The cowrie has a wide distribution. Knowing its life history, we can understand why this is so.

It is interesting to find in the few cases that are known of the young of some of the larger foreign cowries that these do not possess an accessory shell, their eggs and larvæ being in many ways unlike those of our little British shell. There is also evidence in the internal anatomy of our cowrie that it is not very closely related to those large and handsome foreigners and its life history bears this out. It is to be hoped that further work may be done on this interesting subject in those countries where different kinds of cowries are to be found in profusion.



BRITISH COWRIE SHELL AS IT IS USUALLY FOUND WITHOUT THE LIVING ANIMAL, SHOWN FROM ABOVE AND BENEATH. THIS PARTICULAR SPECIMEN MEASURED 10 MM. IN LENGTH

Photograph by
M. C. Dickerson



PORTRAIT
OF A
GRASSHOPPER

ADVENTURES WITH TRILSIDE INSECTS

"Close-ups" of Some Insects at the Bear Mountain Trilside Museum
and the Emotional Responses of Their Observers

BY WILLIAM H. CARR

Assistant Curator, Department of Education, American Museum

Believing that one living creature, whether it be a grasshopper or a bear, is of more importance in the eyes of a visiting public, than many inanimate objects, the Trilside Museum at Bear Mountain, New York, operated by the Department of Public Education of the American Museum of Natural History, under Mr. Carr's direction, last summer decided to satisfy the demands of its visitors for live animals large and small. The bears were maintained, appropriately enough, in the Bear Mountain Zoo and the grasshoppers in the museum near by. The knowledge concerning insects and mammals which these live exhibits contributed to the city visitors was considerable, while the reactions of the observers in turn aroused the keenest interest on the part of Mr. Carr and his associates.

—THE EDITORS.

WE once knew a young man who delighted in catching wild bees, hornets, and wasps, in his bare hands. He would hold the struggling insects cupped between his two palms and later release them buzzing with loud, insistent protestations, but unharmed. The man also was uninjured! Others were encouraged to try the same experiment.

"Just clap your hands over a bumble-bee while it is getting pollen from a flower," he would say. "Hold it for awhile. It won't harm you!"

This youth, so far as we are aware, had no other particular regard for insects beyond demonstrating his unusual ability. While we were glad to watch him in action, we would not advise others to follow in his footsteps for reasons purely personal and painful!

We have observed many forms of expressed human interest in the insect world as a whole, from this strange bee- and hornet-catching propensity to the use of butterfly wings as decorations for glass serving trays, from the employment of



Photograph by Wilfred Miller

THE MONARCH'S FOOD

Milkweed is the favorite food plant of the colorful monarch butterfly larva, which devours the leaves and sometimes the blossoms



Photograph by M. C. Dickerson

BEFORE AND AFTER

At the left the larva is ready to change into the pupa form (chrysalis). A chrysalis is shown at the right



Photograph by Wilfred Miller

TRANSPARENCY

Just before emergence. The monarch is shown faintly outlined within the thin covering of its transformation chamber



Photograph by Wilfred Miller

THE CHRYSALIS OPENS

The "green house with golden nails" has split along several lines. Its usefulness will soon be past



Photograph by Wilfred Miller

EMERGING

The monarch has begun a downward retreat from the ruptured chrysalis wall, the segments of which gradually part as the insect emerges



Photograph by Wilfred Miller

HALF WAY

Slowly the butterfly enters the outer world. The larva was discovered August 1. It transformed August 16, and emerged August 31



Photograph by Wilfred Miller

OUT!

It clasps the deserted chrysalis cover and rests for a time before climbing upward to await an unfurling and strengthening of the wings



Photograph by M. C. Dickerson

READY TO FLY

Soon the monarch will be off on its journeys among flowers and through field and woodland on its flight to the South

beetle wings in manufactured scarf pins to the exhibit of carefully mounted insects in scientific collections. In addition to these varied considerations we have also witnessed what might be termed purely emotional or, in certain instances, detached or real intellectual interest in insects as demonstrated by visitors to our Bear Mountain Trailside Museum.

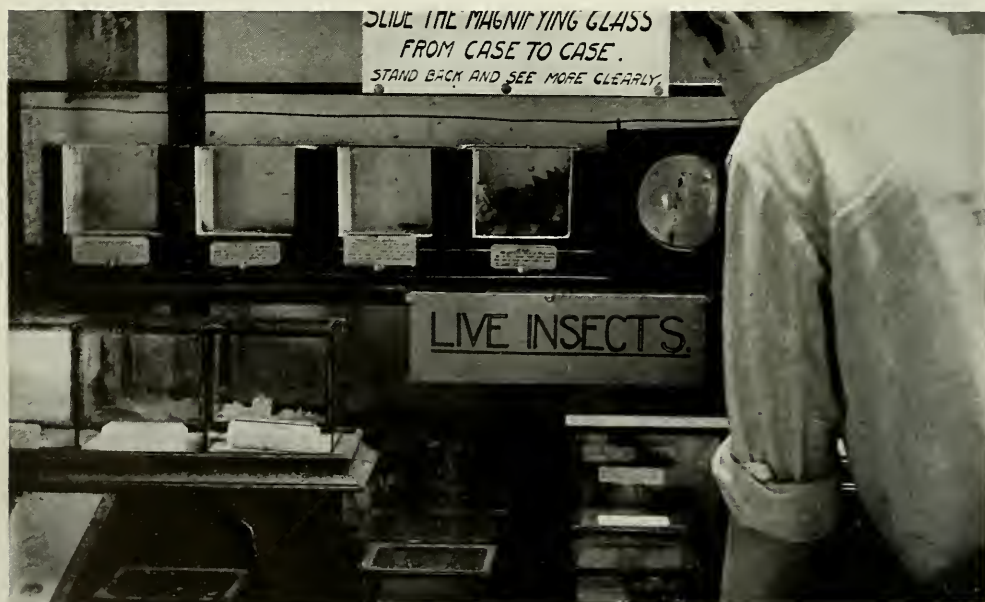
From the beginning of out-of-door museum activity, captive insects have been in favor. At one time, during the past season, we displayed forty-four different kinds—all adequately housed and fed. Public approval of this exhibition was sincere and stimulating.

We had endless opportunity to acquaint ourselves intimately with the diverse ways of the insects under our supervision. But, as the days passed, we found ourselves growing more and more interested in the *people* who viewed the collection. The exhibit virtually became a laboratory for the study of human reactions to visual

symbols as embodied in the appearance and general nature of living specimens. We discovered, among other things, that the principal characteristics of individual common species that attracted the greater number of onlookers were quite obvious. In order of importance they were:

1. Color
2. Movement
3. Form
4. Habit (as depicted in accompanying charts and illustrated diagrams.)

Practically every human feeling seemed to be aroused by virtue of our insect troupe. We seriously considered the possibility of concealing a camera in the rear of the tables, to record the facial contortions of unsuspecting gazers. Everyday emotions, expressed in series of faces, were: *admiration* with a hint of awe, called forth by the monarch butterfly and its life history; *amazement* at the brilliant, intense green of some beetles; *disgust* at certain grotesque, corpulent



Photograph by Wilfred Müller

EXHIBIT OF LIVING INSECTS

This collection in the Bear Mountain Trailside Museum attracted and interested many persons. A magnifying glass was placed in a sliding frame to enable visitors to obtain a "close-up" of various species displayed



Photographs by Wilfred Miller

STAGES IN THE METAMORPHOSIS OF THE SPICEBUSH SWALLOWTAIL

Left: Young larva of the spicebush swallowtail. The black spots on this larva are markings and not eyes. Center: Ready for the coming event. Pre-pupal period of the spicebush butterfly. Delicate holding threads are in place. Right: The chrysalis. Soon the full-grown butterfly will emerge. Note the shed "skin" packet in the corner

caterpillars; *delight* in close-up views of katydids and crickets; and *surprise* at the nimble antics of leaf-hoppers and ants.

In analyzing these emotions and in striving to comprehend their significance, we found it necessary to trace a number of reactions back into the years. We wondered what unconscious background of thought, lodged in the minds of our museums visitors, was responsible for preconceived attitudes toward insects. We noted, for instance, time and again, that children, having located the insect display, would run to their parents and cry,

"Come, Mother! I've found a lot of bugs over here! They're real nice—honest!"

And Mother, though she followed her son, would usually answer, as mothers have probably answered since time immemorial:

"What! bugs! I don't want to see 'em!"

We find a hint of this seemingly universal parental "bug" reaction in the Biblical warning,

All fowls that creep, going upon all fours, shall be an abomination unto you. (Leviticus xi, 20).

It is true that insects are not "fowls" and that they go upon "all sixes" instead of "all fours" but they were probably included in the age-old admonition, nevertheless. Yes, Mother's instincts, developed over countless generations, instilled in her the thought that "bugs" were things to be avoided rather than examined. But presently she would stand before the glass cages and see the monarch butterfly, recently emerged from its chrysalis and, with her son, exclaim,

"Why! that's beautiful—what marvelous colors!"

Then, after looking closely,

"What a shame to keep it shut up like that!"

In a minute, or less time, her belief about "bugs" would change considerably and she would agree, unknowingly, with Sir Theodore Mayerne who, in 1634, wrote of butterflies,

. . . their extended large wings painted by Nature's artificial pencil, with paints cannot be imitated; to which the very rainbow is scarce comparable. . . .

The woman would next find a chart



Photograph by Wilfred Miller

A WINGLESS GRASSHOPPER

Sometimes called the "cave cricket." The picture is enlarged to show leg markings and structure. The long hind legs suggest an explanation for the creature's ability as a jumper

with photographs showing different stages of the monarch butterfly's development from egg to caterpillar, to chrysalis, and eventually to adult. She would read the labels aloud to the little boy, calling his attention to the mysterious transformations pictured there upon the wall.

However, butterflies, as rightfully regarded by nearly everyone, were not considered in the category of "bugs." Caterpillars, on the other hand, were met with distaste and scorn though they were not "bugs" either!

We had a particularly fine larva of the hickory horned devil, that gave rise to more expressions of disgust than any other museum inmate, although to us it was a spectacular, handsome animal. Its rotund body, with rather fantastic protuberances and somewhat alarming mein, drew remarks such as these:

"Oh! Isn't that terrible!"

"I think he's horrible!"

If the outraged visitor had paused long enough to read the sign above the offending insect's cage, his repulsion might have been tempered a bit, for it told of the moth that would appear once the hickory horned devil had pupated and had rested for awhile.

For the edification of a visiting public we always liked to refer to Bacon and Shakespeare when we endeavored to label briefly the metamorphosis phase in the life histories of butterflies and moths. To this end we have frequently employed the following lucid and thought-provoking quotations, similar though they may be:

The caterpillar towards the end of summer, waxeth volatile and turneth to a butterfly.—

(Bacon's Nat. Hist. Century, viii)

and

. . . there is a difference between a grub and a Butterfly; yet your butterfly was a grub.

(Coriolanus v.4, 10, Globe ed. 1873)

If for no other reason, these statements are a valuable aid in dispelling the cater-

*Photograph
by Wilfred Miller*

**KATYDID,
HEAD ON**

An enlarged view
of the katydid's
"face." The "sound
box" is located
above in the V-
shaped wing angle

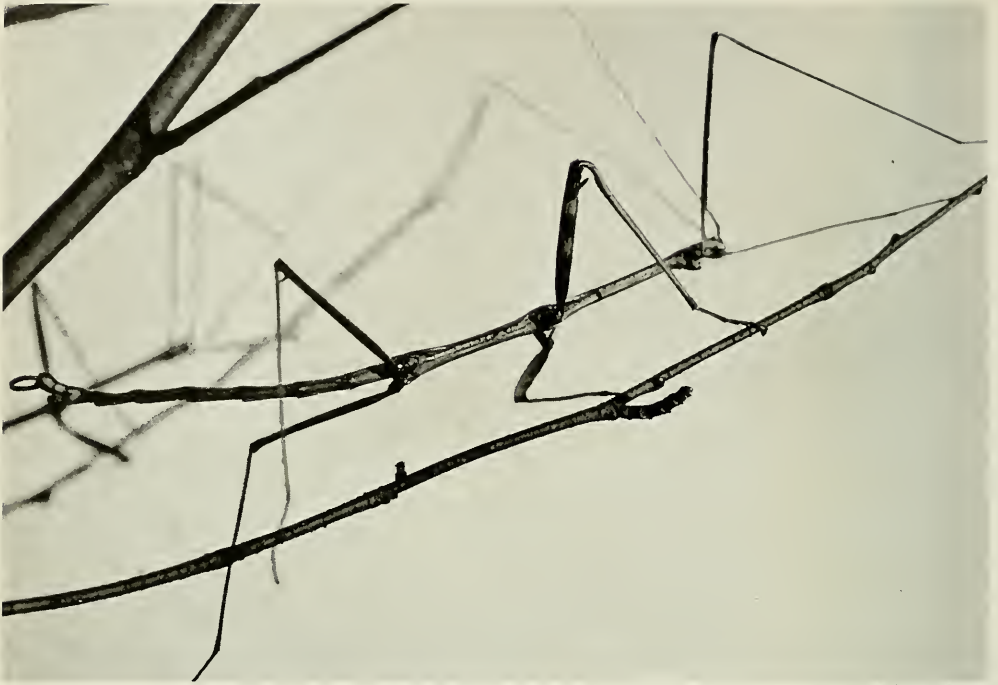


SIDE VIEW

Note the superficial
similarity in surface
of the katydid's
wing and the oak
leaf upon which it
rests

*Photograph
by Wilfred Miller*





Photograph by Wilfred Müller

WALKING STICK

This twiglike insect was responsible for much curiosity on the part of Trailside Museum observers

pillar "disgust" reaction with the promise of better things to come! Many people would rather listen to Shakespeare than to museum label composers!

To us, the impressions of olden writers about insects hold much fascination. We find that, human nature being as it is, practically the same popular conceptions prevail today that held sway three and four hundred years ago. One may easily draw an analogy between the present and the past.

We have little doubt that the "average visitor" to our museum had about the same notions of beetle grubs, and butterfly and moth caterpillars, that Chester did, in "Love's Martyr," when he wrote the following:

Of wormes are divers sorts and divers names,
Some feeding on hard timber, some on trees,
Some in the earth a secret cabbine frames,
Some live on tops of ashes, some on olives;
Some of a red watrish color, some of green,
And some within the night like fire are seen.

We have learned that only a most casual, superficial knowledge, often nowhere near as detailed as Chester's, is prevalent where insects are concerned. In our efforts to tell of facts related to insect lives, we find, therefore, that as a rule only the simplest of explanations should be forthcoming. In supposing that our visitors possess previously acquired information, we err. It is necessary to lead them along, step by step, through a very small portion of the enchanting labyrinth of details that surround our exhibits. If we insult the intelligence of a few, we are sorry. After all, it is the vast majority for whom we work. Frequently, children, thanks to modern training in biology and nature lore, inadequate though it may be, possess a greater fund of information than their parents—or have the parents forgotten? At any event, our attempts at nature

Photograph by Harold Whitford

SILVER-SPOTTED SKIPPER

This butterfly has an erratic flight that suggests "skipping" through the air

exposition are extremely elementary and we are not one bit ashamed!

One of our stellar insect performers was a large, healthy praying mantis. Earlier in the year, one of these creatures had been found at Jones Beach, on Long Island. It had frightened bathers there and was duly killed. An account of the mantis in one of our foremost daily newspapers was about as truthful as the superstitions quoted by Muffet, in his *Theater of Insects*, composed in the early Sixteen Hundreds.

. . . they are called *mantes*, *foretellers*, either by their coming (for they first of all appear) they do shew the spring to be at hand, so Anacreon the poet sang; or else they foretell dearth and famine as Caelius the scholiast of Theocritus



have observed. Or lastly, because it alwaise holds up its forefeet like hands praying as it were, after the manner of their diviners, who in that gesture did pour out their supplications to the gods. . . .

The newspaper story was the direct antithesis to this old description. Muffet's rewrite continued that,

So divine a creature is this esteemed that if a childe aske the way to such a place, she will stretch out one of her feet, and shew him the right way, and sel-dome or never misse.

No, the newspaper tale gave anything but divine qualities to the praying mantis. It was described as "dangerous," "unsafe," and "looking for trouble."

Many of our guests had read the account of the Jones Beach mantis, and they



A MEADOW GRASSHOPPER

It is interesting to compare this insect with its relative the katydid on page 201 and note the similarities and differences

Photograph by M. C. Dickerson



Photograph by M. C. Dickerson

WHITE-LINED SPHINX MOTH

The larvæ of this moth feed upon currant bushes, grape, plum, and many other plants

looked upon our specimen with misgivings. The young man who was responsible for the well-being of our insect family, had much explaining to do. He repeated over and over again, that the mantis was not ferocious in the way the newspapers would have one think. He called attention to the old adage that gives the excellent advice, "don't believe all you read in the papers!"

This was a clear demonstration of the effect of wrong information upon a credulous public, and to illustrate the point, the praying mantis was "Exhibit A."

One of the ever-present fallacies concerning insects, birds, reptiles, and other animals, is that of endowing them with human-like attributes. We find it impossible to descend or ascend, as the case may be, to the animal's level—to occupy its place in the sun and therefore to describe it in its own terms. We weave our own interpretations into any word picture we create. This anthropomorphic leaning is unfortunate. We saw it clearly

emphasized in our visitors' reactions to insects. Once more the praying mantis could be cited as an example, both ancient and modern, for Muffet's quotation, among other things, endowed the mantis with the characteristics of a prophet, and the news reporter referred to it as a trouble seeker.

An insect that aroused admiration was the walking stick. Our label called attention to the close resemblance between the creature and the twigs upon which it clung. The inference was that the walking stick, because of its ability to mimic its surroundings, would be difficult to see and would escape many an enemy by this means. Here the quality of "cleverness" was a prominent feature, from the observers' viewpoint. Whether the walking stick was aware of being clever was quite another matter.

Some of our insects were quite small, so, in order to facilitate examination, we devised a magnifying glass that was contained in a sliding frame. The frame could

Photograph by Harold Whitford

ASTERIAS

The wing markings of this *Papilio polyxenes* are slightly abnormal. Note the short-horned grasshopper on the same stalk

be moved along a track and the glass thus brought to bear upon some twelve different cages. At once this scheme was popular, and as we sat in our office, on a busy Sunday afternoon, we could hear the frame squeaking back and forth as numerous persons used it to advantage.

One of the insects magnified, was the grasshopper. Enlarged about four times this creature presented rather an uncanny appearance as it rested upon the cage bottom or fed upon blades of grass. One day we heard a visitor tell his companion that grasshoppers had loud voices, all of which was correct, if he were speaking of the male gender of long-horns. But the man did not stop here, he went on to say that he under-



stood that they "sing best when someone cuts off their heads."

This remark interested us at once and we inquired whether the man had personally tried the experiment. He said that he had "only heard of it" and could not tell whence his information had

come. Shortly after this, while leafing through an old book, we came upon a statement made by Giraldus Cambrensis, in 1187, in reference to the grasshopper. Among other things he said, with quite apparent untruthfulness, that,

they sing sweetest when their heads are cut off, and when they are dead better than when they are alive.

This was a strange coinci-

RESTING

The white margin along the under wing is very striking. The white-lined sphinx moth is a beautiful shade of olive-brown, buff, black, and reddish—truly a remarkable color combination



Photograph by M. C. Dickerson

dence, but who may say whether our visitor had been influenced, in any way, by the same source?

Only once did we hear a sermon delivered as a result of our insect display. The grasshopper was the object of this discourse and the ants near by, no doubt, helped to suggest the tale. A father with three children in tow, pointed to the grasshopper and spoke of its fabled shiftlessness as related in this verse:

As long liveth the
mery man (they
say)

As doth the sory
man, and longer
by a day;

Yet the grasshopper
for all his sommer
piping

Sterveth in winter wyth hungrie gryping.

—RALPH ROYSTER DOYSTER

We have heard much about the grasshopper's improvidence, but regardless of this, his tribe does not appear to decrease! At any rate, we hope the children benefited by the moral.

The sliding enlarging glass also passed before the cage containing crickets and katydids. We imagined that nearly all of our guests had heard of the *Cricket on the Hearth*, and of the refrain, "*Katy-*

did"—"Katy didn't" and our conjectures were well-founded, for these two musical insects, especially when peered at through the glass, were greeted as old friends by most people. While many had

never before seen the animals, they had, none the less, heard of them and were pleased to make their acquaintance.

We were once asked whether our visitors showed affection for any of the insects, and we answered,

"Yes, many of them professed a warm regard for the cricket, with the katydid running a close second."

As we look back upon our adventures with people and insects, or with insects and people, as you will, we realize more and more how infinite are the sources of human promptings that come to light in strange and unexpected ways. We may never have sufficient depth of insight to solve the riddle of why people think as they do.

In groping blindly for the answer, we may, nevertheless, discover a great many suggestions; and suggestions are better than nothing—sometimes!



Photograph by Anna K. Berger

PRAYING MANTIS

One of the guests at the Trailside Museum



Photograph by Harold Whitford

AMERICAN COPPER
A DAINTY LITTLE BUTTERFLY
WITH GAILY PAINTED WINGS



Courtesy of S. H. Williams and H. D. Fish

Kartabo Point, the Junction of Two Great Streams

TWILIGHT AND DAWN IN GUIANA

A Pageant of Nature Staged in the Jungles of South America

By STANTON C. CRAWFORD

Johnstown Center, University of Pittsburgh

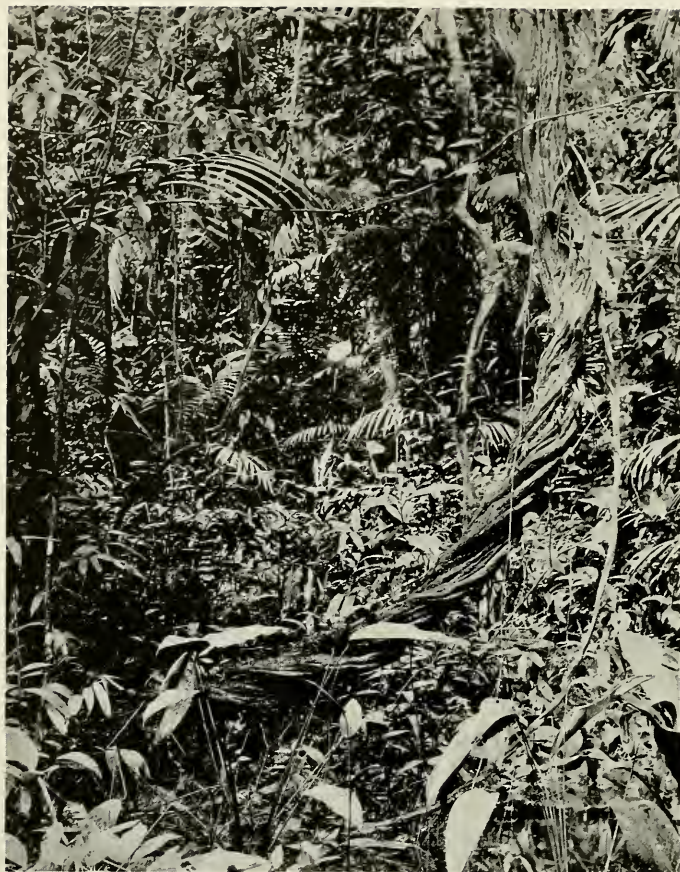
LIVING at the edge of a piece of open woodland, I have often watched and listened to the activities of wild things at dusk and dawn, and wondered about the life of that transition zone lying between darkness and daylight. In summer twilight the last sleepy notes of daytime birds come from shadowy branches. Nighthawks circle against the pale sky. Bats flit about and the whip-poorwill calls.

Why do nocturnal forms of life begin activity as diurnal ones withdraw? In the morning, why will the animals that are normally abroad at night retire just when the conditions of life become best for the daytime ones? Such problems were prominent among those that I hoped to solve, at least to my own satisfaction, in visiting Kartabo, William Beebe's former biological station in British Guiana.

Animals of the night, I know, show many adaptations of form and function that make for successful activity in the darkness, and there are in some cases certain apparent advantages to be realized through the adoption of the nocturnal habit. But it is easy for man to err in

ascribing reasons for the doings of lower animals. True, the species that shun daylight exhibit many unusual refinements of the sense organs, especially in the direction of delicate tactile, olfactory, and visual devices. Some, like the fire-flies and click-beetles, produce light.

Animals may gain from nocturnal living such advantages as the evasion of natural enemies that are abroad in daylight, or avoidance of the evaporation that sun and wind would cause from a delicate external covering. Their preferred food objects may also be light-shunning forms; or they may be more readily acquired at night on account of easier concealment of the hunter, or perhaps through better conditions for detecting victims or other food by the sense of smell. For any purpose, the olfactory sense may be more effectively employed at night, because of greater atmospheric humidity and relative absence of upward air currents. Then, too, there may be better conditions for communication between individuals and for detection of the approach of enemies or friends; odors travel farther and are apparently stronger in the damp



Courtesy of S. H. Williams and H. D. Fish

DEEP JUNGLE

Near Kartabo, at the junction of the Mazaruni and Cuyuni rivers in British Guiana

air; sounds produced have less competition; light-making organs are of value at night and useless by day. Nevertheless, it should not be supposed that, except by the higher mammals, the night time is consciously chosen on account of any of these possible advantages.

It might be considered that these benefits associated with activity at night are factors that in some way modified the ancestral stock of the present forms, and have made these various races nocturnal in habit. But certainly there is more to the explanation than is reflected in these considerations.

Beyond the recounting of these conditions of the nocturnal activity of animals

lies my interest in the life of twilight and dawn. Here is a world in itself, and an enticing one. Why do not all nocturnal animals retire together in the morning when a certain threshold of light intensity is reached? In the evening, what dictates that the daytime forms shall drop out of the scene one by one, while the species preferring the night appear in sequence throughout the period of dusk, rather than together when the shadows finally merge into darkness? One sees the nocturnal forms gradually replace the diurnal ones until a whole new population is abroad; but though he may watch carefully and ponder much, these queries will find no ready answer.

With such an innate feeling for these times of the day, and wishing to

know better the elusive animals of twilight and dawn, I settled down for the summer at Kartabo, on the level point of land between the Mazaruni and the Cuyuni rivers. Here, at the junction of these two great streams in the heart of the rain forest, with the jungle towering behind, the great sheet of water ahead stretching on to the Essequibo, the far jungle walls in sight beyond the rivers, and the clouds piled high, I planned to watch and listen for the rising and retiring of the forest citizens, in a succession of such dawns and dusks as I had never experienced before, and perhaps could never know again.

The experience suffers in being written, but I have endeavored to set down an

accurate picture of the life of tropical twilight and dawn, through combining the actual records of many evening vigils and morning watches. In the material that follows, each paragraph describes the life of a fifteen-minute interval, measured with reference to the moment of sunset or sunrise, rather than to any standard hour of the clock. Though no problems find solution in this record, the stage sees many changes of scene, and the players make their exits and entrances so effectively that the nature lover, at least, is content to put his questions by, and enjoy the passing spectacle.

§§ §§ §§ §§

Night comes quickly in the realm of the equator, but the brief dusk is filled with beauty. There is not enough breeze to disturb the clear silhouette of the palm trees against the golden sky. In this low country there is an uninterrupted sweep of horizon which is lit with color throughout the whole circle, so that one might easily be in error in pointing out the west had he not seen the sun go down.

Here is peace; yet, when one turns to notice it, life is everywhere. The martins are fluttering about, and small seed-eating birds sway on tall grass stems. Humming birds shoot by. In low trees alert flycatchers are vocal. The great-billed toucans utter their coarse calls, as with much intermittent fluttering they awkwardly adjust themselves for the night.

Giant caciques, astonishingly large orioles, are coming in singly from some distant feeding ground.

From the jungle parrots fly to chosen roosting places in the clearings, and parakeets are going in flocks from one tree to another at intervals. After much preliminary visiting they will make a final stop in some chosen tree. The larger tinamou, an inconspicuous bird of the forest floor, has been whistling for a half-hour, with her long-drawn-out calls. The pileated tinamou, however, did not begin calling so early as her relative, and only since sunset is her sweeter trill becoming frequent. Daytime lizards apparently have ceased activity for the



Courtesy of S. H. Williams and H. D. Fish

THE HAUNT OF THE RED HOWLER

A tidewater shore near Kartabo, whence, at intervals during the night, comes the booming of the red howler monkeys



Courtesy of S. H. Williams and H. D. Fish

A DAYTIME LIZARD

(*Iguana iguana*)

It may be found scurrying among the dead and fallen bamboo leaves until sunset

evening, for they no longer rustle among the dead and fallen bamboo leaves.

One must not overlook the insects and their kin. On the ground ants continue their hurried daytime activities. Crickets begin to chirp from their burrows. Fluttering in the bushes are sundry small moths. Centipedes thread through the leaves, while in corners and crevices tarantulas sit in wait for their prey. Spiders, chiefly little fellows, become active on the tall grass. Harvestmen, the "daddy longlegs" of our childhood, stride silently about.

The confluence of mighty rivers here makes of the foreground a great reflector. Mounting high, huge billows of cloud catch a last gleam after the glory has departed from the horizon itself. The sun dropped from sight little more than a quarter-hour ago, but it is already the period of afterglow. The martins and seed-eaters are becoming quiet and hum-

ming birds pass less frequently. Fluttering and calling, the flycatchers, kiskadees, settle down in the bush-tops. The parrots have found their perches and the parakeets are quiet in a palm. Only the pileated tinamou is calling now.

Some boas which were captured over a period of days have been quiet in their boxes during the hours of sunlight, but now begin to show signs of interest in their surroundings, their heads elevated above the smooth coils of their thick bodies. Longhorn grasshoppers and crickets fiddle merrily, while occasionally a tree-frog chirps. In the grass small millers are frequent. Tarantulas as ever are watchful and the spiders spin busily.

The eyes turn again to distant vistas. The rivers are mirror-smooth. It is now a good half-hour since sunset, and darkness is coming on rapidly. Bats begin to leave their hollow trees and flit about. In his cage a giant armadillo brought us

by the Indians is active. Final sleepy chirps are voiced by the martins and kiskadees. A lone, belated, humming bird charges past, perhaps from a final meal of spiders. Calling as they prepare to roost, terns gather in large numbers on "the beacon," a decaying frame of timbers marking a shoal in midstream. The captive boas are quite alert. Among the reeds at the edge of the river another heavy serpent, an anaconda, is hunting. The tree-frogs unite their voices in strident chorus. Huge marine toads appear, and hop about solemnly, looking for ants; one of them may eat two hundred insects before morning. The leaf-cutting Coushie ants start out on their nightly depredations; by morning some chosen tree may be completely stripped of its foliage. Clouds of midges appear and the nocturnal mosquitoes begin to make their presence known. Harvestmen stalk eerily, while the tarantulas still sit in wait.

All too swiftly another quarter hour has passed. From beneath the bamboo clumps near at hand calls the "who-are-you," a nighthawk; and another seems to answer from a distant shore. A few kiskadees are making final sleepy flutters in the palms and bamboos. Across a mile of quiet water terns are heard. The clear and emphatic trills of the tinamou are coming less frequently from the jungle. The last martin has become quiet. In the bungalow, geckos, those tiny lizards with adhesive pads on their toes, begin to chatter from the rafters. Flopping in the fast gathering darkness, the marine toads are abundant. The tree-frog legion increases its clamor. Insistently the boom of big frogs comes from across the river, and from a near-by swamp. Occasionally a fish splashes in the dark water. Now and then beetles drone through the air; one collides with a tent-flap. Fireflies begin to flash among the trees. Bom-



AGOUTI APPLES

Heavy-seeded *Etiaiballi* fruits, which are eaten under shelter of darkness by the agouti, a large rodent



THE HAUNT OF ANACONDAS

These serpents frequent the reeds along the rapids of the Cuyuni River

bardier beetles tumble through the grass, and roaches commence their nightly racings over the tree trunks.

An hour has barely elapsed since sunset, but darkness closes down. The tree-frogs continue their multitudinous chirpings. From swamps of every range of distance comes the deep guttural of frogs. The bats are swooping low, with an occasional chirp. Harvestmen are dancing weirdly on the beach, and tiger beetles race across the open places. From many unexpected quarters fireflies gleam and flash. Scorpions run over the ground and the low tree trunks, searching diligently for insects. Now has come the time of activity for the opossum and raccoon, the agouti and many another rodent. Soon the jaguar and ocelot will be hunting in the darkness.

The last glow has departed from the heavens and the stars have appeared. It is night in the tropics. The citizens of the day are forgotten. The citizens of

the night, a vastly interesting company, are abroad.

❧ ❧ ❧ ❧

An hour before sunrise the first streaks of light appear in the east. The activity of some of the nocturnal forms is continued into the morning calm. Contrasted with the quiet swooping of the bats is the distant booming of the red howler monkeys, which, having chorused at intervals through the hours after midnight, are now indulging in a supreme effort, challenging the day with their reverberant voices. The "poor-me-one," a giant goatsucker whose wailing calls are not frequent, is heard most often at and just before this hour. Beebe calls its voice "the very essence of night." The pileated tinamou, whose call had broken the silence repeatedly following midnight, is now trilling at short intervals. The questioning notes of the "who-are-you" are more insistent than they have

been since dusk. Frogs and toads seem loath to cease activity, and the tree-frogs sing in unabated chorus. In the quiet tide fish leap frequently. Flashing lazily, the fireflies are still in evidence. Termites, which have been parading outside their galleries through the night, continue to promenade brazenly. Various daytime insects are getting under way, but they are cold, wet, awkward.

In fifteen minutes it is light enough to see objects well. The jungle vegetation drips and stirs. Bats still swoop and the voices of the red howlers, the "poor-me-one," pileated tinamou, and "who-are-you" are still heard. The great tinamou also trills. The terns, heard occasionally during the night as they were disturbed by wind and wave, now call to one another as they leave their roosts. In the invertebrate realm, the mosquitoes, ants, grasshoppers, crickets, fireflies, and spiders are lowly but busy citizens. One cannot

long disregard the birds at this time of morning! After a few sleepy chirps the martins start from their boxes, and now the wrens are in full song.

The watch says that it is still a half-hour until sunrise, but it is now light enough to read easily. There is a damp, fresh smell to the earth, and just a hint of motion in the cool air. Dragon flies appear, darting and hovering; the martins will get some of them. The wrens are now joined by seed-eaters and kiskadees, which first sit quietly, looking about, then become active. From the deep jungle a dove coos. In utter contrast toucans begin their coarse calling from tall trees. Warblers and finches are singing, palm tanagers are flying from their palms, and now a woodpecker is pounding. Huge beetles in roaring flight startle the observer, and early-rising bees take the air blunderingly.

The east is bright. It is but a short



BUTTRESSED ROOTS OF A JUNGLE TREE

Which form a refuge for many jungle creatures as its branches do for a variety of birds

quarter-hour until sun-up. Some nocturnal birds are still heard, but less frequently. The echoing chorus of the red howlers swells and falls intermittently. Fireflies cease to twinkle among the trees and termites are seeking their galleries. Now comes a single butterfly. The seed-eaters, martins, and kiskadees become very active. From the dripping jungle is heard the call of a thrush. Along the beach runs a solitary sandpiper. Parrots and parakeets occasionally pass high overhead in conversational flight. Various flycatchers are flying and feeding, their songs becoming prominent amid the medley of voices. One by one they flutter on the bush-tops, announce impending departure with challenging song, and dive into the air to hunt for luckless flying things.

The watch says that the sun rose a few minutes ago, but it cannot yet be seen through the fog hanging over the rivers. The tinamou and "who-are-you" are still occasionally heard, and three of the former are flushed while on a short walk. The distant rumble of the red howlers, coming from miles away, is often punctuated by the slap of leaping fish. Big brown bees begin shooting noisily past. To the

company of birds already seen or heard at this awakening time are now added the giant caciques and brilliant humming birds. A solitary kingfisher has the habit of flying down stream every morning at about this hour. The martins are increasing in number and are very busy, while the finches and ground birds are insistently chattering. There are some macaws flying high.

It is now nearly a half hour since sunrise, and the fog is lifting. The various bird groups, as they successively awaken, turn from the first outbursts of song to the business of feeding. Beebe has happily described just such a time as "an interval when every one was too busy feeding to sing, and the wren's notes were hushed by an astounding succession of tiny spiders, and the chirps of young martins were smothered in winged ants." As the appetite is temporarily satisfied, individual birds pause to salute the new day with call or song, then return to the morning repast. The red howling "baboons" do not sound so terrifying by day. The world moves toward light and color. The citizens of night are lost from thought. The citizens of the day are everywhere.



NATIVE BOYS WITH A YOUNG GIANT ARMADILLO



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

EXPEDITIONS

THE LEGENDRE-INDO CHINA EXPEDITION.—

Letters from Mr. T. Donald Carter, who is representing the American Museum on the expedition, indicates that everything is moving along smoothly and that all are well. The first mammal to be collected by the expedition was a serow taken on one of the islands in the Baie d'Along, on the coast, near Hanoi, Indo China.

Mr. Carter described the hunt in his letter of October 17th as follows:

A friend that Mr. Legendre had been corresponding with had invited us down to stay on board his Chinese junk which he had fitted out very similar to a bungalow and was at anchor in the bay among the thousands of limestone rocks many of which rose for 300 feet from the water. Some of these rocks were small, but many of them were a mile or more in extent. This bay is about 40 miles long and 10 miles wide and is one of the most beautiful spots I ever visited. Upon a few of the larger islands there is found an animal which the French call a "mouflon." I knew that it could not be the mouflon as we knew it and so from the description given by the natives, concluded that the animal must be a goral. When I said to Mr. Legendre the Museum would like the animal, he said that we would have a hunt organized. This he did. We had about a dozen beaters, for this is the only way that the animal can be found. The underbrush is very dense and the rocky cliffs very difficult to navigate.

We started very early Monday morning on a small auxiliary three master, towing a sampan on which our beaters rode. After perhaps two miles we came to quite an extensive island thickly covered with brush. At one end of the island we let out the beaters with their small dog. They swarmed up the mountain-side like monkeys and were soon lost to view. We went along the shore for about a mile until we came to a fairly open place. Here we stationed ourselves up the side of the mountain. In a little over an hour's time we heard the beaters. They had located an animal and were working toward us. Perhaps another hour went by before we saw the boys. Every mountain peak held one where he could watch and direct those working below. The animal passed within 100 yards of where I sat but the growth was so thick I saw nothing. They headed off the animal and again he passed. I had just a glimpse of him but no time for a shot, and much to my surprise found out he was almost black and a serow instead of a goral. I had only my .25-20 and a shot-gun, but he was not seen again. Our afternoon hunt was much the same. I saw one animal but he was far up on the mountain-side. This friend had warned us that it was doubtful if we would get an animal as they were rare and very hard to see, so we were not so disappointed. Mr. Legendre said we would try one more day, so the next day we went to another island, even larger than the others. In the morning we did not even see one but at noon, while we were at lunch, one of the boys came in with the news that one had been found at the other end of the island. Over we went to that side and stationed ourselves from the beach on up the hill. I was on the beach and had a fairly good view of the hill-side. In about an hour's time the boys had located the

animal and then the drive was on. About an hour later I saw the animal through the bushes coming down the rocks about 200 yards away. As he passed through an opening I shot with the .25-20 and he stopped, thus giving me another shot. As he turned I shot again and this time I hit him. He proved to be a good-sized male with good horns. We are sending the skin home as soon as it is dry.

On October 23 Mr. Carter writes:

We are leaving tomorrow morning for Lao-kai which is on the Chinese border. We can go this far by train. Here we expect to make up our caravan (between 25 and 30 horses will be needed) and then proceed through northern Tonkin. After about three weeks by horse we reach the river. This we expect to float down. Later we will use other horses and finally an auto. We expect to reach Hue about the first of the year.

Everything has gone well and we are well equipped and are all looking forward to a very enjoyable trip.

Mr. Carter is expecting to return to New York about April 1.

EXPEDITION TO PERU.—Early in March the anthropology division of the American Museum sent a small expedition to Peru and Bolivia for six months, under the direction of Wendell C. Bennett, assistant curator in anthropology, and John Phillips. Their proposed plan is to survey the region around Lake Titicaca, from La Paz, Bolivia to Cuzco, Peru. This is, in a sense, a continuation of the survey of the Peruvian Coast made by Dr. Ronald L. Olson last year. The Museum possesses a large, and well localized series of collections made by Adolph F. Bandelier during the years 1895 to 1900. The survey of this Lake Titicaca region will provide the necessary background for the careful description of these fine materials. The Southern Highland section was the center of distribution for two of the Andean cultures,—the Tiahuanacan and the well known Incan. These two cultures, as well as an ill-defined "Chullpa" culture, are intermingled in the Lake Titicaca region. The expedition hopes to aid in the disentangling of these mixed culture traits and their distributions.

ARCHAEOLOGICAL RESEARCH IN MEXICO.—Clarence L. Hay, research associate in Mexican and Central American archaeology re-

turned on February 22 from a short trip made for the purpose of observing recent archaeological discoveries in that country. He visited Monte Alban, Oaxaca, where the celebrated Mixtec tomb was found, and had the good fortune to be shown the treasure by its discoverer Lic. Alfonso Caso. We are pleased to announce that Sr. Caso has consented to contribute an article in the near future to *NATURAL HISTORY* on these excavations which brought to light what is perhaps the greatest single archaeological treasure ever discovered on the American continent.

Mr. Hay also visited the great pyramid of Cholula where the Mexican government is making important excavations, and spent several days at Teotihuacan with Dr. George C. Vaillant, associate curator of Mexican archaeology at the American Museum. Doctor Vaillant is conducting the fifth season of stratigraphical research in the Valley of Mexico, and is now studying an extensive collection of pottery and some skeletal material unearthed in the excavations at Teotihuacan.

Mrs. Vaillant, working independently in Cuernavaca, Morelos, discovered a quantity of figurines and pottery which are of considerable importance in determining the extent of the "archaic" culture in Mexico.

PROFESSOR HENRY FAIRFIELD OSBORN sailed from New York, January 9, on the motorship "Stella Polaris," for a four months' cruise to the South Sea Islands and around the world.

ASTRONOMY

THE AMATEUR ASTRONOMERS ASSOCIATION continues to hold its semi-monthly meetings on Wednesday nights. The last meeting of the Association will be on May 18. Following is the schedule of speakers:

- April 6—Dr. Clyde Fisher—"Northern Lights."
- April 20—Major Anthony Fiala—"Astronomy in Exploration."
- May 4—Dr. Chester A. Reeds—"Meteorites from a Geologist's Standpoint."
- May 18—Motion Pictures of Jupiter, and annual and last meeting of the season.

The Association is also continuing its series of astronomical radio talks over Station WOR on Saturday afternoons, from 4:40 o'clock to 4:55.

CONSERVATION

DIRECTOR OF SANCTUARY ACTIVITIES FOR THE AUDUBON ASSOCIATION.—Ernest G. Holt, internationally known naturalist and explorer, has been appointed Director of Sanctuaries for the National Association of Audubon Societies, according to an announcement just

made by Dr. T. Gilbert Pearson, president of that organization. Mr. Holt, recognized as one of the leading ornithologists in the United States, has led many scientific expeditions, or conducted surveys, particularly through the tropics, for a number of institutions, including the American Museum of Natural History and Carnegie Museum of Pittsburgh. His most recent expedition, conducted under the auspices of the National Geographic Society, took him up the Orinoco River for hundreds of miles.

CANADA ENDS SEASON'S KILLING OF BUFFALO.—The slaughter by the Canadian Government of surplus buffalo in the national park at Wainwright has been completed for the season, according to N. B. Walton, general superintendent of transportation of the Canadian National Railways. Altogether 1200 animals were killed and the herd was thereby reduced to less than 6000 animals, which is about the number that can be properly supported by the grazing possibilities of the park. The meat was shipped to various parts of Canada for sale in open markets. The hides are being converted into rugs and coats and selected heads will be sold by the government to clubs and individuals.

THE UNITED STATES DEPARTMENT OF AGRICULTURE reports that 1,865 waterfowl that had been wounded by hunters and had flown into Tule Lake Bird Refuge, Siskiyou County, California, were rescued by refuge employees and volunteers aided by a spaniel trained to retrieve crippled birds, during the 1931 open season and the following weeks. The reservation protector, H. M. Worcester, has reported the details to the Bureau of Biological Survey, U. S. Department of Agriculture, which administers the refuge. The protector also reported that 1,359 mortally wounded birds had been given to local charity organizations for food.

In the administration of the refuge, a 10,600-acre reservation established by Executive Order on October 4, 1928, the officials permitted hunters to recover birds falling within the sanctuary, though they did not allow them to carry their guns inside. Many birds, however, Mr. Worcester explained, sailed far into the refuge before they fell—some as much as half a mile. These were not recovered by the hunters, and nearly all of them, the reservation protector believes, would have starved, frozen, or become victims of meat-eating animals had it not been for the rescue work. Near the end of the campaign, it was estimated that about 200 eagles had gathered gradually, attracted to the refuge by the disabled birds.

Beginning November 25, Mr. Worcester with deputies and volunteer coöperators gathered the birds daily until January 5. The crippled waterfowl were retrieved gently by a well-trained Springer spaniel dog. They were then placed in a box on sled runners and taken by the men to near-by special pens on Link River, Klamath Falls, Oregon, where they were cared for and fed.

Kept in open-top pens, the birds were at first allowed to escape when they had recovered enough strength to fly. After finding, however, that a considerable number of the wounded birds left the pens before they were able to find food for themselves, the refuge officials decided to restrain them until they had completely recovered.

Mr. Worcester reported that 1,173 ducks (723 pintail hens, 392 pintail drakes, 19 mallard hens, 21 mallard drakes, 12 widgeons, and 6 gadwalls) were placed in his pens. There were 685 geese (386 Hutchin's and cackling, 209 lesser snow, and 90 white-fronted) and 7 swans cared for. About 30 per cent of the ducks later died, but there was only a 10 per cent loss of the geese.

Eighty-five per cent of the geese recovered alive had broken wings, although less than 17 per cent of the recovered ducks were so injured. Ducks, it was thought, fell much sooner after being winged. The wings of 37 geese were shattered so badly that amputations were necessary. Of these birds 22 were still alive and doing well at the time of Mr. Worcester's report. Many of the winged birds, Mr. Worcester believes, were injured by long-range shooting from hunters' blinds as the birds passed high in the air.

Birds that were killed the refuge officials donated to charity institutions of Tule Lake Townsite, California, and Merrill and Klamath Falls, Oregon. Permanently disabled birds they distributed to parks and zoos for exhibition and breeding purposes. Those liberated they first marked with Biological Survey bands to assist in the nation-wide waterfowl studies being made by the bureau.

The rescue work, in the protector's judgment, was highly successful because of the birds saved. In addition, Mr. Worcester believed that the publicity received through the local papers caused "enough comment to make the hunter more conservative in his long range shooting."

EDUCATION

THE APPRECIATION OF GEMS is the subject of a free course of four informal talks to be given on Saturday afternoons at 4 o'clock during April by Herbert P. Whitlock, curator of minerals and gems at the American Museum. The course is designed to acquaint the general public, and especially those engaged in the jeweler's trade,

with the Morgan Collection of Precious Stones in the Museum. Each talk will be one hour in length and will be illustrated by slides, many of which are colored to represent the actual gem stones and art objects.

The program is as follows:

April 9, The Antique Use of Gems
April 16, Jade: Its Carving, Mythology, and Symbolism
April 23, Famous Gems of History
April 30, The Art of the Lapidary

WASHINGTON CELEBRATION.—In celebration of the Washington Bicentennial, the American Museum of Natural History presented on February 22 an illustrated lecture and a special showing of the new motion picture "George Washington, His Life and Times." Three showings of the film were planned, but when a total of six thousand visitors presented themselves for admission, a fourth showing became necessary.

Each program began with the audience at attention, saluting the American flag, while Scout Bugler Theodore Saunders played "To the Colors."

The Museum registered 17,500 visitors during the day, a record attendance.

Dr. George H. Sherwood director of the American Museum was appointed a member of the City of New York's Commission for the celebration of the two-hundredth anniversary of the birth of George Washington.

PROGRAMS FOR PRIVATE SCHOOLS.—As part of a policy for making the American Museum more widely known and enlarging its circle of friends, a series of programs for the private schools of New York has been instituted. The first of these was held on January 29, when pupils from the Allen-Stevenson, the Browning, the Buckley, the Collegiate, the Lawrence-Smith, and the St. Bernard's Preparatory schools attended. Many of the children came with their parents. On March 11 a similar evening was devoted to girls schools, including the Brearly, Chapin, Hewitt, Nightingale-Bamford and Spence schools. The programs on these two occasions included motion pictures of mammals, shown in the main auditorium; a visit to the new Vernay-Faunthorpe Hall; and a visit to the Museum's studios to see the modeling and mounting of large mammals. On April 8 and 15 further programs will be held.

PROGRAM FOR FOREIGN-BORN ADULTS.—This winter an opportunity has been afforded to the foreign-born adult students in the New York public evening schools by the education department of the American Museum to select for themselves the subjects of the five lec-



THE APPALACHIAN TRAIL
Officially corrected to February 1, 1930.

2. The Yale Chronicle Films "The Eve of the Revolution," and "The Declaration of Independence." Followed by a tour of the Hall of North American Mammals.
3. Washington Bicentennial Celebration, and the film "Yorktown."
4. The Yale Chronicle Films "Columbus" and "At Jamestown." With a visit to the Indian Hall.
5. Martin Johnson's film, "Trailing Wild Animals through Africa." Followed by a tour of the African Hall.

The Museum's auditorium was filled to its capacity at each lecture.

NATURE LORE LECTURES.—The department of public education of the American Museum is coöperating with the Thirteenth Camp Leadership Course at Teachers College, Columbia University. Mr. William H. Carr, assistant curator of the department, has been appointed director of the Nature Lore Section of the course, and will deliver a series of eight lectures at Teachers College on Monday evenings, beginning February 29, closing with the lecture on April 25. The subjects covered include a Balanced Nature Lore Program, Animal Life In and About Camp, The Earth Beneath Your Feet, Nature Handicraft in Camp, and Building a Nature Trail and a Trailside Museum.

IN THE COURSES FOR TEACHERS given at the American Museum during the spring semester under the joint auspices of the Museum and the School of Education of New York University, Dr. Clyde Fisher is devoting Thursdays from 4:15 to 6:00 to the subject of Astronomical Bodies and Their Movements, while on Mondays at the same hour Mr. Sydney Heilprin is giving a course on Earth Features and Their History.

The School of Education of New York University recognizes these courses for two points resident credit, and the Board of Education of the City of New York grants 30 hours credit.

NATURE TRAILS

THE APPALACHIAN TRAIL from Maine to Georgia has been rerouted to run through

tures given for them at the Museum, to aid them in their studies. These students fall into two groups, those who are just beginning to learn English, and those further advanced who are studying American history. Their selections were submitted to the Museum, at a council of delegates chosen by the students.

The lectures were presented alternately for each group, but on February 22 both joined in a Washington Bicentennial Celebration at the Museum, when Mr. John Finley addressed them, and the motion picture film "Yorktown" was shown.

The subjects selected for these programs were:

1. "Nanook of the North." Followed by a visit to the Eskimo Hall.

the American Museum's Nature Trail System at Bear Mountain, New York. Mr. Benton Mackaye, originator of the Appalachian Trail and vice-president of the Regional Planning Association of America, has shown a keen interest in the Trailside Museum. It was through his offices, and with the support of Major William A. Welch, that the Museum's Nature Trails have been included in the Appalachian Trail System. Mr. William H. Carr, director of the Bear Mountain Nature Trails, has agreed to supply natural history labels for several miles of the Appalachian System, and will coöperate with Mr. Mackaye in various nature teaching efforts in the same connection.

It is the hope of NATURAL HISTORY Magazine that it may have the pleasure of publishing in a later issue an article by Mr. Mackaye on the Appalachian Trail System.

EXHIBIT OF DUGMORE PAINTINGS

AN exhibit of unusual interest at the American Museum from March 28 to April 14, is a group of oil paintings of African and North American big game and birds, and a group of dry point etchings, both by Major A. Radclyffe Dugmore, F.R.G.S., whose article "Art and Animals" will appear in the next issue of NATURAL HISTORY, with reproductions in black and white of some of the paintings.

These pictures have all been painted from material collected in the field and the result of many years of work and study by Major Dugmore, who has exhibited repeatedly in London, New York, Boston, Chicago, and elsewhere during the past twenty years. Most of his life has been devoted to the study of outdoor natural history, and he was one of the first to undertake the photography of wild life both in this country and in Africa.

COMPARATIVE AND HUMAN ANATOMY

THE JAMES ARTHUR LECTURE ON THE EVOLUTION OF THE HUMAN BRAIN.—The late James Arthur of New Rochelle, New York, who was an Annual Member of the American Museum, left to the Museum a bequest of \$36,500, the income of which is to be expended for the study and investigation of the human brain and for founding a series of annual lectures to be known as the James Arthur Lecture on the Evolution of the Human Brain. The first of these lectures was given at the Museum on March 15, 1932, by the eminent neurologist Professor Frederick Tilney of Columbia University.

Professor Tilney rehearsed briefly some of the popular delusions about the brain and then took up the scientific history of the subject, beginning

with the foundations of the fore, mid and hind brain in relation to behavior in fish, amphibian and reptile, followed by the critical innovations in the development of the mammalian brain and its effects upon the behavior of the mammal. He discussed the general significance of critical changes affecting the brain in passing from fish to man, as well as the behavior significance of the changes in transit from the reptile to the mammal, correlating changes in brain and behavior all along the line and through the apes to man. He showed the behavioristic significance of the predominance of the frontal lobe in man and discussed the three great platforms of progressive advance in the neocortex and their effect upon human behavior.

The lecturer expressed the appreciation of all students of the brain for the generous interest of the donor of the fund, which will stimulate study and assist in spreading the results of research upon this important organ.

ANOTHER mounted skeleton, a member of the Equidae family, is now nearly completed and will soon be placed on exhibition in the Horse Alcove of the American Museum. This specimen, the Chapman zebra, *Equus burchelli chapmani*, a native of Central South Africa, will be the second of a series of four zebras, the Grevy, Chapman, Grant, and mountain, illustrating different phases of the stride in the walking action.

Mr. S. H. Chubb, associate curator in comparative and human anatomy, who is preparing the exhibit, is planning to have these four chief types of zebras, when finished, so mounted that each specimen will show a moment in the walking movement later than the preceding one, the whole representing a complete stride divided into four equal periods. The species will be arranged in the order named, with the extremes in size at the ends of the line, the Grevy, the largest, leading the procession, as it were, to start the motion picture, while the small and rare mountain zebra will bring up the rear. This will place next to each other in the series the two more closely related ones, the Grant and Chapman, both of the Burchell Group and of very little variation in size.

The Grant zebra is now on exhibition, while the bones of the two remaining, the Grevy and mountain, are cleaned and ready for mounting, and great numbers of photographic studies have already been made of living Equidae which will aid in determining the pose of these two specimens. When the Chapman zebra is finished, the preparation of the mountain zebra will be begun.

—E. D. C.

J. LEON WILLIAMS

DOCTOR J. LEON WILLIAMS, D.D.S., I.D.S., who died February 23, 1932, in his eightieth year, was an expert in the field of dental research and a Life Member of the American Museum, to whom the Museum owes a valuable collection of casts and replicas of the crania and teeth of the prehistoric races of Europe. This collection was brought together by Doctor Williams during his thirty years' residence in London and in connection with his studies on the form of the teeth in recent and extinct races of mankind. He discovered that, taking humanity as a whole, there are three types of central upper incisor teeth. In the first type, in which the crown is usually high, the inner and outer borders of the crown, as seen from the front, tend to be straight and vertical; in the second type, the opposite borders diverge sharply toward the lower end of the crown; in the third, which is usually broad, the outer border has a marked double curve. The other teeth, he observed, tend to conform to the same type as do the central upper incisors. Upon this fact he designed a beautiful series of artificial dentures, harmonizing with individual types of central incisors. He found these three types of teeth not only in all known human races, living and fossil, but even in all known species of the great anthropoid apes, a fact which he regarded as proof that the great apes are related to man by descent from a common ancestor. Upon his return to America his collection was exhibited at the Buffalo Exposition and was then presented by him to the American Museum to form the nucleus of the "Hall of Man." There it forms the centerpiece of the hall, together with the famous restorations of prehistoric races of man by Professor J. H. McGregor, and other material subsequently added by gift or purchase.

Doctor Williams was one of the founders of the International Association for Dental Research. He was long engaged in studies on the microscopic structure of the enamel in man and other mammals, but in later years ill health prevented the publication of his results.

HONORS

THE AMERICAN ACADEMY OF ARTS AND SCIENCES has elected Dr. William King Gregory to a fellowship in Class 2, Section 3, Zoology and Physiology, which includes sixty-seven fellows. Fellowship in the Academy is limited to 800, one half within 50 miles of Boston, the other half elected at large. At the present time the membership numbers 628.

SCIENCE OF MAN

AN ETHNOLOGICAL COLLECTION FROM WEST AFRICA.—Prince W. A. Zalstem has recently deposited with the department of anthropology at the American Museum an unusual series of ethnological specimens secured by him during several years' residence in the Old Mossi Empire of the Colony of Upper Volta, French West Africa. Since the Museum's ethnological collections from West Africa are far from complete, this Mossi material has been placed on exhibition in the north end of the African Hall of Ethnology, on the third floor. Though a few of the objects show Islamic influence, the greater number are representative of pure Mossi culture. The fine examples of work in leather demonstrate the masterly handling of this material by the Mossi, and such objects as the symbolically decorated dance costume, the amulet-bedecked riding gear, the various hunting amulets, and the examples of weaving give some idea of the intricacies of Mossi culture.

MEETINGS OF SOCIETIES

THE THIRD INTERNATIONAL CONGRESS OF EUGENICS will be held under the auspices of the International Federation of Eugenic Organizations on August 21–23, 1932. The honorary presidents are Leonard Darwin and Henry Fairfield Osborn; president, Charles B. Davenport. The scientific papers and the social features of the Congress will be centered at the American Museum of Natural History and at the Eugenics Record Office in Cold Spring Harbor, Long Island. The exhibits of the Congress will be at the Museum and will be on view for one month, August 22 to September 22, 1932, in Education Hall. The exhibits will be classified under numerous headings, including Human Traits or Qualities, Human Genetics, Heredity and Environment and their relative rôles in the development of human qualities, Heredity and Development, Human Migration, Mate Selection, Differential Fecundity, Population Study, Eugenical Forces, etc. The chairman of the Exhibits Committee is Dr. Harry H. Laughlin of the Eugenics Record Office at Cold Spring Harbor.

It is the purpose of this exhibit to show the history, content, present researches and trends of eugenics both as a pure and as an applied science. It will demonstrate the fact that eugenics is not birth control, that it is not enforced human mating, but that it is the study of those forces which operate in human evolution in so far as such studies may aid man to understand his own origin and his innate possibilities, and to apply such findings to the improvement of

his own racial and family stock. In this connection it is regarded by the officers of the Congress as fortunate that the Congress and the exhibits are to be held at the American Museum of Natural History, the work and aims of which so strongly emphasize the natural history of man,

The space allotted to the American Museum was in a prominent position and was sufficiently large to permit adequate display of all the materials transported to New Orleans.

Dr. William King Gregory supplied a life-sized bust of a gorilla, collected by Mr. Harry C.



THE AMERICAN MUSEUM EXHIBIT AT NEW ORLEANS

Several departments of the American Museum were represented in an exhibition of museum material, on the occasion of the annual meeting of the American Association for the Advancement of Science

including his palæontology and his racial history. Work on the new Hall of the Natural History of Man is therefore being pushed forward as rapidly as possible.

THE AMERICAN ASSOCIATION OF MUSEUMS will hold its 27th annual meeting at Cambridge, Massachusetts, May 12-14, with the Fogg Art Museum of Harvard University and other museums of the University acting as hosts.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE held its annual meeting in New Orleans from December 28 to January 2. Six departments of the American Museum contributed exhibition material for a booth in the Municipal Auditorium in New Orleans on this occasion, and more than thirty thousand persons visited the exhibit during the meetings.

Raven. This cast attracted considerable attention and held the central position in the booth. The bust was flanked with four paintings by Mr. Arthur Jansson, lent by the department of publications.

Mr. Barnum Brown's exhibit of a restored fossil Triassic ancestral crocodile, accompanied by X-ray plates and photographs, was of great interest to the public and excited much newspaper comment. Mr. Brown also exhibited some animal bones from a cave near Carlsbad, New Mexico, with which an arrow of Folsom type had been found seven feet below the surface and in such relationship that the human association was definite. These specimens, carefully labeled and arranged, also aroused much comment due to their importance in tracing back human activities of a remote past.

Dr. G. Kingsley Noble's cast of a rattlesnake

from the Reptile Hall of the American Museum, was an attraction because of its animated nature. Many people responded to the invitation to press the button and hear the rattles vibrate.

The Museum Library displayed thirty different publications, including guide leaflets and other types of Museum printed material. A number of orders for these publications were placed by the visitors.

NATURAL HISTORY MAGAZINE was represented both by Mr. Jansson's cover paintings and by a number of issues of the publication itself.

The department of public education of the Museum displayed a number of school loan exhibits, including bird habitat groups, cases of fossils, minerals, and individual mounted birds. The zoological cases of skulls and of animal orders, prepared by Mr. John C. Orth, won considerable approval and many requests were received for working plans for duplicates of these.

Mr. William H. Carr carried the responsibility for installing the exhibit for the Museum.

MRS. GRACE FISHER RAMSEY on February 19 attended the annual meeting of the Progressive Schools Association held at Baltimore where she spoke on museum courses for teachers. The following day she represented the American Museum at the annual meeting of the Supervisors of General Science in Washington, and on Tuesday and Wednesday attended the meetings of the National Association of Visual Instruction. On Tuesday morning Mrs. Ramsey spoke on a survey of teacher training by the museums of the country. At this meeting the National Association of Visual Instruction was merged with the department of Visual Instruction of the National Education Association so that there is now only one national organization in the country devoted to this phase of education.

Mrs. Ramsey was elected a member of the executive committee for six years of the newly merged organization and a member of the National Council of Education.

OTHER MUSEUMS

THE ALLEGANY SCHOOL OF NATURAL HISTORY in Allegany State Park opens its sixth season on July 5, closing on August 24. This "Summer School in the Forest" is conducted by the Buffalo Society of Natural Sciences in coöperation with the New York State Museum and is affiliated with the University of Buffalo from which its students receive college credit. Registration should be made with Harold T. Clement, Curator of Education at the Buffalo Museum of Science, or Dr. R. E. Coker, Director, Allegany School of

Natural History, Box 950, Chapel Hill, North Carolina.

Courses will be given in Field Zoology by Robert E. Coker, Ph.D., John Hopkins and Professor of Zoology, University of North Carolina; in Field Geology by Frederick T. Thwaites, A.M., University of Wisconsin and Lecturer in Geology at that University; in Field Botany by Robert B. Gordon, Ph.D., Ohio State University and Instructor in Botany at that University; in the Natural History of Birds by Aretas A. Saunders, Ph.B., Yale and Teacher of Biology, Central High School, Bridgeport, Conn.; and in Nature Study by William P. Alexander, B.Sc., Cornell and Field Naturalist and Assistant Curator of Education at the Buffalo Museum of Science.

The Allegany School of Natural History is nine miles from Quaker Bridge, New York, and well above it, being located on a hillside bordering Quaker Run in its upper part at an altitude of about 1900 feet.

It is a notable feature of the setting of the School in Allegany State Park that within an area of some 65,000 acres under the care of the State much of the wild life is protected, and so one may occasionally see in wild state bear, deer, raccoon and porcupine, besides observing daily the abundant smaller mammals—squirrels, chipmunks, field mice and less frequently, jumping mice, shrews, weasels, mink and others. There are few places, in fact, where small animals in great variety can be so readily observed or collected. Nor are there many sites in which nature can be studied at such close contact.

Teachers in public schools and colleges, particularly those who have had little opportunity for field studies, university and college students, scout and camp leaders of various kinds, young and amateur naturalists, and those interested in the nature work of museums, public forests and parks, find in the Allegany School of Natural History the opportunity to broaden their experience, advance their training, and receive fresh stimulus.

NEW PUBLICATIONS

Handbook of Birds of Eastern North America. By Frank M. Chapman, 1932. D. Appleton & Company, New York and London, XXXVI—581 pp.

DOCTOR CHAPMAN'S *Handbook* has been the *vade mecum* of eastern bird students since the publication of its first edition thirty-six years ago. More than any other American bird book it has deserved the adjective "indispensable." Without a peer when it was first issued, it has never been surpassed by a work in the same field. This, when one considers the vast strides

that have been made by ornithological writers during the past three and a half decades, is high praise both of the first edition and the most recent revision.

Four years ago Doctor Chapman was awarded a Roosevelt Medal for having had "more influence than any other man in America in making ornithology a popular subject . . . a part of the education of countless men, women and children." If the contributors to the popular knowledge of ornithology, and to the tremendous interest in birds and their conservation—which could not have been aroused without knowledge—might somehow be graded, there is no doubt that Doctor Chapman's name, like Abou ben Adhem's, would lead all the rest.

This, the "second revised edition" of the *Handbook*, has not only been completely revised; it has been completely reset. The order and the nomenclature have been brought into conformity with the new edition of the A. O. U. 'Check-List,' and distributional and migration data have been brought up to date. New species and sub-species—the total is now 675—have been added. The value of the broad bibliography has been augmented by the inclusion of many "local lists." New plates and line drawings have been added, and the non-collecting field student is given an increased recognition, especially in two excellent plates by F. L. Jaques. An historical review brings the progress of world ornithology up to Rowan's book, reviewed in the last number of NATURAL HISTORY.

The introductory matter, "mental pemmican" that provides a virtual survey of the field of ornithology, has been extended to include the most recent and significant products of research.

Ten years ago Ludlow Griscom characterized the *Handbook* as "a book which no student has ever outgrown." One may go further and call it a book the science of ornithology has not outgrown.—WILLIAM VOGT.

Fossils and What They Tell Us of Plants and Animals of the Past. By R. S. Lull.
The Coming and Evolution of Life. By H. E. Crampton.
 The University Society, Inc., 1931, New York. 8vo

THE University Society of New York has recently issued its second unit of four brochures dealing with "High Lights of Modern Knowledge." A very comprehensive brochure of the first unit, dealing with the history of the earth, by Dr. Chester A. Reeds, was recently reviewed in NATURAL HISTORY. Number One of the second unit, entitled *Fossils and What They Tell Us of Plants and Animals of the Past*, is by Professor R. S. Lull of Yale University. The first forty-four pages are devoted to such general topics as the nature and antiquity of fossils,

how the age of fossils is determined, the location of fossils, fossils and the theory of evolution. In the remaining fifty pages the author gives a brief resumé of the animals of the past, stressing especially the influence of change of climates upon animal and plant life. Many of the figures are based on the famous fossil skeletons discovered by the late Prof. O. C. Marsh, which have been mounted in the Peabody Museum at Yale by the author and his assistants.

Professor Lull notes that "Even a brief description of the evolution of the entire animal kingdom as set forth in the fossil records would fill many times the allotted pages of this book. One must, therefore, after a general summary, turn to certain groups wherein the fossil series is remarkably complete, referring the reader to more extended works for further instances and greater detail." But even so, it is somewhat surprising that so many of the most significant palæontological discoveries of modern times are ignored; one looks in vain in the index for South Africa, Texas, Kansas, Patagonia, Russia, Theromorphs, Cotylosaurs, *Plateosaurus*, or for the names of von Huene, Scott, Stehlin, Broom, Williston, Watson, Dollo, Smith Woodward, Stensiö, and many others. If these subjects and authors are left out of modern palæontology in an introductory survey of the "High Lights of Modern Knowledge," who or what can fairly be included?

NUMBER Two of the second unit is *The Coming and Evolution of Life* by Prof. Henry Edward Crampton, of Barnard College, Columbia University. Perhaps the majority of popular books both for and against evolution are written by persons with a regrettably scant practical acquaintance with the subject, either in the field or in the laboratory. Lawyers, statesmen, theologians, philosophers, and statisticians, who write books on evolution, have necessarily spent the greater part of their time in other fields, and the training they have received there has not made up for their lack of practical experience in the field of evolution itself. On the other hand, professional zoologists who are engaged in the complex problems of classifying animals or plants have for the most part become so engrossed in their specialties that they will not turn readily aside to write a brief work under such a sweeping title as "The Coming and Evolution of Life." Fortunately for the "University Series" and its readers, the author of the present brochure belongs to neither of the classes indicated above. For, on the one hand, he has had a long and brilliant career as a

field and laboratory naturalist, having collected in the South Sea Islands hundreds of thousands of snails of the genus *Partula* and its allies; his studies on this vast material, continued through many years, finally enabled him to demonstrate the fact that evolution is now going on and to measure its pace. On the other hand, throughout his long experience in conducting broad-gauge

college and university courses in zoölogy, he has retained an evident zest in presenting the evidences for evolution with flawless logic and cumulative force. In fact it would be difficult to match this modest opusculum among contemporary works on evolution. The illustrations are few in number but are remarkable for their clarity and directness.—W. K. GREGORY.

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SIXTY-ONE 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.

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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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Series of illustrated lectures held on alternate Thursday evenings in the autumn and spring of the year are open only to members of the class of \$10 annually or higher 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
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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 have been constantly in the field for years, gathering information in many odd corners of the world. During 1931 twenty-three expeditions visited many distant portions of the globe. In 1932, however, owing to the limitations of funds, expeditions will necessarily have to be eliminated except as they are financed by gifts. In this work of exploration, consequently, the American Museum especially needs the generous help of its many friends in order to further the scientific work of the institution. Contributions to this phase of the work of the Museum are of more than usual value, and the Museum will be glad to discuss any angle of its delayed program of exploration with anyone interested in aiding this work financially.

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 108,000 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 coöperating 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 augment greatly the Museum's work, not only in New York City public schools, but also throughout the United States. More than 27,945,076 contacts were made with boys and girls in the schools of Greater New York alone, and educational institutions in more than thirty-three states took advantage of the Museum's free film service during 1931. 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

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BLAZING THE TRAIL

ONE of the most interesting of the racial groups in North America is the French Canadians, among whom Dr. H. L. Shapiro, of the American Museum's department of anthropology, has made an important series of studies and observations. In the next number of this magazine Doctor Shapiro will give his account of these picturesque people.

READERS of NATURAL HISTORY will recall Dr. James P. Chapin's accounts of his experiences in Africa, the last of which was published under the title "Day by Day at Lukolela." In the next number of the magazine Doctor Chapin will recount some of his adventures on that great continent while collecting for the American Museum in the Kivu region.

THOSE readers of NATURAL HISTORY who are interested in gems will recall the occasional articles on various phases of the subject by Herbert P. Whitlock, curator of minerals and gems in the American Museum. For the next number Mr. Whitlock has written another article, this time on "The Antique Use of Gems," in which he tells, among other things, the story of the development of necklaces.

RECENTLY two articles by Robert H. Rockwell have appeared in NATURAL HISTORY, both dealing with the expedition sent out in the schooner "Blossom" by the Cleveland Museum of Natural History. In the next number Mr. Rockwell will tell of further adventures of those who took part in this cruise, as they visited the islands of the South Atlantic.

IN the March-April number we announced that an article by Prof. T. D. A. Cockerell would appear in this issue—an article on insects (more especially bees) and the expedition to Africa on which he collected them. Unfortunately, however, we were not able to include it. It will be presented in the July-August number.

ECLIPSES of the sun, for all the fact that we understand them to be merely the cutting off of the sun's light by the interposition of the moon, are phenomena that never fail to stimulate the imagination. On August 31 there will be a total eclipse, visible this time in Ontario and New England, and NATURAL HISTORY is fortunate in being able to publish an article in the next number descriptive of eclipses and what is to be learned from them. Dr. Clyde Fisher, curator of astronomy at the American Museum, is the author, and after the eclipse he will write another article telling about this momentary darkening of the sun.

THE articles by William H. Carr concerning his experiences at the Trail-side Museum in Interstate Park have been unusually popular with our readers. Another will appear in the next number—an article about tyranny and just punishment in which two tiny East Indian monkeys that were formerly in Mr. Carr's zoo play the leading parts.

IN the Okefinokee Swamp rises the river whose name has been made immortal by Stephen Foster's song "Way Down Upon the Suwanee River." Rich in plantation history, unique in geographical formation, and vital in its beauty is this famous stream, yet very little seems to have been written about it. Late in the fall of 1931 Mr. Charles Newton Elliott made a canoe trip down the entire length of the river, and in an article that is to appear in the July-August issue of NATURAL HISTORY he describes some of its unique characteristics. The article will be richly illustrated with photographs taken on this trip.

IN addition to the features announced above, we have several others scheduled, including an article of exceptional interest on one of the most important of recent archaeological discoveries. We cannot yet say definitely whether this will come in time to take its place in the July-August issue.

THE COVER OF THIS ISSUE

THE cover painting of this issue of NATURAL HISTORY is by Major A. Radclyffe Dugmore, whose exhibition of paintings and etchings attracted so much favorable comment when it was on display in Education Hall at the American Museum. The requirements of the cover forced us to cut the picture down from its natural rectangle to the less desirable square, with the result that the picture has suffered somewhat. Nevertheless, it still remains an excellent portrayal of a moose in the autumn woods, and tells more clearly than the black and white reproductions in this issue how faithfully Major Dugmore has pictured the animals he has selected as subjects for his canvases.

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NUMBER 3

NATURAL HISTORY

MAY-JUNE
1932

The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor



A. KATHERINE BERGER
Associate Editor

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LIONS OF EAST AFRICA

For twenty-five years Major Dugmore has been a student of the fauna of East Africa and of North America. His photographs of lions are well known, and his paintings, of which the original of this picture is one, are excellent portrayals of life in the wilds

See "Art and Animals," Page 229

VOLUME
XXXII

NATURAL HISTORY

NUMBER
THREE

MAY-JUNE, 1932



ART AND ANIMALS

The Adventures of an Artist Who Has Painted the Big Game
and Birds of Africa and North America in
Their Natural Habitats

By MAJOR A. RADCLYFFE DUGMORE

ART, or rather graphic art, as connected with wild animals, goes back as far as ancient history, but until more recent times the tendency has been to depict the various creatures chiefly as objects of the chase. Why this should have been the case is difficult to understand, for as objects of beauty and grace many of the wild beasts are most satisfying subjects.

Without delving into the dim past, let us take the paintings made within the last century or two. How many well executed pictures have shown wounded, dead, or dying stags; others impaled on the pike; lion, tiger, and other unfortunate animals being hunted. It has always struck me as wrong and unhealthy, and unworthy of the creative art of the painters. Then, too, why should anyone care to have continually before his eyes such scenes of horror and suffering. Is not the living animal, free and happy, shown in its natural environment, a more beautiful subject for a picture? Children brought up from infancy to see each day a painting or reproduction of an animal being tortured are not being influenced in a way that will benefit them.

Rather it will make them callous to the suffering of the so-called dumb creatures.

In recent years there has been a very marked reaction against pictures of this type, I am glad to say. Dead and dying animals are no longer considered suitable subjects for the canvas, even though the camera is still used to show the mighty (?) hunter standing proudly on or by his usually defenceless victim. Unfortunately, art critics have, to some extent, been to blame for the little use of wild animals as material for painters. Horses, cattle, sheep, and even pigs were, and still are, considered as fitting models for the artist, but the wild animal with all its beauty is looked upon with doubt.

Some years ago a society of animal painters was formed, and I, of course, was greatly interested; here at last there was going to be recognition of what was dear to my heart. I applied for membership, but was abruptly "turned down." Later I saw the first exhibition of this society's work, and discovered that there was not a single picture of a *wild* animal, the nearest being a lion in a zoo. Then I understood why I was not valued. That the society died a natural death, I be-



MARCH OF THE MONARCHS

The majestic elephants of Africa have been painted by competent artists far less often than have the elephants of India



FLEEING FROM A GRASS FIRE

Major Dugmore, in his paintings of elephants, has presented the enormous beasts as they appear under varying conditions that affect their lives



ELEPHANTS IN A SWAMP

The paintings reproduced on these two pages are of African elephants. Major Dugmore has spent much time in portraying the wild life of Africa.



NIGHT MARCH OF AFRICAN ELEPHANTS

Few sights in nature can equal the majesty of such a herd, as it strides across the grasslands of Africa in the moonlight



THE NOON REST

Major Dugmore, in this painting, presents zebra, Coke's hartebeest, waterbuck, and impalla resting in the shade of a tree during the heat of midday

like to have done. I have been forced to make the results of my observations pay my way, for travel is an expensive luxury, especially when the travel necessitates devoting so much time to each particular subject.

It is more than forty years since I took up painting seriously, and studied in Italy. For a long time I devoted my efforts to landscapes and marines. Then as I became more and more interested in natural history I decided to learn how to paint animals and birds; but I discovered very quickly that my task was more difficult than I had believed possible. Not only must I have a working knowledge of anatomy, but I must learn the character and habits of each species, and this could be done only by spending endless time in the wilds

lieve, is beside the point. I simply mention the case to show the prejudice that may exist in the minds of some artists.

All my life I have been interested in birds and animals, in their habits of life, as much as their actual appearance. With the object of accumulating knowledge and helping to create a better understanding and sympathy, I have devoted my energies so far as possible to studying my subjects in their natural habitats. By means of writing, photographing, lecturing, and painting, all that I have learned has been given to the public; but the unfortunate handicap of poverty has restricted seriously the work I would

where I could study directly from nature. For thirty years I have availed myself of every opportunity, but the years have passed far too quickly and the amount of knowledge that I have acquired seems insignificantly small. Every time I start on a picture I realize only too well how little I know, so that I find myself in a constant state of discouragement.

My idea about a painting of any wild animal is that it should try to combine four particular qualities, or objects: It must be a good portrait of the animal in its normal wild form (frequently very different from the type found in captivity) both as to color and development.

It should show accurately some phase of the animal's life, in other words be a natural history record. The settings should be correct and typical, this of course means that all vegetation, whether merely suggested or done in detail, should be truly rendered. Lastly, both in composition and in execution it should, so far as possible, be able to rank as a work of art. Atmosphere and coloring should be carefully considered. A mere portrait, even though correct in every detail, if hard and unsympathetic and lacking in composition and feeling, is not necessarily a *picture* even though it may be a technically correct representation of the actual animal. I have, therefore, endeavored to combine art and science.

The "highbrow" artists declare that art should not have to be the *correct* rendering of the subject, but rather a

suggestion. This may be and probably is true in many cases, but so far as the wild animals are concerned I fail to see why accuracy should lower the value of the painting.

The greatest handicaps to the work of wild animal painters are the difficulties of getting within close range of the model, and the continual movement, which makes drawing a source of constant difficulty. Consequently I feel that intelligent use of the camera is quite legitimate, provided, of course, that photographs are not actually copied. They should be regarded simply as notes or sketches. Otherwise grotesque attitudes may result. Then, too, there is the question of perspective. Many who use the camera know nothing about lenses, and employ those of short focus so that any objects photographed at close range are



AN AFRICAN LEOPARD

The beauty of this African cat can be visualized even from this reproduction in black-and-white, which does scant justice to Major Dugmore's painting



ZEBRAS GILDED BY THE RISING SUN

In this painting Major Dugmore has portrayed a zebra family with the rays of the early morning sun falling on their gaudily striped bodies

badly distorted unless the animal stands broadside to the camera. It is therefore essential to use a lense of correct focal length, the longer the better. Then, if the animal happens to be standing so that the head is nearer than the hindquarters, the proportions will be more accurately rendered. I have seen frequent examples of paintings which were evidently direct copies of photographs made with short focus lenses, and the results were far from satisfactory.

I am sometimes asked whether my pictures are made from actual scenes painted on the spot. Anyone who knows anything about the habits of wild animals realizes that this would not be possible. The best one can do is to make rapid sketches from a place of concealment. The scene itself may be registered in the mind and reconstructed on the canvas with the aid of the sketches. A good, reliable memory is absolutely necessary

and the power of observation must be cultivated; every detail should be noted and stored away in the brain for future use. Without the ability to see and remember, the painter of wild life is seriously handicapped. Inaccuracies will be bound to creep in to the detriment of the picture.

As an example of this question of careful observation let me give the following experience: I was holding an exhibition of my work in a London gallery some years ago, and one of my visitors was R. J. Cunningham who, I believe, knew more about the habits of African big game than any other man. He came to the gallery a number of times and seemed to be particularly interested in a picture of elephants. One day in the course of conversation he remarked:

"Dugmore, I am surprised that anyone with your experience should have made the mistake of placing an old cow



AFRICAN BUFFALO AT THE FOREST EDGE

Often referred to as the most dangerous of African big game, the buffalo has rarely been painted



SUSPICIOUS

The power and alertness of the African buffalo is vividly presented by the artist in this unusually striking canvas



AT A WATER HOLE

Typical of Africa is this presentation of animals congregated at a water hole. Zebra, giraffe, oryx, marabou stork, and others are shown peacefully together about the shallow waters of the vitally important gathering place

elephant with her young directly in the sunlight when all around there is a forest. Surely you know that the shade would be preferred to that strong sun."

"Well," I replied, "but you have not noticed that this picture is of Marsabit forest?"

"Why on earth didn't you tell me so? Of course you are right, for that is one of the few places I know where the elephant will do what you have shown."

"That's right. I noticed that the thick mist which covers the forest on most nights saturates the trees with moisture, and the elephants, as you know, hate having water drip on their backs, so that in the morning it is usual for them to stand in the sunlight until the trees have dried,—and that is what I have tried to show."

He smiled and bought the picture. This illustrates what I mean about the value of carefully observing the animals in their own particular habitat.

During the time I spent in the Marsabit

country I had many opportunities of making sketches of elephant directly from life. Occasionally my ambition to secure these sketches resulted in more excitement than I cared for. As for instance when a small herd got my scent and with the utmost caution came to try to find me. The largest member of the herd, a cow with her young, was the leader, and she did not stop until she was so close that her trunk was waved over my head. I was flat on the ground and remained there for fifteen minutes, expecting every moment that the mighty creature would take just one more step forward and crush me to death. Needless to say I neither photographed nor sketched that elephant, though I had a wonderful opportunity to study her skin at extremely close quarters. It was only about half an hour later that I had a chance to make some interesting sketches of the herd at fairly close quarters when there was not sufficient light for photography.

There are times when a wonderful subject presents itself, but under conditions which make painting impossible. I recall one night when I had been watching ever since sunset in a "boma" or hiding place made of bushes. A few yards away there was a water hole to which I had hoped animals might come; but the hours passed in silence without visitors until shortly before dawn. Then the sky slowly took on the glorious colors that precede sunrise. When the country before me looked like a veritable fairyland, a herd of zebra came over the hill back of the water hole. In a short time some of the leaders reached the edge of the water while the others in single file were silhouetted against the glowing and rapidly changing sky. It was a picture perfect and complete, but so transient that it was only possible to photograph it in my mind; however, the impression was so strong that it remained, and several years later I put it on canvas—one of the most satisfactory pictures I have ever done.

Another of these fleeting scenes which furnished me with material for a painting was when a herd of caribou in Newfoundland galloped past me in a snowstorm. Through the falling snow there was the halo-like glow of pale sunlight. Unfortunately the photograph of the painting, which is reproduced here, does not show the delicate pale yellow light which in value differs but little from that of the cold tone of the snow against the sky. In this instance there was no time to make even a rough sketch as the animals had come and gone within a few seconds.

Frequently I make the landscape sketches complete from nature in places where I have actually seen the animals. This, of course, is less difficult than working almost entirely from memory. The reproduction of the mule deer among the golden aspens in the Canadian Rockies is an example of this method of work; so also is that of the elk, or wapiti, standing in the shallow water. To secure this subject I spent many afternoons waiting in a hiding place on a small island, shivering



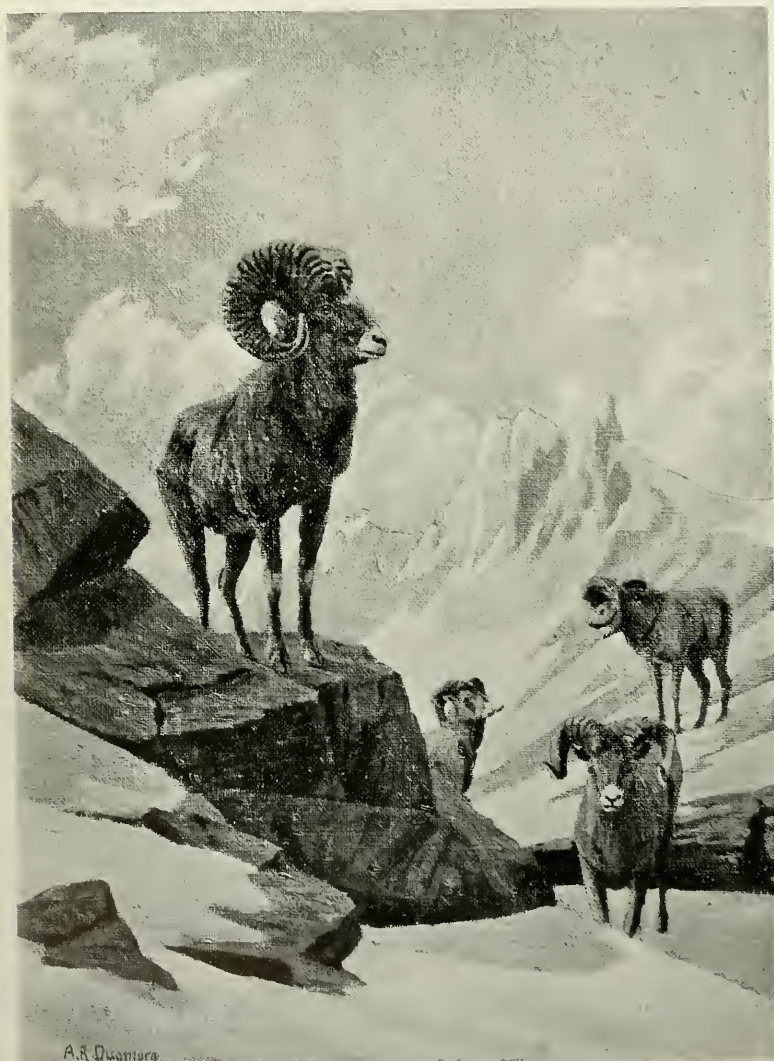
RHINOS

These cumbersome animals, with the tick birds riding on their thick-skinned backs, are among the strangest and most interesting of all the animals that Major Dugmore has painted



NEWFOUNDLAND
CARIBOU

A herd of caribou glimpsed momentarily as they trot through the sweeping flakes of a sub-arctic snowstorm



ROCKY MOUNTAIN
SHEEP

These animals have long been ardently sought by hunters, but have far too rarely been portrayed on canvas



ROCKY MOUNTAIN GOAT

Clinging to precipitous cliffs and bounding away at the least sign of danger, the Rocky Mountain goat is among the most difficult of animals to hunt, whether with gun, camera, or palette and brush



CARIBOU IN A SNOW- STORM

It is not unlikely that artists have painted so few such pictures because of the difficulty of studying their subjects. Major Dugmore has spent years in the wilds of North America as well as Africa studying, sketching, photographing, and painting





ELK

Typical of certain portions of the Canadian Rockies, this painting by Major Dugmore is among the most appealing of his canvases

in the cold draughts that blew through the valley. Not only was it necessary to have an elk take more or less the attitude that I wanted, but the sun must strike across at the proper angle, for everything depended on the long shadows. During the autumn months in the Rockies clouds are inclined to form late in the afternoon so that, no matter how clear the sky may have been all day, the sun goes down behind the clouds. Evening after evening I waited in vain; those wretched clouds would come just before the sun was low enough to cast the shadows of the trees across the shallow water. However, patience won the day, and eventually I was fortunate enough to have the right

conditions so that I was able to make the completed sketch on the spot.

These are examples of peaceful incidents in contrast to which was the experience that led to the painting of the African buffalo shown on page 235. I had spent a somewhat exciting morning trying to secure moving picture film of buffalo which were very numerous on this mountain. Toward noon all the animals had made their way into the forest, so I took up a commanding position which gave a good view of a favorite feeding ground, and then decided to avail myself of the opportunity to have lunch. As I was enjoying my simple and much needed meal, I heard buffalo making a lot of



MEETING OF THE RIVALS

Another of Major Dugmore's canvases picturing the caribou of Newfoundland



MOOSE IN BURNT LAND

A striking painting of the largest of North American mammals in a setting typical of the north woods



CANADA GEESE

A wedge of the great birds, migrating across a clouded sky. This painting catches a phase of Nature familiar to everyone

noise behind where I was sitting. Apparently the noise was coming nearer, and I wondered what was going to happen, for I confess frankly to having a very great fear and respect for these animals. Suddenly over the brow of the hill a large and much excited bull appeared, not more than forty or fifty yards away; and he commenced to tear up the vegetation in a most ill-tempered manner. Needless to say I lost interest in my lunch and crouched low in the yellow grass. For what seemed a long time that great beast stood there looking over us toward the opposite side of the valley. Then he broke into a run and crashed past scarcely twenty yards away,—fortunately without having seen me or my equally frightened camera bearers. The rear view of that disappearing buffalo delighted my heart. It had been a close call, but the picture of the animal standing against the skyline stuck in my mind with the result that I painted the picture.

Before starting work on paintings of some of the more difficult animals such as the lion, I have found it advisable to make first of all a rough sketch and then make careful clay models based on actual measurements of the skeleton. This saves some confusion, and enables me to make the final drawings with greater accuracy. It may seem to involve an unnecessary amount of work whereas it is really a labor-saving device, especially if the position of the animal is at all complicated. In doing the picture of the Canada geese in flight, I made first of all a number of photographs of the wild birds near Montauk Point, Long Island, in order to be sure of the various wing positions. Then I secured a living bird from which I did the actual painting. Occasionally with birds I find it advisable to take a fresh skin into which I rub glycerine and arsenic so that it will not harden, and mount this carefully. By this method the position may be changed at will. Sketches



WHISTLING SWANS AT SUNRISE

A gorgeous early morning sky, clouded and vivid, makes a perfect background for the swiftly flying flock of great white birds

and photographs are essential in order to obtain good results.

Some day if fortune favors me I hope to go out to Africa again and paint the famous and much photographed lions of

the Serengeti Plains directly from nature. Nowhere else in the world is there such an opportunity, and I live in the hope of accomplishing this even though it may be the last effort I shall ever make in the field



BLACKTAIL DEER



Pixie Reef, Part of the Great Barrier Reef of Australia

GIANT CLAMS AND BURROWING CLAMS

Some Marine Animals That Inhabit the Great Barrier Reef of Australia,
and Play an Important Part in the Struggle between
Its Growth and Destruction

By C. M. YONGE

Leader, Great Barrier Reef Expedition, 1928-29

THERE is something impressive about mere size. It is, therefore, not surprising that the shells of the giant clam, *Tridacna deresa*, the largest bivalve mollusc of this or any other period in the world's history, have been famous since they were first brought to Europe by the early navigators. The Republic of Venice presented Francis I of France with a pair of magnificent shells, which were later, in the reign of Louis XIV, presented to the Church of Saint Sulpice in Paris, where they are still used as holy-water basins. The Greeks who conquered Persia under Alexander the Great found "oysters" in the Indian Ocean more than a foot long, and their mention of them is probably the earliest record of the occurrence of *Tridacna*.

The giant clam is an inhabitant of

shallow waters within the tropical areas of the Indian and Pacific oceans, but is probably most abundant and attains its greatest size on the Great Barrier Reef which stretches for twelve hundred miles along the eastern coast of Queensland. Specimens measuring more than three feet in length and some two feet in breadth are common on the sheltered regions of the outer barrier reefs, while there are somewhat legendary stories of specimens fourteen feet long! Actually the largest authentic record is of an animal four feet six inches long and two feet five inches broad. An animal of this size would probably weigh about four hundred-weight.

The shells are of immense thickness and strength, and the two valves are connected at the base by an elastic ligament which

pulls them apart. An immensely powerful muscle (see figure on page 251) which may be as much as six inches in diameter, is attached near the center of each valve and by its contractions the shell is closed. Since, when fully expanded, the shell valves may gape to the extent of almost a foot, it is quite possible for a man who has stumbled into one to be caught by the ankle when the shell promptly closes. No amount of struggling has any effect other than to make the muscle contract yet more tightly, and there the unfortunate victim will be trapped until help reaches him or the tide rises and drowns him. Actually it is very easy to open the shells if one has the right tools. The chisel end of a crowbar is the ideal weapon. If this is thrust between the valves (which gape a little even when the muscle is fully contracted) and japped up and down several times in the region of the adductor

muscle, this is severed and the shell valves immediately fall apart, exposing the soft flesh within.

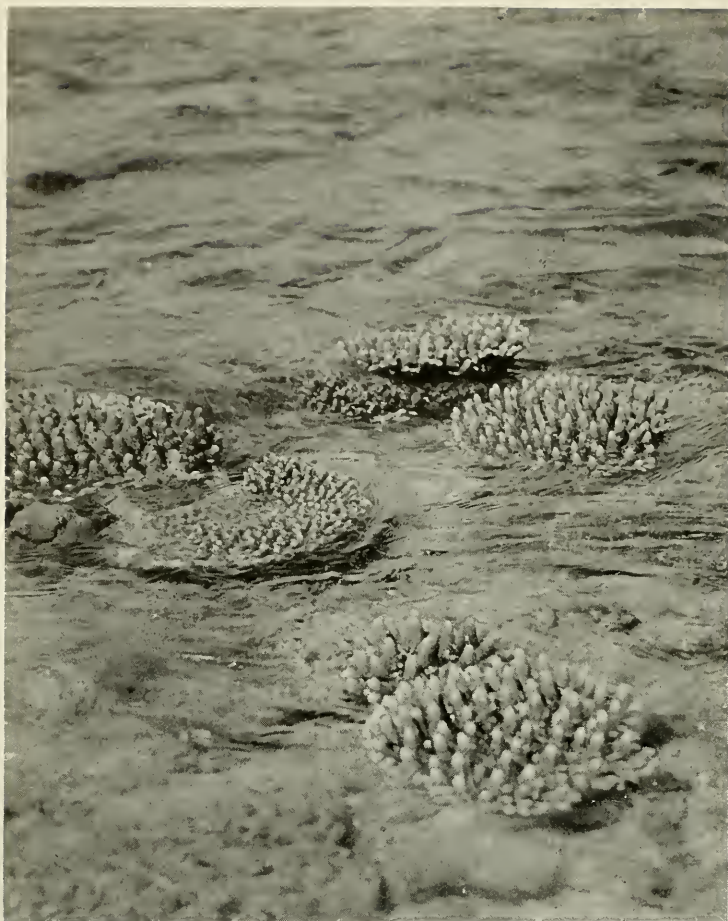
The risk of being caught by giant clams is not so serious as might at first appear because, on the Great Barrier at any rate, they are usually found resting on the surface of the reefs, and it would mean a great step upward to insert the foot between the open shell valves. Occasionally, however, the giant clam may grow in a large crevice so that the upper surface of the shell is flush with the surface of the reef. Under such conditions there is a very grave risk to the incautious wanderer. Naked divers have also been caught under water and, unable at once to free themselves, have been drowned.

The capture of such "prey" is of absolutely no value to the clam—indeed, on the contrary, it is a positive incumbrance—the whole process being the



THE MANGROVE SWAMP ON LOW ISLES

View from the summit of the lighthouse on Sand Cay, where members of the Great Barrier Reef Expedition lived and worked for a year. The anchorage, with the expedition boats, is in the foreground



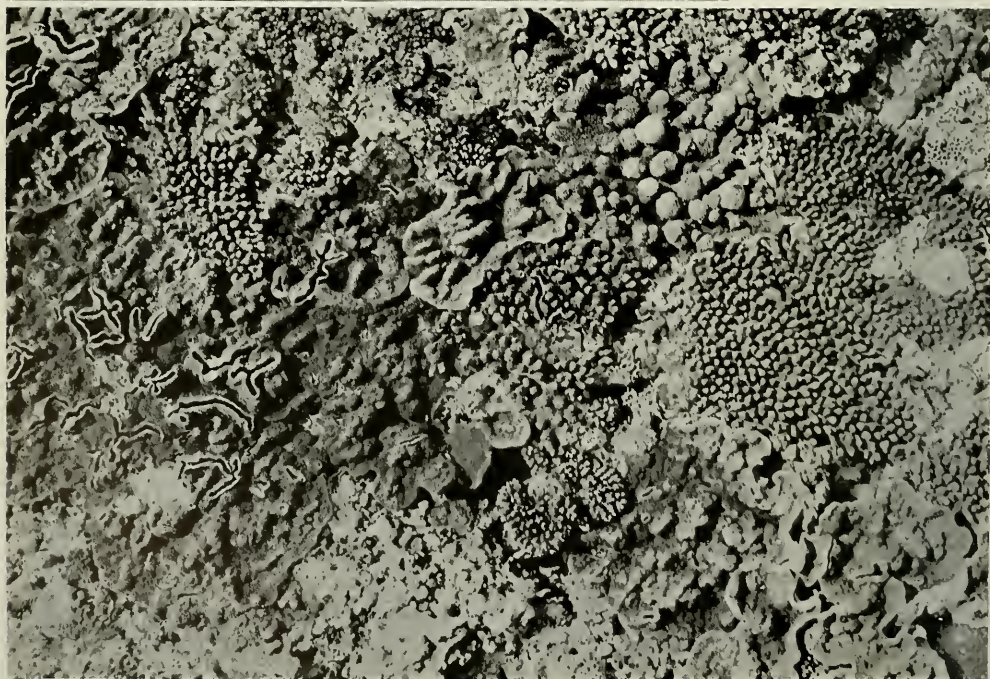
PARTLY EXPOSED MADREPORE CORALS

The conditions under which the madrepore corals grow influence greatly their development. If the water is sheltered and quiet their branches are numerous and delicate, but if exposed to rough waters they become stunted and solid



REEF BUILDERS

Corallines encrusting the corals on the surface of a reef exposed at low tide





LOW TIDE 24

The receding tides at Low Isles uncover great areas of coral, chief among which are the blue and heliotrope fronds of the picturesque madrepore coral



STAGHORN CORAL

Though giving the illusion of being strong and capable of sustaining a man's weight, the branches of the staghorn coral are really very fragile, and a heedless foot will quickly break through and sink into the jagged mass with serious results in the way of cuts and scratches



automatic response to pressure against the flesh exposed between the gaping valves. In spite of its spectacular size, the giant clam feeds in the same manner as the common bivalve molluses, such as mussels, cockles, and oysters, and upon precisely the same type of food. When a clam is seen from above, as shown on page 250, the colored flesh, or mantle, is seen to possess two openings, one long and slit-like and the other round and situated at the summit of a projecting cone. As shown by the large arrows in the diagram on page 251, a stream of water is drawn through the first of these and out by way of the second. This current is continuous so long as the shell valves are open, and is brought about by the beating of innumerable fine hairs, or cilia, which cover the surface of a complex lattice-work of tissue which were originally

thought to be concerned with respiration and are still called gills. The beating of cilia on the sides of the delicate bars which compose the lattice-work of the gills causes a current to be drawn through the gills and ejected by way of the second, exhalent opening. But, although water is drawn through the gills in this manner, the openings are too small for the passage of the minute floating animal and plant life of the sea, and this is collected on the surface of the gills which are actually very delicate and efficient sieves.

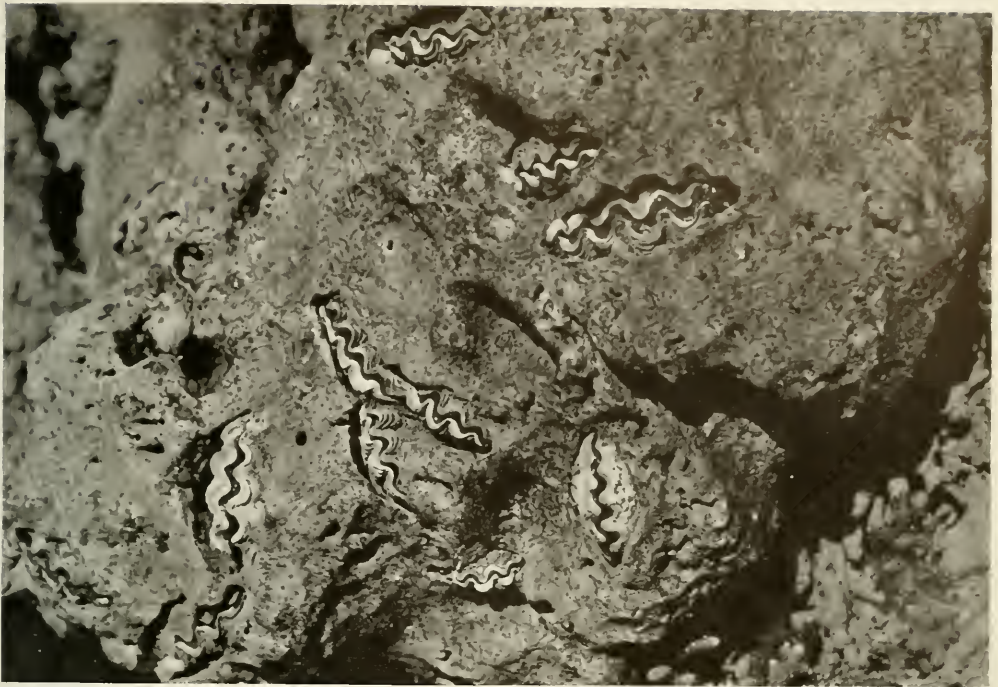
The minute particles, animate and inanimate, which collect on the surface of the gills, are conveyed, in the manner indicated by the arrows in the diagram, toward the mouth. This is guarded on either side by a pair of long, triangular flaps known as labial palps, which are



Photograph by G. W. Otter

A GIANT CLAM
(*TRIDACNA DERESA*)

The gaping shell valves of this remarkable creature are exposed by the low spring tides, and form a trap for the foot of a careless explorer on the reefs, as they close promptly and with a powerful grip upon anything inserted between them. This specimen is about three feet long



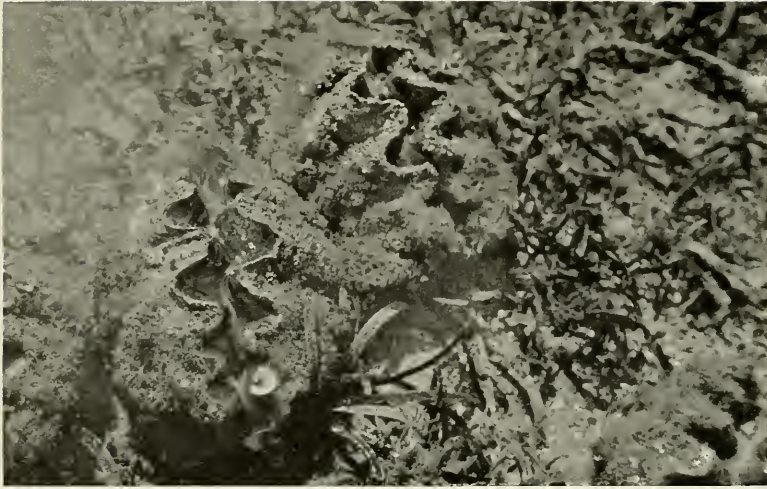
A REEF DESTROYER

A dead coral boulder being riddled by the common burrowing clam (*Tridacna crocea*), one of the many agents of reef destruction

covered with a series of parallel ridges on their inner, opposed sides, but are smooth on their outer surfaces. These palps, as in practically all bivalves, are most important organs. They possess elaborate series of ciliary tracts the function of which is to sort out the food. The larger particles are rejected and the finer ones passed on to the mouth and thence into the stomach. The rejected material is collected beneath the palps and then conveyed backward toward the inhalent opening, whence it is from time to time ejected as a result of sudden contractions of the great adductor muscle, which causes a sharp jet of water to be shot out of both inhalent and exhalent openings. A reef just covered with water when the tide is running out or just rising presents a curious sight, for little fountains of water keep appearing everywhere, each one denoting the presence just beneath the surface of a clam which has suddenly

contracted. The passing of a shadow over the animal will frequently cause it to contract, and it is quite customary for an observer to be met with a shower of water when bending down and peering through the surface.

So far the description of the anatomy of the giant clam might apply with only slight modifications for other bivalve molluscs. But now we come to an important and most interesting peculiarity common to the various species of clams but unknown in other bivalves. The fleshy mantle which is exposed when the animal is expanded and actually curls back over the edge of the valves of the shell is always beautifully colored. In the giant clam the mantle is usually brown or olive-green with bright emerald-green spots and occasional lighter areas. In the smaller clams, as we shall see, it may be much brighter. But the most remarkable feature about the mantle is not



THE HORSE-HOOF
CLAM

Hippopus hippopus
in its normal habi-
tat. Its closed shell
looks very much
like the hoof of a
horse. The scal-
loped edges inter-
lock so perfectly
that the mantle be-
comes completely
enclosed

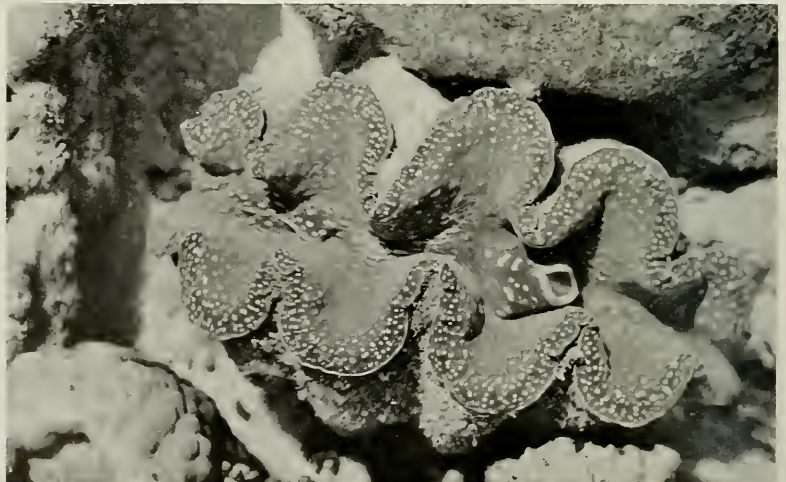
its rich and beautiful color but the presence within it of innumerable minute, round plant cells. These are brown in color and no more than $\frac{1}{2500}$ of an inch in diameter, each being composed of but a single cell which increases by division into two.

One of the most striking characteristics about reef animals—corals and their allies especially—is the presence within their tissues of similar unicellular brown plants, and there can be no doubt as to the great significance in the life of animals composing coral reefs of this “symbiosis” with plants. But, whereas

corals are carnivorous animals which invariably refuse vegetable matter which they are unable to digest, the clams are natural herbivores living on the minute plant life or “plankton” which drifts about in the sea. The nature of the association between the plants and the corals and the plants and the clams is, accordingly, very different. In the former the plants gain protection and abundant food, for they rid the coral automatically of its waste products which are largely the inorganic salts out of which plants can build up first starch and later proteins. The plants thus form perfect excretory organs

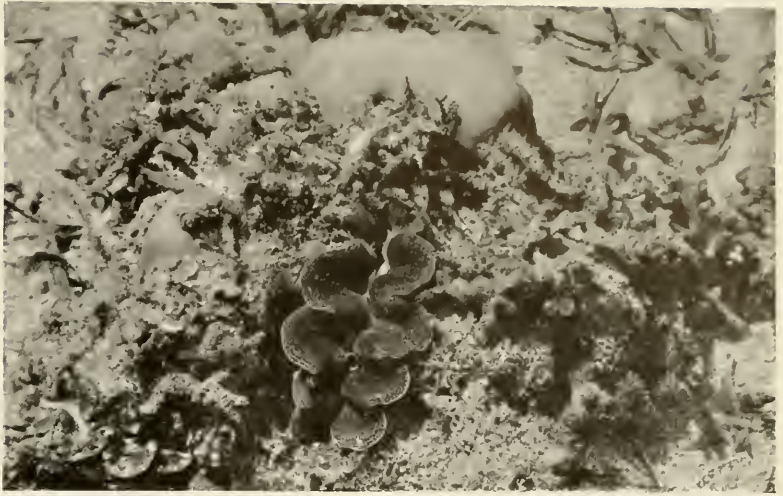
GIANT CLAM
UNDER WATER

Here it is fully expanded, with the colored mantle tissue exposed to so great an extent that it has a foliated appearance. The exhalant and inhalant openings are shown. The giant clam plays its part in the economy of life on coral reefs and is also of value to native peoples



BURROWING CLAM UNDER WATER

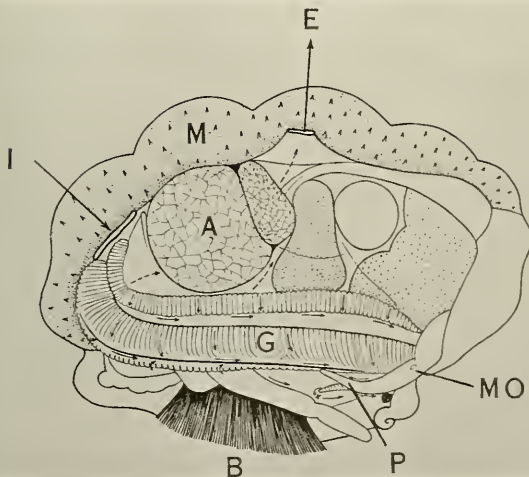
The blue mantle tissue is fully expanded, entirely concealing the shell, and exposing the conspicuous exhalant siphon. At the lower left in the picture is the expanded mantle of a frilled clam



and are of particular use to an animal that is deficient in such organs. The clams, on the other hand, have much more highly organized bodies, an excellent blood system, and satisfactory excretory organs. But they need abundant food and the plant plankton in coral reef seas is scanty. They would appear to have overcome this scarcity of food, in part at least, by cultivating in the exposed edges of the mantle abundant crops of an ideal food. If the surface of the mantle is scraped very lightly with a knife, a brown scum is obtained which consists of practically nothing else but these unicellular

plants. They are also found in process of ingestion and digestion within the stomach and other parts of the digestive system.

There are no other bivalve molluscs which possess such thick, fleshy mantles or which expose them to the same extent, curled back over the edge of the shell valves. Even in the brightest day when the water only just covers the clams and they may be exposed to a temperature of over 35° C, they are always fully expanded with the surface of the mantle completely exposed to the powerful rays of the sun. The contained plants are thus under ideal conditions, for they must have



ANATOMY OF THE BURROWING CLAM

The mantle tissue on the one side has been removed. A, adductor muscle; B, byssus threads; E, exhalant opening; G, gills; I, inhalant opening; M, mantle; MO, mouth (underpalps); P, labial palps. Large arrows denote direction of water currents, small arrows direction in which food is carried on the gills, and broken arrows the route taken by water after it passes through the gills. With the exception of the byssus threads, the anatomy of the giant clam is practically identical

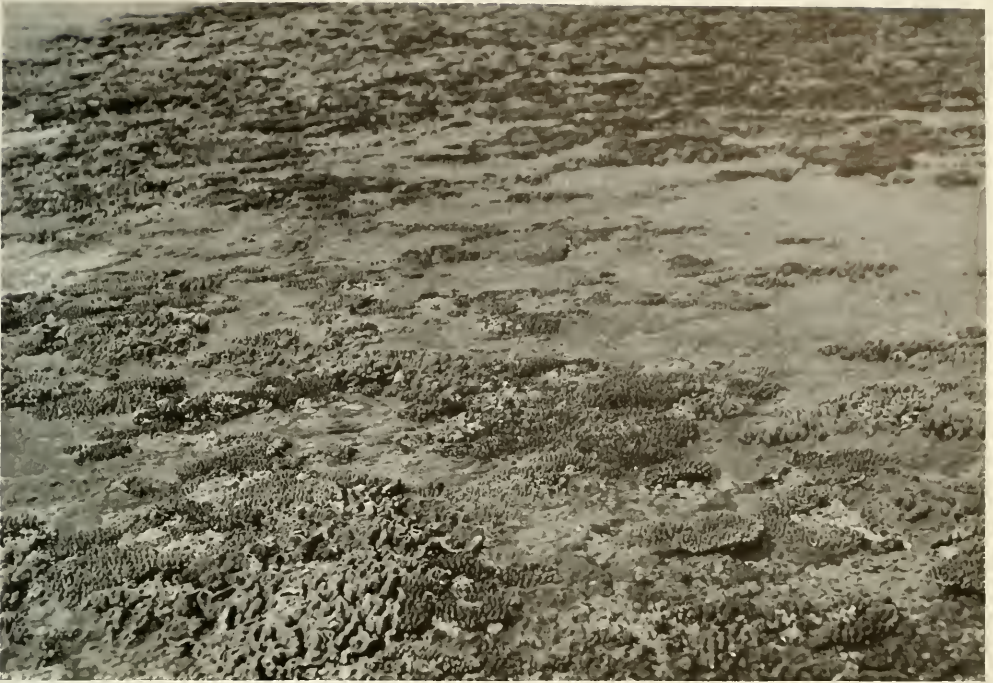
sunlight without which their contained chlorophyll cannot build up starch out of water and carbonic acid gas. At the same time the chlorophyll works most efficiently when the light is not too powerful and the deep colors of the mantle probably act as very effective light screens. Alone amongst bivalve molluscs, therefore, the clams grow abundant supplies of ideal food within their own tissues. The plants, on the other hand, gain protection, abundant food and exposure to light, while only the excess is taken as food by the clams.

The giant clam plays its part in the economy of life on coral reefs and is also of value to native peoples. The massive shells form a not unimportant part of the material of reefs in certain areas and assist the skeletons of corals in providing the "bricks" of which reefs are made, the "cement" being provided by calcareous algæ, or nullipores, which grow over every

dead surface, binding the loose pieces together. The empty shell valves make excellent basins and as such have been, and still are, used by natives. Many of the islands of the Torres Strait between Australia and New Guinea are of coral origin and have no standing or running water upon them. Nowadays those which are inhabited have great underground cement tanks into which runs the water collected on the roofs of the native houses, the supply accumulated during the wet summer season being sufficient to carry the community over the dry winter months. But in former days, as reported by Captain Matthew Flinders in 1802, and the French explorer, Dumont D'Urville, in 1840, the water was collected in empty clam shells so placed as to catch the drips that fell from the Pandanus palms. Lastly, the giant clam is edible, the big adductor muscle being especially prized by natives. Captain



A BIT OF THE LARGEST CORAL FORMATION IN THE WORLD
Corals exposed and awash in the lee of an outer reef of the Great Barrier



AN OUTER REEF AT LOW TIDE

Showing the stunted, encrusting type of coral that grows on the outer reefs exposed to the sea

Cook on his voyage of discovery along the east coast of Australia in 1770 was struck by the size of these "gigantic cockles" and gave them as fresh meat to his sailors, finding, which is hardly surprising, that one was more than a sufficient meal even for them.

There are other clams which have habits similar to those of the giant clam and differ, apart from their smaller size, in details only; indeed, so little is known about the development of these animals that it is frequently difficult to decide whether a particular clam is a young giant clam or a distinct species. But the horse-hoof clam (*Hippopus hippopus*), though closely allied to the clams of the genus *Tridacna*, is quite distinct. It has shell valves which interlock perfectly when shut and which are rather different in shape and sculpturing from those of *Tridacna*. The mantle is not exposed to quite the same extent (although there are

abundant unicellular plants within the pale olive-green or gray tissue) for it never overlaps the shell. Like the giant clam and certain other species of *Tridacna*, the horse-hoof clam lives always on the surface of reefs, although it is confined, like them, to the sheltered lee side. It is not secured in any way to the surface but relies solely on its weight to prevent its being carried away by the force of the sea. *Hippopus* is seldom more than a foot long but is somewhat broader in proportion than *Tridacna*.

There are three species of *Tridacna*, all very common on the Great Barrier Reef, which are invariably found, not free on the surface but burrowing into coral rock. These were at one time considered to be the young stages of the larger, freely-exposed species, but are now known to be distinct species with very different habits. The burrowing species are never found free on the surface of the reefs or vice



SAND CAY AT LOW ISLES
Showing the huts used by the expedition during its year's stay



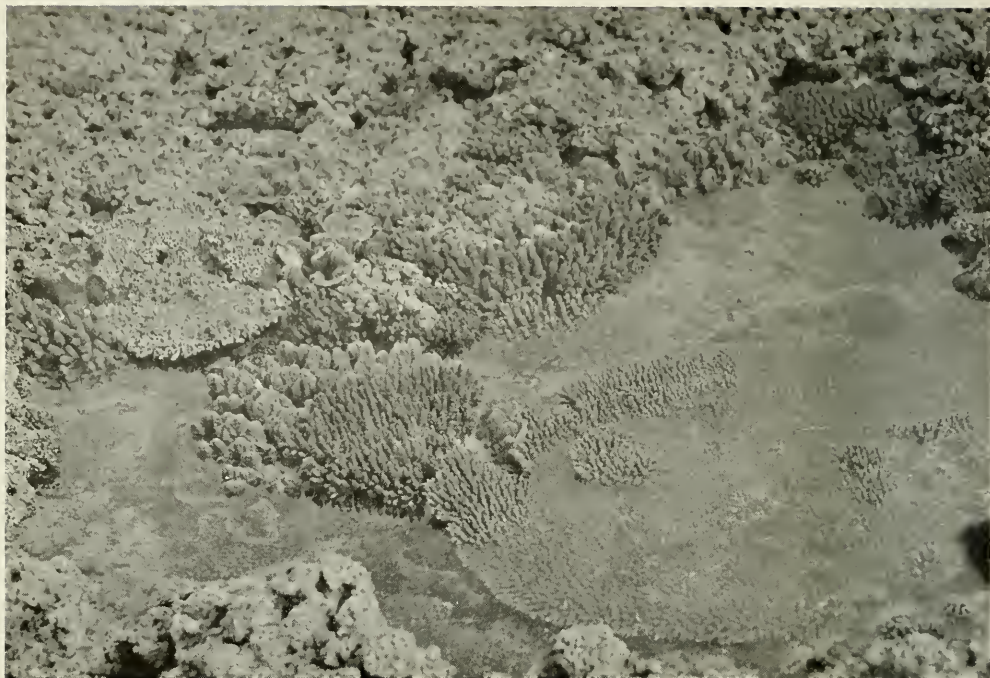
BRANCHING STAGHORN CORAL
Partly exposed on the lee of Mer Island, Torres Strait



WHERE THE GREAT BARRIER REEF EXPEDITION WORKED
Experimental area of reef at Low Isles when exposed by the tide



THE REEF EDGE
Wind and sea play their part in shaping the structure of the Great Barrier Reef



A CORAL POOL

Starfish, sea urchins, crabs, and mollusks lie hidden beneath the overhanging growths in the quiet, shallow pools among the varicolored corals

versa. There is a very good reason for this. If burrowing clams are taken out of their burrows and exposed in a pool they are immediately attacked by crabs and other crustaceans and the flesh quickly eaten away. These enemies enter by way of a large opening between the shell valves on the under side, which is absent in the freely exposed species and in *Hippopus*. Through this opening passes the muscular foot and, more important, a mass of byssus threads such as secure a mussel. In the case of the burrowing clams these threads are exceptionally numerous and strong and by their agency the animal is fastened down tightly to the rock and, by rocking on this fulcrum, the shell valves grind away the comparatively soft limestone at considerable speed until they have excavated a burrow so deep that the upper margin of the shell is just flush with the surface. The appearance of a rock bored by them is shown on

page 249. The giant clam and *Hippopus* do not, at any rate when fully grown, possess a byssus and there is consequently no gape between the shell valves on the under side. It is probable, however, that they are attached when young, as it is difficult otherwise to see how they would maintain themselves.

The commonest of the burrowing clams, and by far the most destructive, is the smallest of the three species known as *Tridacna crocea*. Its burrows are shown in the figure on page 249, and its appearance when expanded, in the figure on page 251. The mantle, which is even more widely exposed than in the giant clam, is invariably deep blue. It bores into solid blocks of coral rock—never into any other substance—and is by far the most efficient of the borers. The boulders in certain areas are riddled with the burrows of these animals which lie literally “check by jowl.” Even the

largest specimens seldom exceed six inches in length.

The two other species of burrowing clams, *Tridacna elongata* and *Tridacna maxima* var. *fossa*, are somewhat larger and are amongst the most striking objects on the surface of the reefs. These are the so-called "frilled clams" whose sinuous mantles are always brilliantly colored, green, blue, yellow, orange or brown, every color but red. They both grow to double the bulk of *Tridacna crocea* but are not such efficient burrowers, for they never work their way into solid rock but are confined to areas of dead branched coral or half-consolidated fragments, in the holes amongst which the young clam probably establishes itself, enlarging and deepening the cavity as it grows.

All these burrowing clams, and especially the first described, are very important reef organisms. All coral reefs are the site of a constant struggle between

the forces of growth and the forces of destruction. Of the latter the fury of the sea is probably the most potent, but hardly less important is the action of many boring organisms which quickly reduce the coral rock to small fragments and to coral mud. The burrowing clams are the most spectacular and not the least important of such animals, and by their activities more than counterbalance the additions to the material of the reefs provided by the massive shells of the giant clam, the horse-hoof clam, and the other freely exposed species

The immense size of the giant clam, the boring habits of the smaller species of *Tridacna*, and the habit, unique among bivalve molluscs, possessed in common by all these clams, of cultivating a portion of their food in their own tissues, together combine to make *Tridacna* and *Hippopus* among the most interesting of all marine creatures.



STARFISH WITH CORALS AND VARIOUS ENCRUSTING GROWTHS ON THE SURFACE OF A REEF



© Photograph by Mary L. Jobe Akeley

Mt. Sir Alexander, the Northernmost Dominant Peak of the Canadian Rockies

THE EXPLORATION OF A NEW PEAK IN THE CANADIAN ROCKIES

The Mapping of the Headwaters of the Fraser River

BY MARY L. JOBE AKELEY

AT the headwaters of the Fraser River stands a mountain gigantic and sublime. Its snow cornices and hanging glaciers protest the ascent of man to its jagged summit. Its gray and serrated rocks rise in forbidding pinnacles at every hand. Its flowing glaciers—steel-hard, crevassed and blue, trail downward into forests of spruce and balsam, thick and green, that crowd about its base.

A little more than a decade ago no one had set foot on this northern sentry of the wilds. Nor had any one witnessed its splendors at close range. On early mornings the mountaineers who scaled the greater peaks of Robson and its neighbors, could plainly see the snow dome of this mountain lifted high above the enveloping haze that clung like a soft and opalescent drapery from base to shining summit.

"There's a fine new country beyond the Smoky," they had all agreed.

On clear days it seemed less than one hundred miles away as the crow is supposed to fly and as afterward it proved to be, but on the days when the atmosphere was more opaque, it hid itself completely in the interminable blue. As I had climbed among the peaks on the great divide where Arctic and Pacific waters part, this northern peak became for me an insistent challenge. I resolved to set out to meet this mountain face to face, and if luck should hold, to stand upon its top.

Fifteen years ago, the area along the Continental Divide, north and west of Mt. Robson, the highest peak of Canada, was "new country." The government survey extended only twenty miles beyond this great peak. During six weeks of that summer, I made an expedition into this unmapped region, accompanied by my friend, Margaret Springate of Winnipeg, and our two guides, Donald Phillips, veteran Canadian guide and

mountaineer, and his brother Wilkins. Phillips in 1909 with G. B. Kinney had made the first pioneering ascent of Mt. Robson, reaching a few feet below the actual summit in a driving snow storm. From youth he had guided in Ontario and later in Alberta and British Columbia. His unusual ability equipped him well to lead our little outfit through valleys and forests and across high alp-lands where the only trails were those made by the grizzly, the big horn, the moose, and the caribou.

The area we set out to investigate was between 119 degrees and 121 degrees west longitude and between 53 and 54 degrees north latitude. Our "farthest north" was attained by trails almost entirely of our own making, a distance of two hundred miles northwest of Robson Station, on the transcontinental railway. It was here that we definitely located our Big Ice Mountain which we temporarily named "Kitchi," ("The Great" in the Cree Indian language) and which was afterward named Mt. Sir Alexander by the Geographic Board of Canada, for the famous explorer of the Rocky Range, Sir Alexander MacKenzie.

It began at Winnipeg in June.

"Why shouldn't we go in together and have a look at that big mountain?" Miss Springate and I had asked each other.

She, a hardy Englishwoman, was keen for roughing it, while I, then with five seasons of mountaineering in Western Canada to my credit, was thoroughly at home on the trail. We both believed our

trip should materialize into something worth while. Here was a chance to see what would one day be put in those blank spots on the map. Who knew, save a solitary Indian or two, what was hidden in the recesses of those mysterious ranges?

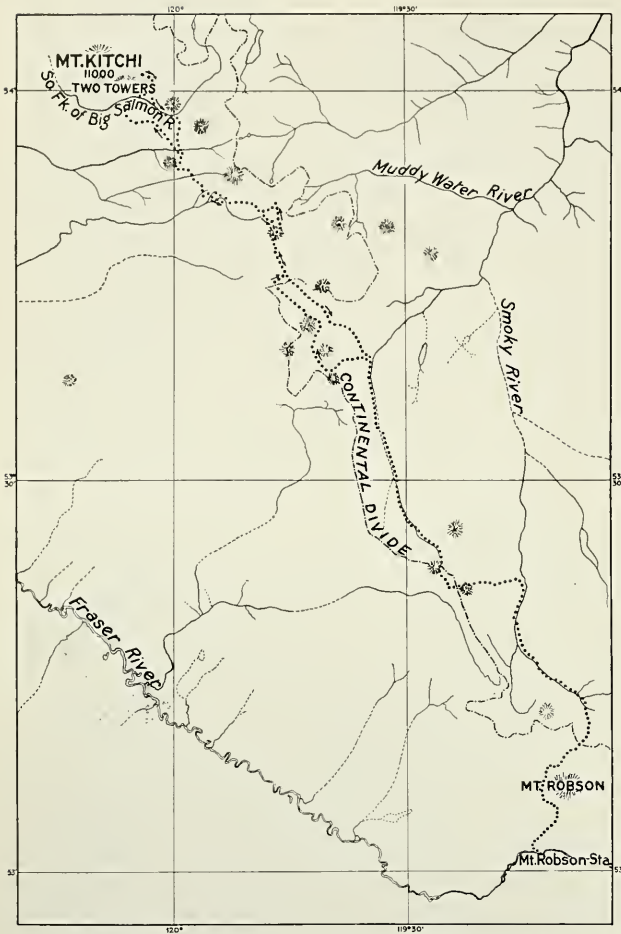
In July we left Jasper for Grant Brook on the Fraser River, twenty miles west of Yellow Head Pass. Here Phillips' outfit met us and we took the trail north to Moose Pass, from which point we made a reconnaissance climb to determine our route to the Big Mountain. Here let me explain that such wilderness travel is done on horseback, the food being carried



© Photograph by Mary L. Jobe Akeley

ONE OF THE STEEP TRAILS

Many miles of new trail were cut out of the dense forests that everywhere block the route to "Kitchi" (The Great Mountain)



THE DOTTED LINE SHOWS THE NEW ROUTE EXPLORED IN 1917 BY MARY L. JOBE AKELEY AND MARGARET SPRINGATE, FROM MT. ROBSON TO THE TRIBUTARY HEADWATERS OF THE FRASER RIVER

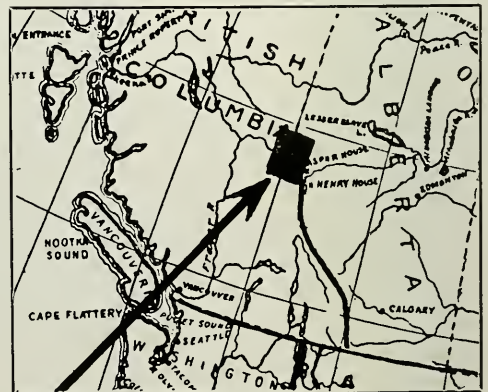
on the backs of pack-horses. An outfit is the horses and their equipment. These cayuses, as the northern horses are called, can go wherever a man can go without using his hands; but naturally there are many places where the "passenger" from motives of comfort, precaution, or sheer fright will prefer to walk and lead the cayuse.

We pitched our camp at tree-line on the flower-filled slopes of Moose Pass, and from it as we ascended Mt. Pamm, we had our first view of "Mt. Kitchi." It rose, a great white pyramid, shining out through the distant horizon haze, and lifting its glaciated head far above the black peaks

of its immediate environment. We conjectured that the peak was eighty or ninety miles distant from us.

Our plunge into the wilderness was made northward along the Big Smoky, a large tributary of the Peace, which heads in the Robson glacier, thence up Glacier Creek, and over Bess and Jack Pine passes to the headwaters of the Jack Pine. On the big hill at the Smoky Cañon we found the trail extremely steep. For about two hundred feet where it follows the edge of the river, it is less than two feet wide and at least seventy feet above the water. Before taking our outfit over, our men worked for two hours cutting trees to build out the trail and filling it in with broken rocks to insure a footing. The horses, well trained in wilderness travel, came over the steep descent cautiously, testing every step and sniffing occasionally at a cayuse skeleton bleaching at the foot of the precipice.

The approach to Jack Pine Pass had been very abrupt, rising and descending 1500 feet in less than a mile, but



THE ARROW INDICATES THE LOCATION OF THE EXPLORED AREA IN BRITISH COLUMBIA



Photograph by Donald Phillips

HARD CLIMBING

Mary L. Jobe Akeley back-packing on the thirty-mile trail separating her last camp from the great mountain

the descent on the north side of the Pass was the steepest place I had at that time ever seen horses negotiate. At one place we had traveled along on a deep-furrowed grizzly-bear trail, where a whole army of grizzlies had marched up and down, each stepping exactly in the track of his predecessor, until deep black holes fifteen inches long and eight inches wide had been beaten into the ground. Our cayuses, with goatlike sureness of foot zigzagged down a forty-degree slope at a terrific speed, marvelously maintaining their balance. In this, our longest day out, we had been on the twenty-mile trail ten hours; we had made an ascent of 5000 feet and a descent of 4000. It was the only day we stopped for any rest or substantial food. Heretofore and afterward a few raisins, a little sweet chocolate, and a cracker or two had kept us going from a 6:30 A.M. breakfast until a 2:30 P.M. camp.

Beyond the Jack Pine the only trail

was a snow-shoe trail which Phillips and Frank Doucette, his trapping partner, made in 1911. Reaching one of their old caches, we expected to find flour, rice, and butter, but the robber wolverines had destroyed everything to the last morsel. This was a great loss to us, and put us on short rations more quickly than we had anticipated.

Beyond the head of Jack Pine our difficulties increased. All day we waded on foot through muskeg too soft to hold up our horses or plunged through streams to our knees and then fell through thickets of alders twelve feet high. The rain beat down steadily, and we were steaming hot under our rubber coats, and at the same time drenched to our waists. It is impossible to ride through such country. No horse can hold up a rider when he has nothing but a peat bog for a footing. Ten maddening hours of trail-cutting and muskeg! Finally we discovered a comparatively dry, hard spot, a little island sur-

rounded by two channels of the river—the only place level enough to hold a tent and at the same time not a spongy muskeg. There was scant picking for our horses, no brush for our beds, and the firewood had to be chopped on the other side of the river and carried across. Almost insensible to fatigue, I had even ceased to mind the constant “squish-squash” of my feet slipping up and down in water-logged stockings in my overflowing boots. We unpacked our horses in the driving rain.

While the kitchen boxes were being taken off, dry, dead twigs of spruce—those curled close to the trunk protected by the sweeping green branches above—were secured, and these with a few heavier branches started the blaze which means “food,” the most potent word in the forest. Our kettle was soon steaming, our hunger satisfied, as our boxes yielded bannock and canned pork-and-beans. Our thirst was forgotten in the divinest drink in the world—tea, “trapper’s tea”—tea that will float an egg, tea that will set you going again if need be on the trail.

At the head of the Jack Pine where we were practically at the end of Phillips’ knowledge of the country, it was necessary for us to locate our peak again and get our bearings and landmarks for the remainder of our journey. Climbing a near-by ridge to an observation peak, 7600 feet according to the aneroid, we photographed the landscape on all sides.

To the southeast Mts. Robson, Whitehorn, Resplendent, and Pamm (our first locating climb) were plainly visible; northwest two black peaks (we called them the Black Twins) were prominent in

the foreground. Our course was correct, for the Big Mountain, now much farther off than Mt. Robson, was distinctly visible north of these twin peaks. For several days succeeding, as we traveled on, they continued to be our landmarks. From this station here above Jones Pass, the Big Mountain, with its great snow and ice abutments, was more prominent than any other feature of the northern landscape.

Great tumbling gla-



© Photograph by Mary L. Jobe Akeley

THE GREAT ICE MOUNTAIN

A massive, white, shining peak lifted itself above high rock cliffs into the blue

ciars everywhere surrounded it, while the summit seemed a long, knifelike *arête* with a long slope to the southwest and another to the northeast. Through the glasses the south face appeared extremely difficult. As is usually the case in these ranges, we later found the north face impassable. From this point all the main ranges lie northeast and southwest; only four were visible, but we crossed eight later on, and at this point we were less than halfway.

We were in the midst of wild country. Here, right in our path, on a green slide, a black bear fed contentedly; below us a big bull moose strode through the meadow where our horses were grazing, and came leisurely up the mountain-side toward us; at the top of the ridge a flock of goats as white as the snow itself gazed a thousand

feet down into the deep gorge, watching another goat climb nimbly toward them. A flock of ptarmigan still in semi-winter plumage fluttered across the snow in front of us, while a horde of gophers scurried away under our feet. That night our camp-ground was so steep that I rolled out of my tent.

Across this alpine pass we wrestled mightily with dense woods—cutting our way, foot by foot, until we came down into a long valley of open muskeg. Through this we traveled all day. So far our route had lain chiefly in the province of Alberta. We now crossed a 5300-foot pass, near the boundary where the meadow is filled with beaver dams, and a mile beyond came to another 5300-foot pass leading into British Columbia. Here the mountains are choked with vast forests filled with the thickest undergrowth, which meant serious and exhausting exertion for both man and horse.

Beyond the East Smoky basin and the east watershed of the West Smoky we

came to a small stream flowing into the West Smoky. Here we halted our outfit for the last time. To reach this spot Phillips had brought our horses down 1500 feet over sheer, shifting shale. It was impossible to take the animals farther. In a dense spruce forest we made a permanent base camp and cache and turned our horses out in an extensive meadow to graze. We hoped they would be there on our return.

Our real work had just begun. Un-speakably rough, wild country lay between us and the Big Mountain; that we knew; how vast and how difficult, we could only conjecture. Our last hope of reaching it was to "back pack." Accordingly we took four days' provisions and our personal and climbing outfits on our backs and started into the unknown. I felt a sadness at leaving those cayuses behind; never before had I realized what it meant to be a pack-horse; never before had I been so tortured by a pack. Miss Springate and I



© Photograph by Mary L. Jobe Akeley

FAITHFUL AND SURE-FOOTED MOUNTAIN CAYUSES

Without pack-horses travel in this type of country would be impossible

each carried an eiderdown quilt, our personal belongings, and our heavy cameras—fifteen-pound packs. The men carried thirty to forty pounds. There was a small shelter tent for Miss Springate and me while the guides had one small canvas bed-cover between them in lieu of a blanket. One frying pan, two small pails, four cups, and four spoons were the sum total of our kitchen and table outfit. I allowed myself the luxury of one cake of soap and a toothbrush, two oranges and six lemons for the climb, but a towel and a change of raiment were forbidden. It is a severe mental ordeal to make up four such packs. You are torn between the desire for warm clothing and the distaste for carrying a heavy burden.

Securely caching our main supply of food and clothing under the big tent-fly and leaving on a blazed tree a legend telling of our route and destination, we plunged into dense alder thickets, and into a tangle of devil's-clubs in full leaf and higher than our heads, whose thorns pene-

trated our thickest clothing. Forging the West Smoky, we struck hard climbing on the mountain beyond. From the base of the mountain ran abrupt broken cliffs of gray, weathered rocks covered with thick scrub through which we fought our way. Our packs were heavy, there was no sign of water, the heat was intense, and our progress was slow.

Hard travel had been our daily portion for three weeks, with long days and short hours of sleep. For the past week I had scarcely set foot in the stirrup, and I felt the fatigue resulting from unusual exertion and insufficient rest. Up, up we climbed. Noon came and passed, and still no sign of water. Suffering from hunger and tormented by thirst, we ate our lunch, using two of the precious lemons to wash our parched throats. On, on, and still no water. Finally, two hours later, near the top, and when we were in desperation, we found a tiny trickling stream from which we collected a few spoonfuls of water in our rubber drinking cups.



© Photographed by Mary L. Jobe Akeley

THE RAMPARTS OF MT. SIR ALEXANDER

Two colossal rock peaks rose above a wide deeply crevassed glacier

We climbed over a broken ridge and came out above tree-line into a rock-filled amphitheater, to find that still another ridge and valley separated us from the Big Mountain. Crossing about two miles of this rock-fall, we scrambled over a long, treeless ridge and beheld without interruption the Great Ice Mountain. A massive, white, shining peak lifted itself into the blue from a walled fortress of rock. Two colossal rock towers stood guard on the north-east, while on the south rose a long file of lesser peaks, glacier-hung and glowing with iridescent tints in the evening sunlight. Beyond the two big towers we glimpsed a wide glacier, while the valley, with a broad foaming river trailing through its depths, dropped

cañon-like in front of us, from gloom to deeper gloom, to meet the cascade of color pouring from the mountain itself. We were amazed at the beauty of the scene. Our mountain was far more impressive than we had ever dreamed.

We donned our extra sweaters that night, stretched up the little silk fly, and slept in front of a blazing fire. We had allowed only four days to explore the mountain, and we were still one long day's march from the east side, which we considered feasible for climbing. As our progress in a direct line toward the mountain was now hindered by steep

cliffs, we made a detour to the west through an opening down an almost perpendicular wall, well forested with rhododendrons and devil's-clubs. Here we reached the valley of the large glacial river, the Big Salmon, with its three converging branches, each with its headwaters flowing from vast glaciers on the northeast side of the Big Mountain.

This additional day now required to reach the base of the mountain put us on short rations. One large flapjack without any trimmings was our luncheon allowance. It was amazing how that flapjack stayed us during the six and one-half hours of our afternoon's march. We were nearing our goal. We intended to camp on the terminal moraine of



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THE SHARP PINNACLE
OF MT. SIR ALEXANDER

Eleven thousand feet in elevation.—In this photograph the peak shows clearly, but it is often obscured by heavy snow clouds

the east glacier, where it runs into the timber, and where it would be easy to obtain fuel. However, an approaching thunder-storm made camp a necessity about a mile below the moraine. We barely got the little silk shelter-tent up, and our packs and some dry balsam boughs inside when the storm broke. All night the rain and snow fell. The next day was an impossible one for climbing. The rain stopped in the afternoon, and Phillips went out to reconnoiter. He felled a tree across the river, still too powerful to ford even at this proximity to its source.

At a distance, the long, flowing east

glacier had seemed the feasible line of attack, but now at close range we saw that perpendicular cliffs 2000 feet high cut off the approach to the main peak. It was therefore necessary to look for another route, and we hoped that the north or west slopes might be practicable. This hope was not founded on our observation of the mountains in this region, for the north side is always the difficult one. Returning in the darkness at ten o'clock—the night had fallen two hours earlier than usual on account of the overhanging storm-clouds—Phillips declared that he was able to locate a route only to the base of the last peak. Beyond that he could not see.

The morning dawned cloudy.

The past days had been very difficult for Miss Springate and she determined not to attempt the climb. At six o'clock, therefore, Phillips, Wilkins, and I started across the two miles of deeply crevassed, flowing glacier on the east side of the mountain. We soon struck great crevasses fringed with huge *seracs* and shadowed by the everlasting snows. We were surprised to note that our aneroid registered only 4000 feet, thus proving that these glaciers are 1500 feet lower than they are at Mt. Robson. The ice was as hard as steel, and we crossed it with great speed. From a long, lateral moraine we climbed on the northeast face of the

mountain over rock-falls and cliffs to the glacier beyond. Here a vast blue-green ice fall fringed the sky line, overhung the sheer, gray cliffs, and constantly avalanched down to the long moraine below.

The ice was thrown up in gigantic piles, like a long line of huge, fantastic animals ready to spring into the depths below. The murmur of hidden streams came from subterranean depths. Now and then came the roar of an avalanche; no wonder we had heard them when twenty miles away; but all the rest was deadly still. This glacier is like a strange, new world. Photographs may suggest its wonders but they cannot portray its awful magnificence.

Just as we reached this second glacier, heavy, gray

snow-clouds broke in a rage over us. Pulling on our extra sweaters, mittens, and caps, against the wind, we huddled close to the rocks, gasping for breath, and watched the storm hurl itself on the valley below. Now the view of the flowing glacier and the southern ridge shifted and changed like a kaleidoscope. First the clouds rent themselves on the high towers and enveloped their lower cliffs in mist and in driving, sleety rain; below, the clouds drifted down, down, to where the jade-green glacier crawled into the dense, black forest, where we could see the long branches beating to and fro wildly under the fury of the storm. All



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HEADWATERS OF THE FRASER RIVER

They flow in a wide and turbulent stream immediately from the glacier of its source

around us were biting sleet and snow and the dread roar of the avalanche echoing from peak to peak.

Presently the clouds thinned a little; it grew lighter, and we started on. For two hours we traveled very carefully across the crevasses, hoping that the storm would cease. Instead, it now began to snow harder, the ice chasms drifted full of snow, and climbing became both difficult and dangerous. I could not see fifteen feet in any direction. It was ghostlike, threading in and out among crevasses encompassed by the mysterious storm. I was appalled whenever the storm thinned for a moment and I looked into the yawning caverns of ice at my feet. Above us the sharply sloping pinacles were lost in the frozen mist, below us the ice-tongues ran downward into dense cloud-banks. My sleet-incrusted clothing was like a coat of armor. My hands were wet and paralyzed so that I could scarcely grip my ice-ax, and my benumbed feet were heavy and unsteady in my snow-clogged boots.

With the storm thus beating down upon us we could not catch even a glimpse of the north side of the Big Mountain. I knew that our diminished "grub-pile" made another attempt doubtful, and the thought of failure made me very unhappy. However, there are several conditions in climbing when it is best to

agree swiftly with the laws of nature. A blizzard heads the list. Never argue with a snow storm at 7000 feet above sea level! Give it up and wait for a fair day! With the storm still breaking over us, we picked our way cautiously and haltingly back over the ice, and ten hours after our start reached camp, drenched to the skin. Back-packing did not allow us a change of clothing so we dried out by the fire. That night the weather turned clear and cold.

Though we were now on short rations, we had that day killed six ptarmigans, which afforded us "mulligan" for both supper and breakfast and even made possible the thought of climbing again on

the morrow. However, the morning again dawned gray; at six a light rain was falling, and on the mountain it was snowing hard. When we weighed up our provisions we received a shock. At no time in the past two days had our hunger been satisfied; and although all kinds of big game had been stalking about our camp, they kept a safe distance from the rifle. We decided on an immediate return to our base camp. Disappointed, hungry, and dejected, we plodded silently through the rain-soaked under-



© Photograph by Mary L. Jobe Akeley

MT. SIR ALEXANDER GLACIER

Along this steep and jagged acclivity, Mrs. Akeley and her guide climbed the 9500-foot elevation

brush. Rain—freezing, drenching rain penetrated every fiber of our clothing. The treacherous muskeg was all about us and into it we repeatedly fell.



© Photograph by Mary L. Jobe Akeley

AN ALMOST VERTICAL SNOW SLOPE

The great mountain rose before the explorers—a virgin ice peak, sheer and awe-inspiring

Noon came with splendid sunshine. A breeze drove the clouds in drifts across the sky and clearly revealed the Big Mountain. It was bad enough to give up our climb in the face of foul weather; but it seemed the worst of hard luck to be compelled to turn our backs upon our hearts' desire now that it had cleared, and all for the lack of food. After a meager lunch of one piece of bannock and a thin slice of bacon, and tea all around, we had remaining only flour enough for two small bannocks, some tea, two lemons, and four slices of bacon.

We were all heartsick with disappointment. My one hope was that we could get some game and return for another attempt on the mountain. I hesitated to suggest this to our head guide, realizing the responsibilities and heavy labor it

would involve. Finally, we all held a council of war and Phillips volunteered to make a second attempt. However, we all knew our chances were slight, as this was our fifth day without sight of game, and each hour was taking us farther from our goal.

We were traveling to our base cache along a shorter route. About five o'clock, after climbing 1500 feet up the worst rhododendron mountain yet encountered, we suddenly came upon fresh caribou tracks—so fresh that little particles of soft earth were still balanced on the edge of them. We were all so famished that we followed the trail like starving Indians. We were going up wind, when suddenly a grassy hill, steep and sparsely wooded, rose straight in front of us. There on the crest three hundred yards away a young caribou was feeding. Phillips, in the lead, stopped stone still; the rest of us dropped flat to earth. Twenty seconds we watched before it became aware of us. Away it trotted! In an instant Phillips dropped his pack and ran like a Cree, heading not toward the caribou, but to the left and below it. He knew that it would run for the timber and he was bound to intercept it. He did. Two shots! And then he shouted to us. When we arrived the caribou had breathed its last. We had an ample food supply. We named the watershed—where now we made camp—Providence Pass.

The next morning we returned to our camp on the moraine, having cut down our packs to the last ounce, and determined again to attack the mountain. We took with us the four slices of bacon and a little tea and flour which remained, but our main food supply was the freshly killed caribou. We had no salt. Caching the silk shelter-tent, we carried only a piece of canvas as a windbreaker and a reflector for our fire.

A camp at snow-line without any

shelter is not pleasant. The wind howls down the mountain-side and chills you through and through; the fire demands serious and constant attention, burning out and having to be replenished before you are properly warmed. The night is interminable.

Wilkins now developed rheumatism and Miss Springate still felt unfit for the climb, so at daybreak Phillips and I began the ascent alone, following our old route. Going beyond the point at which the storm had driven us back, we found the second glacier of vast extent, very steep, and deeply serrated with crevasses, some of them twenty feet in width and easily fifty feet in depth. On either side were great ice walls, 500 to 1000 feet high, blue and crevassed from foot to top. As far as the eye could range forward were long vistas of snow, huge boulder-like lumps of ice, deep ice caverns opening into the very bowels of the glacier and spanned here and there with shallow, narrow snow bridges.

Crossing about five miles of this ice, we at last reached a long, sloping shoulder where our aneroid registered 7800 feet. We were immediately under the northwest face of the main peak.

"What do you think of it now?" Phillips called out, as he paused a moment in his step cutting.

"I can't see anything but my feet," I replied.

I was struggling up the last stiff bit of ice. A few more steps and I stood in a new world. A huge ice peak, sheer and terrible, rose straight in front of me. From its base my eyes traveled up an almost vertical snow slope to perpendicular rock cliffs, deeply notched with chimneys; then, from ice field to higher cliffs, more formidable than those below; and at last they rested on the austere mountain top itself, a pile of broken ice and broken snow cornices. Through my glasses the culminating ice cap showed

a deeply crevassed glacier with a maze of vertical *seracs* and great blue-green ice grottoes. Icicles fifty feet long depended across these caves. The *arête* was everywhere broken and knifelike.

"I'd rather take you up Mt. Robson twice," was Phillips' only comment. This northwest face was certainly the most formidable of all. As I looked, the great ice field above us was torn by a whirling avalanche, which plunged down over the cliffs directly in front of us. The sight was awe-inspiring. The mountain was obviously impossible to our two selves with our limited equipment.

This main peak rises about 2500 feet above the base of the first cliffs and attains an elevation of about 11,000 feet. From it a long glacier flows westward for about two miles. Above it, on the west ridge



© Photograph by Mary L. Jobe Akeley

NORTHWEST FACE OF MT. SIR ALEXANDER
A new world,—with avalanches constantly thundering across its face



Photograph by Donald Phillips

ALONG THE ROUTE TO MT. SIR ALEXANDER

The Jack Pine flows from the high mountains down through a vast and lovely forest

adjoining the main peak, are numerous hanging glaciers all tributary to a large river flowing off to the southwest and fading away into the distant blue. Through our glasses this stream looked easily 500 feet wide. As we afterward definitely knew, it is the Big Salmon, the North Fork of the Fraser River. The Big Mountain is thus encircled by the two arms of the Big Salmon, deep, wide streams which have their birth in the vast glacial areas—and stands at approximately 120 degrees 30 minutes west longitude and 54 degrees north latitude.

Looking down from our lofty height we saw another glorious snowy range in the west rising 5000 feet above the valley abundantly fringed with glaciers. Across a pass to the northeast are two lovely steel-blue lakes, each about a mile in length. To the north of the Big Mountain and perhaps eight to ten miles distant is a sharp snow peak, apparently a 10,000-foot mountain. Phillips and I could easily have climbed 800 feet farther, but as that would have been futile, we built

a cairn at 7500 feet and returned to our camp. We had spent fourteen hours on the mountain.

When night fell upon our little moraine wikiup and the white glacial mist again whipped down upon us, I felt as if I had been walking in my sleep. I scarcely recognized myself—a battered, grimy creature, crouching there by the flickering fire. I was too weary even to unlace my boots. Phillips looked at me curiously.

“You are dead tired; and—you’re as dirty as a man,” he said.

So exhausted was I, after our long, hard climb, that as we began the homeward march, I could scarcely drag one foot after the other. The unvaried diet of unsalted caribou was not sustaining me. I was desperately weak. I would have given my birthright for a pinch of salt. The absurdity of the situation was the quantity of meat we consumed and our perpetual hunger. All day I was conscious that my pace was being carefully watched, and my pack was lightened until I was ashamed.

Across a wide alpine pass we struck four hours of good going in the smooth, grassy meadows. Below tree-line we found quantities of huckleberries, which we ate like bears. We reached the West Smoky. Here a rushing torrent 200 feet wide ran clear as crystal over blue and red and green boulders. Miss Springate and I waded it hand in hand. I was on my last wind, and she, too, was thoroughly weakened by insufficient food. When about two hours from our cache and with 1500 feet of climbing still ahead, we came upon a maze of windfalls, rhododendrons, and devil's clubs for which British Columbia is justly famous. Troubled lest darkness overtake us, I quickened my pace, putting all my strength in this final spurt. It was not enough! My water-filled boots retarded me at every step. I fell in my tracks when we stopped to rest. Presently I was stumbling and falling just because my feet would not co-ordinate. Up over ledges of rock,

through rhododendrons and devil's clubs and rhododendrons again, we climbed until we came to a long windfall and to wet and slippery rocks beyond which the darkness lay. My pack crushed my shoulders; the devil's clubs tore my face and arms. Although our guide kept not more than twenty feet ahead, I could scarcely see him, it was so dark. Soon, I could only hear him. I floundered on, falling again and again over logs and into holes, and sinking sometimes to earth merely because of my own weight. Once when I hit my knee a stinging blow on a sharp stake, and did not get up immediately, the guides heard me groan and started back toward me. I lurched up before they could reach my side. They went on and mercifully said nothing.

I now began to use every sort of mental lash I could command. "You *must* get into camp tonight." "Go on; don't go to pieces at the finish." "It is easy to take one step; you can take another." And,



© Photograph by Mary L. Jobe Akeley

THE BIRTH PLACE OF THE FRASER RIVER

The exploring party traversed four miles of this deeply crevassed glacier before and after reaching the base of the ultimate peak

"It would be disgraceful to collapse and weep." So I goaded myself up the last lap.

Our entrance into camp was made in silence—a little later when we had drunk plenty of hot tea it became a time of rejoicing. Here were food and warmth and security. At least our big effort had been

made. We had not given up without a good fight. Now safe, dry-clad, and content in the shelter of the base camp, we realized for the first time that we had taken long chances, but—at least we had explored "Kitchi,"—we had met the Big Mountain face to face.

A SECOND ARTICLE BY MRS. MARY L. JOBE AKELEY WILL APPEAR IN A LATER ISSUE, DESCRIBING FURTHER EXPERIENCES IN THE MOUNTAINS OF WESTERN CANADA



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NEW COUNTRY

In the left background the ten-thousand-foot snow peak is Mt. Mary Jobe, named by the Canadian government in honor of the author's explorations and for the first map made of this region



WATCHFUL WAITING

THE WOODCOCK

Photographing the Hermit of the Woodlands

BY ALFRED M. BAILEY AND FRANCIS R. DICKINSON

Chicago Academy of Sciences

WITH PHOTOGRAPHS BY THE AUTHORS

THE twilight hour of early spring is the period of romance for the woodcock. Other drowsy-voiced migrants may be talking themselves to sleep among the shadows of the thickets, but the secretive woodcock chooses this time, when all nature is starting to rest, to go through his courtship antics. He leaves his place of concealment, struts among the tangled vines with his tail spread and beak out-thrust, and then suddenly springs into the air, circling until he appears as a black dot against the star-studded blue, his clear, twittering voice carrying across the woodlands. Sometimes he will fly swiftly, with rapid strokes of his short, stiff wings, from one end of a patch of timber to another, and then, circling downward, he will swoop into the darker shadows of the woods and drop to the ground near his starting place.

This fine "shore bird" was once an abundant one in the northern states, but it has been greatly reduced in numbers in

recent years. We had long desired to photograph the woodcock upon its nest, and many hours were spent in the field, endeavoring to locate the eggs. But to find a woodcock's nest is like finding the proverbial needle in the haystack. You have to know where to look. We pressed our friends into service at every opportunity, without success, until one Sunday late in March. After a day of weary tramping, we were returning home tired, and not a little discouraged, when we stopped to chat with a neighbor. We had been looking for woodcocks, we told him, but had had no success.

"Why," our friend replied, "I can show you where to find one."

Dinner was forgotten, and we retraced our steps across the woods for a mile, to a sheltered creek where the tangled vines, fallen leaves, and moist earth seemed to promise ideal cover. Then our friend led us to a broken bank and pointed proudly to a freshly excavated hole. We looked at him blankly for explanation as we



HANGING THE BLIND TO A HANDY LIMB

The carefully hidden nests of the woodcock are usually guarded from wandering animals by logs or fallen trees



THE OVATE EGGS OF THE WOODCOCK

Against the russet and tan of the leaves and grasses, the mottled buff and brown eggs were almost as hard to see as their owner



LOW BROW OR HIGH BROW?

The high placing of the eye, exaggerated by the length of the bill, gives the woodcock a somewhat witless, self-satisfied expression



TO BROOD OR NOT TO BROOD ?

The whirl of the camera makes her pause. Notice the eggs just showing in the left foreground. Will she have courage enough to cover them?



SHE DECIDES IN THE AFFIRMATIVE

After hesitating for a moment, she advances cautiously, waiting at the edge of the nest before settling down

protested woodcock did not nest in such a place.

"Oh," he said disgustedly, "I thought you said 'woodchuck.'"

But there came a day, and it was last spring, when we met the Expert. He was one of the rare individuals who like to look for the "needle," and his hobby was finding woodcock nests. He promised us, when the proper season arrived, that we should have the photographic victim we desired. The Expert was true to his word, and when the nesting time of our bird arrived, he spent a few hours in favorite haunts, and then reported that he was ready to lead us by the hand.

April is notoriously a fickle month, never knowing whether to consider herself the end of winter or the beginning of spring. On the April day when we went camera hunting, she was in the former mood. A gray sky overhung a brown earth, sodden with the last of the melting snow, and the slight drift of air, though not

frosty, smelled of damp leaves rather than of sprouting violets. We were in rolling country where open glades alternated with mixed hardwood timber, mostly oak and hickory; and though the hum of a distant interurban trolley at times reminded us of civilization, we were confident of success. Our Expert, gifted with second sight, had actually located two nesting woodcock.

Our motion picture camera, two tripods, and a bird blind slowed us down a bit, but presently we began to ascend a slight rise of ground covered at the top with clumps of brush, patches of tall, dead weeds, and a few moderate-sized trees. Stopping about ten feet from the base of one of these, we were told that we had arrived at the first nest, and that the bird was on it.

This was good news, but we like to verify such statements, and for a while the amateurs tried in vain to do so. Carefully, foot by foot, we scanned the



ON AGAIN, OFF AGAIN

The strain is too great. She turns tail, a very stubby one, and is all set to leave in a hurry. The photographers try stopping the camera



THINKING BETTER OF IT

Somewhat reassured, she aims one of her shoe-button eyes at the blind and seems to be weighing the pros and cons



BACK ON THE JOB

As she sits motionless in the underbrush, her bill transforms into a dry stem, and the tip of her tail into a splintered stub

dead leaves, the thin clusters of weeds, the fallen branches that lay almost at our feet. After a few minutes of this, we admitted defeat. Our pilot then pointed out a certain spot not eight feet away, where a few slender ground shoots, emerging from the leafy carpet, made a miniature thicket, and as we stared at the spot the form of a brooding woodcock materialized from the background, much as the image on a photographic film gradually builds up in the developer. The blending of her plumage with the warm tones of the oak leaves and their darker shadows was incredibly perfect. Her bill, motionless and slanting down, became merely one of a hundred small stems. Only her eyes, black and round, gave a clue by which she could be found again whenever we turned away.

All this time she was steadily watching us, completely confident in the power of camouflage—and who knows or ever will

know just how much of this confidence is based on consciousness and how much on instinct? To see how far her reliance would stretch, we advanced quietly to within four feet of her, and while one bent over and started the camera, another slowly put out his hand until it was directly over the nest and not more than four inches above it. Still she stayed; but when the hand descended and gently touched her back, the spell broke and away she dashed with a frightened flurry of wings.

After locating the second bird, which was a trifle less trustful, we returned to the first spot and set up the blind at a distance of seven feet, from which a six-inch lens brought the nest close enough to fill about half of the finder. Two of us draped ourselves over a log inside the cover and waited, while the third, he of the second sight, wandered off to find more nests.

"Waited" is the word. For half an hour nothing happened except that the log grew noticeably harder and the stubs on it noticeably sharper. Then, through the holes in the blind, we discovered our quarry moving slowly through the underbrush twenty yards away. Little by little she approached, feeding as she came, not at all alarmed. Now and then she dug her long bill into the soft loam, evidently probing for food. Occasionally she moved forward with a curious bobbing motion as though stamping on the ground with one foot after the other, and then she paused, as though listening. The purpose or result of this performance was not evident, but it may have caused insects or worms to move and thus reveal their presence.

For another hour or more she wandered about, seldom out of sight, but never within range of the waiting camera

focused on the nest. At last, however, she seemed to make up her mind, and walking more rapidly, came in on a bee line. Three feet from the nest she paused to eye the blind, then advanced again. She stepped into range of the camera, and the film whirled as she approached the nest; then just as the woodcock was lowering herself upon the brown splotched eggs, she became alarmed and darted a few feet away. She paused there, partly concealed among the dead leaves, for many minutes, staring at the blind, and then, as though not satisfied that all was well, walked off through the underbrush.

It was our last opportunity, for a cold drizzle began to fall, and the reproachful voice of the Expert was heard across the woodland as he shouted, "Hey! This is an April shower—but I'm no May flower," so we folded our blind, shouldered our camera, and plodded homeward.



A TEST

When the hand descended and gently touched her back, the spell broke



A MALE PINE-WOODS TREE-FROG WITH INFLATED VOCAL SAC

A VOICE FROM THE PINES

The Call of the Pine-woods Tree-frog Is a Characteristic Sound During Spring and Summer in the Woods of the Okefinokee Swamp Region

By FRANCIS HARPER

DURING the night a white mist in the Okefinokee piney woods has enveloped the rough, gray-brown trunks halfway up to their expansive green crowns; it has also cast its breath on the low undergrowth of palmetto, gall berry, and huckleberry, where the light of dawn reveals countless dewy spider webs spread out in all their glistening tracery.

As the rising sun dispels the mist, the birds are more vociferous than later in the day: the bobwhite pipes, the joree calls and sings, the redbird gives a cheery *o-leet, o-leet*, an unseen woodpecker drums, and the pine warbler trills dreamily. Soon the earth warms beneath a brightening sky, and the pine lizards come forth from their nocturnal retreats in crevices of the bark, to bask and run on the fallen trunks or to bob up and down in displaying their brilliant throats to their ladyloves. As the morning wears on, a breeze stirs the myriads of pine needles into murmuring music that brings peace and delight to one's soul.

At the blazing noontide man and beast

seek what shade they can find in these open, parklike woods; but the turkey buzzard continues its tireless soaring above the tree-tops, and such dauntless spirits as the kingbird and crested flycatcher scarcely desist from their cries. Perhaps an afternoon thunder shower comes on, with hurrying gray clouds that have become laden with moisture over the distant Gulf and here discharge it on the thirsty land. The heat and glare of the previous hours depart, and the green woods have a pleasant aspect in the rain. The slanting drops quickly moisten and darken the southwestern sides of the tree trunks. And now multitudinous creatures of the pine lands, both avian and amphibian, respond to the welcome change and fill the air with their various and characteristic notes.

Toward the day's end the sun sends radiating bands of light through the breaking clouds, to be mirrored, on rare occasion, in the eastern sky. A cowbell tinkles musically as the cattle return toward their pen from the day's foraging, and their driver makes the woods re-

sound for miles with his yodeling—that most inexpressibly beautiful of all things to be heard in the Okefinokee. In the waning light the nighthawks disport themselves overhead, diving and booming; and the bats, those lovers of the dusk, sally forth from their hollow trees and pursue their insect prey in erratic, leather-winged flight. And finally, as night descends, the world of the piney woods is given over to the weirdly calling barred owl, to the prowling bear and raccoon, to those scurrying and secretive lesser folk—the mice, rats, and shrews, and to a rain-gladdened host of lusty-voiced amphibians.

Such sights and sounds, and many more, are the offerings of the piney woods in their various moods of spring and summer. There is one sound in particular, a most characteristic one of this verdant wilderness, that is very apt to greet the

wayfarer here and there, during almost any of the twenty-four hours. It is a curious, dry, prolonged little cry, of very uncertain origin. A casual person might pass it by as one of those intangible sounds of the woods that hardly arouse conscious attention. Another, more responsive, might be put in mind of some aberrant, stridulating cicada, or of some harsh-noted member of the wren tribe. Still another, well versed in animal lore, though a newcomer to this region, might shrewdly guess at some relative of those little beings that so long ago made music for Aristophanes' discriminating ear with their chorus of *brekekekex, ko-ax, ko-ax*.

All the same we'll shout and cry,
Stretching all our throats with song,
Shouting, crying, all day long,
Brekekekex, ko-ax, ko-ax.

ARISTOPHANES: *The Frogs*
(Translation by B. B. Rogers).



CAMP ON CRESSER'S ISLAND

Among moss-hung live oaks and water oaks in a hammock, in Okefinokee Swamp, on July 23 1931. Both in this hammock and in the surrounding pines the voice of the pine-woods tree-frog is one of the most familiar sounds



A "FROG'S-EYE" VIEW OF CHASE PRAIRIE
Taken from fifty feet up in a moss-draped slash pine. May 17, 1912. From such a vantage point a tree-frog can overlook square miles of watery wilderness, dotted with prairie "heads" or islets of pine and cypress

Now the sound starts up again, apparently from some point well above the saw-palmettos and other low undergrowth: *kek-kek, kek-kek-kek-kek-kek, kek-kek, kek-kek-kek-kek-kek-kek-kek-kek-kek-kek . . . krak' . . . krak'*. And here and there from the open ranks of the pines a variable answering cry is heard. Whatever the authors may be, there is some sort of society or fellowship among them. The strident cry gets under way a trifle haltingly, becomes a rather steady, rapid, prolonged rattle, and winds up with a couple of slower, more emphatic notes in a cracked voice. It is all but useless to try following one of the sounds to its source; only a rare chance will lead to discovery. Even after long familiarity with the habits and appearance of the authors, I spent nearly a month in the region last summer, hearing the sound almost every day and making frequent effort to locate some of the individuals, and yet not setting eye on a single one.

But on several occasions in other years, out of the hundreds of times I have listened to this cry, I have been fortunate enough to detect a little tree-frog ensconced behind a projecting slab of bark on some longleaf or slash pine, at a height of four and a half to ten or twelve feet above the ground. Doubtless some have escaped notice by occupying a still higher perch. As one crouches partly hidden in this daytime nook, its resemblance to the pine bark in both color and pattern is remarkable. From this fact as well as from its habitat there is a peculiar appropriateness in the common name it bears—the pine-woods tree-frog. On Chesser's Island there is also a local name of "scraper frog," which was eventually found to refer to this species; it was bestowed in reference to the sound of the notes.

An average individual is about an inch and a quarter to an inch and a half in length of body. In its resting attitude the arms and legs are sometimes folded so compactly beneath the body that the



AN INDIAN MOUND
Covered with saw-palmetto and other plants of the piney woods, on Bugaboo Island Okefinokee Swamp. June 6 1929.

fingers and toes, with the enlarged disks at their tips, may be scarcely visible. These disks are characteristic of tree-frogs in general and enable the animals to cling to vertical surfaces as smooth as a plate of glass.

The species was made known to science by Latreille in 1802, in his *Histoire Naturelle des Reptiles*, where it was given the name of *Hyla femoralis*. This appellation happens to have escaped the nomenclatural upsets that befall so many species, and has been preserved intact to the present day. Though the species has been discussed and redescribed from time to time by such distinguished American herpetologists as LeConte in 1825, Holbrook in 1842, and Cope in 1889, it was still possible for Mary C. Dickerson to remark in her *Frog Book* of 1906—more than a century after the discovery of *Hyla femoralis*—that “Nothing is on record regarding its life history or habits.”

The range of this little tree-frog extends from the Dismal Swamp in Virginia to



A DRIED-UP CYPRESS POND

Near Suwannee Lake, Ware County, Georgia. May 7, 1930. The numerous cypress ponds are the principal breeding areas of the amphibians of the adjacent piney woods, but during an occasional dry season the water disappears completely



A VISTA BETWEEN CYPRESS “HEADS”

On Chase Prairie, June 12, 1929. The pine-woods tree-frog finds a suitable breeding area in these watery prairies

Florida and Texas. It is apparently limited to the Coastal Plain, where the abundant pines furnish it with a congenial habitat. In North Carolina it seems to have been recorded hitherto only from the coastal counties of New Hanover, Onslow, and Craven. One rainy night last July, however, when I had traveled more than an hour's journey northward from Florence, South Carolina, on the Atlantic Coast Line, its characteristic notes sounded commonly from the trackside pools or ditches, being plainly audible above the rumbling of the train. The locality was probably in Robeson County, North Carolina, and about fifty miles farther inland than those previously recorded in the state.

No other amphibian of North America seems to be so closely associated with pine trees as is this species. In the Okefinokee region I have seldom found it very far from a pine. In the depths of the swamp it may be absent over consider-



THE CAMOUFLAGE OF A PINE-WOODS TREE-FROG

In its daytime nook behind a projecting piece of pine bark, the pine-woods tree-frog bears a remarkable resemblance to the bark in both color and pattern. Camp Cornelia, Charlton County, Georgia, May 24, 1929

able areas where these trees do not occur; but let a few straggling pines appear, and there its notes are likely to be heard. Thus it is found not only in the piney woods proper, of both the mainland and the islands, but also to some extent in hammocks, creek swamps, cypress bays, and sphagnous bogs, for at least a few pines are present in all of these habitats.

Now and then it wanders away from the pines into neighboring live-oaks, magnolias, or other trees. It also affects rail fences of split pine logs, or the rough walls of cabins, and sometimes it is discovered on a saw-palmetto leaf in the piney woods.

I have come across one in a golden mouse's disused nest that was suspended in a festoon of Spanish moss in the hammock on Chesser's Island. In the creek swamp at Suwannee Lake I have twice located one snugly stowed away for the day in a knot-hole of a titi (*Cyrilla racemiflora*). These knot-holes, at a height of one and a half to five and a half feet, seemed to give it a refuge fully as secure as that provided by a loose slab of pine bark.

When gently touched in one of its daytime retreats, the frog will scarcely budge. During the breeding season individuals have been found occasionally on the ground during the day; perhaps these had not waited for nightfall to begin their journey to the breeding ponds.

On a green palmetto fan or in a tuft of green pine needles the species shows itself capable of changing from the more normal brownish or avellaneous coloration into one matching its immediate environment; and one of my former friends in the region tells me of finding equally green individuals on his tobacco plants.

In the expansive piney woods surrounding the Okefinokee this tree-frog is undoubtedly one of the most abundant amphibians. In its normal habitat four individuals to the acre, or approximately 2500 to the square mile, would probably be a reasonable estimate. Such density of population may be readily appreciated

by one who is abroad during a warm summer shower and listens to the calls inspired by it. In a mile-wide strip of the mainland adjacent to Okefinokee Swamp for its entire circumference of, say, 120 miles, with perhaps four-fifths of this territory occupied more or less by standing pine timber, we would have a pine-woods tree-frog population of possibly 250,000 individuals. In the four Georgia counties that include the swamp there must be millions of them!

The adults very evidently lead solitary lives, except when congregating at the ponds and pools for breeding purposes. Ordinarily it would appear that no more than one frog is to be found on a single tree.

The vocal season lasts for at least five months, from mid-April to mid-September. Whether it begins earlier or continues later, I have not determined,

owing to absence from the region. During this whole period, in sunshine as well as in rain, the ordinary calls may be heard practically every day from the frogs in their diurnal hiding-places. The intervals between these calls are extremely variable, according to the weather conditions. When a shower is impending or falling, or after it has passed, there is a general tuning-up of these sprites far and wide through the piney woods.

One May evening, about sunset, I located an individual that had been calling in its retreat about seven feet up on a large pine on Billy's Island. It was facing the trunk, while the lower part of its back rested against a projecting flake of bark. The upper part of its body was inclined away from the tree, and its arms were stretched almost straight to reach the trunk. This position gave ample play for the vibrations of the swollen vocal sac.



THE PINE-WOODS TREE-FROG IN CALLING POSITION

The vocal sac and practically the whole body of the pine-woods tree-frog vibrate with the extraordinary vigor of its nocturnal breeding calls as it clings upright to the rough pine bark. Suwannee Lake, Ware County, Georgia, June 27, 1929



IN THE CREEK SWAMP BORDERING SUWANNEE LAKE

A platform has been built at a height of about sixteen feet among the cypresses, black gums, water oaks, and sweet bays. From this stand the hunter looks down through the dense undergrowth of "hoorah bushes," titi, high-bush huckleberries, "lather-leaf," and catbrier, in the hope that his hounds will drive a hog-stealing bear within sight and range. May 16, 1930

Not only the throat but the sides and indeed nearly the whole body vibrate with the very rapid interchange of air between the lungs and the vocal sac. The latter, when fully expanded to a hemispheroidal shape, becomes nearly half as large as the rest of the body, and is fairly translucent. It does not quite reach to the tip of the chin, as the sac of a toad does. The calls are so rapid that the sac does not become appreciably deflated between notes, as happens with some of the related species that call more deliberately. If the frog becomes alarmed and

ceases calling for a time, the sac may remain about half inflated.

The special nocturnal calls or breeding choruses of the males are heard from about mid-May to late August, or possibly later. They occur almost invariably during the first couple of nights after heavy rainfall. At the time of these choruses the temperature ranges most commonly in the vicinity of 72° to 74° F., with extremes at about 68° and 80°. The bodies of water at which the frogs congregate for breeding include cypress ponds, roadside ditches, rain-water pools in fields, and branch and creek swamps. The males take up their calling positions on trees standing in or near the ponds, and on logs, floating chips, or the ground near the water's edge. On vertical pine trunks they cling bolt upright, with sprawling toes; on

black gum saplings in the ponds they may perch vertically on the trunk or horizontally on the limbs or they may secure a variety of footholds among the twigs and leaves.

One June night, in a little pond near Suwannee Lake, the light of my electric torch seemed to serve as an attraction to the frogs, for a black gum sapling beside which I was standing became full of them. They came leaping along the branches and among the foliage, and several took up calling positions within a few inches of each other. They were so

confiding that I could touch them with a finger or a twig and maneuver them somewhat into photographic position. One or two even clung to my fingers.

Here was an especially good opportunity to observe some of the changes and variations in color to which the species is subject. I had long been aware that the individuals encountered at night are generally much paler and more uniformly colored than those seen by day; the darker portions of the color pattern, in particular, fade considerably.

Although it is possible that such factors as temperature, humidity, and emotional state may play some part in the color changes, it would seem most simple to explain the general nocturnal fading on the ground that in the darkness a variegated color pattern is needless for protection. A certain amount of variation, however, is obviously individual in nature, since it is observable at one time in a single group of calling males. Thus the upper parts of some of those observed during this night near Suwannee Lake appeared an almost uniform pale greenish or brownish. Yet others retained in some measure the variegated color pattern of the daytime.

The calls with which these males summon receptive females to mating are made up of individual notes very similar to those in the middle part of the ordinary diurnal calls. As a whole, however, they are quite distinct. They are extremely

vigorous, prolonged, and rapid. There are now no drawling terminal notes in a cracked voice, such as are heard by day. One who remains in the midst of an assemblage of a dozen or two raucous-throated males for several hours finds the incessant din quite oppressive to the auditory organs. Indeed, at a distance of no more than a few feet the racket is fairly deafening. By partly closing my ears at such a time, I have shut out the sound of *Hyla femoralis* almost entirely, at the same time hearing more distinctly than before the shriller notes of other species present, such as the oak toad (*Bufo quercicus*) and the swamp cricket frog



A TURPENTINER

On his daily rounds to "pull boxes" on the longleaf and slash pines, the turpentine worker has probably more opportunities than any one else for listening to the cry of the pine-woods tree-frog. Near Camp Cornelia, Charlton County, Georgia. May 29, 1929



THE HOME OF A
TIBETAN LANDOWNER

AGRICULTURISTS OF TIBET

Peasants in a Land of Nomads—Their Homes, Their Industries,
and Their Religion

By C. SUYDAM CUTTING

Trustee of the American Museum

TIBET, by and large, is anything but agricultural, yet in the southern portion of that elevated land, four hundred miles or so directly north of the upper reaches of the Bay of Bengal and near the northern borders of Bhutan and Nepal, certain of the Tibetan natives have developed a type of agriculture that seems to be unique. On their section of the high and wind-swept plateau behind the snow-clad Himalayas, where Nature gives them a growing season that averages only four months free of frost, they are able to plant, to grow, and to harvest their crops of barley and peas, but, having done so, these hardy people do not use these products for their own consumption. Buttered tea is almost their only food, and the barley and peas that their efforts, with Nature's meager help, produce, go entirely to feed their horses and their cows.

Compared with the country to the south of the mountain wall that sets this land apart, Tibet is a sparsely populated region, for the most part given over to wind and semi-barrenness. Consequently the intensive agricultural methods of other lands are far from necessary. Rainfall, too, is limited, but to make up for this lack, the plateau is intersected by many streams and rivers fed by the melting snows of the extreme uplands. The streams, being swift, and the need for arable land being small, it is an easy task to build the simple system of short canals that supply the irregular fields and patches with the water that they need. Thus, even at altitudes of 13,000 feet or more, the fields of barley and peas (which are mixed when sown) are tilled with comparative ease.

The peasant agriculturists of Tibet do not live in tents as do their nomadic



THE HOME OF A TIBETAN PEASANT

These structures are rude but substantial. They are built either entirely of stone or of a sort of plaster, and have very few windows

fellow Tibetans. Instead, they build rude but substantial houses of stone or plaster, with wind-proof walls that are usually almost devoid of windows. Glass is rare and can be had only by the "wealthy." Even where it is used, the windows are small and few, and the houses that cannot boast glass are usually, for all practical purposes, windowless, for what windows there are must be closed against the almost ever-present wind by shutters solidly made of wood. Thus one can imagine what the dark interior of such a house must be. Only one fire—always using yak dung as fuel—is kept going. The room in which it burns is a combination of kitchen and living room, and here, hovering about the fire, one finds the inmates, save when they are out of doors attending to their cattle and their horses.

Even in Tibet there are degrees of wealth and comfort, with the result that large landowners and petty rajahs have

more elaborate houses. Even these, however, from the western point of view, leave more than a little to be desired, though some of them have certain sturdy architectural features that are pleasing and are obviously thoroughly comfortable to those who inhabit them.

Tibet is anything but a clean land, and the inhabitants so rarely bathe that one cannot fail to wonder at their freedom from disease. Being Buddhists, too, they are not permitted to kill even the most offensive creatures, with the result that all of them are flea-ridden. Still, the rarefied air is dry and cool, and the odors of the lowlands of India have no counterpart here. Even decaying flesh and bones along the roads do not give off the breath-taking odors that occasionally offend one's nostrils farther south, and the result is that, despite the omnipresent filth, one is not overly conscious of it.

Trees do not grow naturally in Tibet, but it is customary to plant small clumps

of cottonwoods about the houses, with the result that something similar to a garden is often available for the owners during the summer. One home that we visited—that of a wealthy carpet manufacturer—had in it a private Buddhist temple, while the factory on which the owner's wealth was built, was near by. In it the workers, both male and female, lived, and for their efforts, to which they devoted all the hours of 'daylight, they received their board and lodging and the munificent pay of one or two cents a day.

Manufacturing is limited and simple, carpet and paper making being two of the most interesting activities. The paper that is made is of the crudest quality, gray and coarse. Women pound bark and wood pulp in water, and when the fibers are thoroughly mixed, set layers of the mass over cloth frames. By dipping these frames in water the pulpy mass can be spread evenly, whereupon it is set in

the sun to dry. The crude "factories" in which this product is made house the employees as do the factories that produce carpets.

Buddhism being the national religion of Tibet, a large percentage of the population is made up of lamas—priests who live a life of celibacy. Usually these priests are chosen from among the more influential families, and often they enter their period of training when they are as young as ten years. For a number of years they remain as acolytes, during which period they devote themselves to study. As a result they acquire a vast amount of Buddhist lore, and some of the older lamas, who have kept up their studies, become exceedingly erudite in their field. Their education, however, bears little resemblance to education in the western sense. As a matter of fact, while some learn to read and write, most, if not all of them, would be classed as intensely



PLOWING WITH YAKS

Throughout Tibet yaks are used principally as pack animals. Sometimes, however, they are ridden, and among the Tibetan agriculturists they are often yoked to the plow



TIBETAN CITIES ARE NOT CLEAN

Pools of water often collect and dirt is the order of the day, but mosquitoes and flies are absent or exceedingly rare, and the many germs of the region south of the Himalayas do not thrive on the Tibetan plateau

ignorant by any western standard. Vast though their stores of information may be, it would be utterly useless amid modern civilization.

Lamas do no work. Their religious studies and duties occupy their time exclusively. The result is that they have to be supported by the peasants, who supply them with all the needs of life. The drain on the population is consequently great and has been offered as one explanation of the backwardness (in western eyes) of this crude land.

Shrines are to be found in every town and village and often in the open country along trails or roads. In the city of Gyantse there is a large shrine that is more than usually interesting. It contains a large library, with innumerable books piled up on shelves and covered with dust. These books are all loose leaved, and have stiff carton covers

that are bound round with string.

Elsewhere in this temple are numerous effigies and small shrines, some of which are extraordinarily queer. Two stuffed yaks, for example, hang from the ceiling. Other effigies are life-sized figures representing ancient abbots of the lamasery. The shrines are gods—usually Buddhas—before which, day and night, burn wicks stuck into yak butter. As a result, every temple has an unmistakable odor.

Buddhism, like other religions, has sects, but in all of them the principal thought in the lama's mind is that of reincarnation. No Buddhist may take any life—not even that of the fleas that abound on him. To take the life of a man is the most serious, of course, and the person guilty of this crime is thought to face positive reincarnation as a louse which, apparently, even in Tibet is considered to be the lowest of the low.

THE BETTER HOMES
HAVE SPACIOUS
COURTYARDS

Except for temples and shrines, Tibetan cities are purely residential. The strings stretched above this courtyard carry prayer-flags, which are common decorations in this region

A TIBETAN
BAZAAR

These booths are the Tibetan counterparts of the busy native markets of the cities of India. Throughout Tibet, however, these marts are small, and are open usually only in the morning





THE "ORCHESTRA" AT A NATIVE DANCE

Masks and weird costumes are a part of the religious dances so common in Tibet. The music, to western ears, leaves much to be desired

Strict as all these rules are, however, they are many times departed from.

Near Gyantse is a lamasery in which the lamas have adopted a most severe custom. These lamas sometimes incarcerate themselves in tiny cells where they remain in absolute seclusion for periods ranging from a month to a lifetime. During this period of incarceration they neither see nor speak to anyone. The cells have tiny apertures covered with removable wooden boards. When meal-time comes a lama raps on the board and then removes it. At the signal the lama within puts forth his hand and receives his buttered tea, but his hand is covered by a large glove as he must never permit mortal eye to see any portion of his person. I took a photograph of the glove-covered hand of a lama said to be an old man. He had been in his cell for many years and had announced before going in that he would never come out. Some day, when there is no answer to the knock at buttered tea time, they will know that he

has ended his long period of seclusion.

This dreadfully ascetic life is thought to improve their reincarnations, and all the lamas of this lamasery go through periods of such seclusion for varying lengths of time. One lama, for instance, had spent seven years in one of the cells, but decided at the end of that time he had had enough and would never go back. So often had this particular man prayed with his forehead touching the stone floor that a permanent bump had developed.

The lamas are dressed in the usual yellow or red robes of their class, but the peasants are clad in substantial garments woven of yak hair or yak leather. These heavy garments are well fitted to resist the cold and the wind. Heavy leather boots are the usual footgear, and are both substantial and warm. Women often wear leather dresses and their hair is done in the Lhasa style, with a complicated head-dress bound permanently into the hair.

The people of the higher classes dress



A TIBETAN LAMA

This particular man had, at one time, spent seven years in a tiny cell, without being seen even by those who brought his food, and without speaking to anyone. He came out at the end of that time

more comfortably and a petty rajah who entertained us at a true Tibetan meal made quite a display when surrounded by his wife and children. The food he gave us, too, was excellent—very different from the peasant food. Mutton was the staple. After being chopped and formed into small balls it was effectively flavored with high seasoning. Macaroni—imported—was present and a native drink called *chung* was served. It is not unpalatable, but becomes so when one has to drink it for about two hours.

At Gyantse we called on the governor who, at one time, had been first man in waiting on the Dalai Lama himself. Consequently he was in high standing with the central government. When we arrived, he asked us to lunch, and when he made his return call, we offered him good India tea and powdered milk in solution. Of these he would touch nothing as he had had his servants bring along his kettle and buttered tea. Of this brew he would drink forty to fifty cups a day.



NATIVE TIBETANS DANCING

These masked figures began their dance with slow and solemn tread, only to increase the pace until it became a rapid, whirling motion

In meeting dignitaries such as this one, it is customary to make gifts. We presented him with a self-winding wrist watch, and he, in return, presented us with some Tibetan carpets.

The governor was very pleasant and had a well-developed sense of humor. The last time we saw him was one morning about breakfast time. He was just starting off on an administrative trip, but came to see us because he had to deliver more carpets that had come to us from the Dalai Lama in Lhasa. He said that, considering the fact that he came as an emissary of the Dalai Lama, he ought to spend the entire day with us, that being the custom under such circumstances. He then apologized and said that so prolonged a visit was impossible, as he could not cancel his trip. Pleasant as the governor was, a full day with him would have been rather trying. A long attempt at conversation, Tibetan on one side, Hindustani on the other, with an interpreter in between, would soon have worn out everybody.



THE OPENING TO A LAMA'S CELL

Through this tiny opening food is passed to the lama within, who covers his hand with the huge, awkward glove shown, in order to get his meal without even his hand being seen by those outside



FIELDS OF THE TIBETAN AGRICULTURISTS

These fields are small and are watered by short canals leading from near-by streams

Tibet differs much from southern Asia in that it is in no way overpopulated. This is particularly obvious in the cities. They have no large, permanent bazaars such as tourists to the East always see in the larger cities. There are small marts, but the stalls are temporary structures readily taken down. Bazaars of this sort, which have singularly little to offer, may be open only during the mornings and are then closed and removed for the rest of the day.

Except for the temples and shrines, Tibetan cities are purely residential, and there is no congestion. The better class homes all have spacious courtyards, and across these strings are stretched upon which prayer-flags flutter. There is one standard prayer throughout Tibet—"Om mani padme hum"—which, interpreted, means "Oh, thou jewel in the lotus." No Tibetan priest or layman really knows what this means, but this fact alone gives the prayer a certain charm, as this lack of significance lends mysticism to it.

Every house has one or more watchdogs—large, heavily coated, fearfully vicious beasts. They are courageous and very different from the pariah dogs of

India and China. Often they are kept chained all day and are loosed only at night. Wherever one goes it is best to be on one's guard, and certainly one should never enter a house or a courtyard without being absolutely certain that the dogs are secured.

With the absence of offensive odors, are other lacks that need not be regretted. The dry air, bitter in winter and never



THE CITY OF GYANTSE

View taken from the fort that guards the city. The dark patches are areas of cultivation

hot in summer, does not breed germs. During the summer there is no pest of flies. Pools of water may sometimes form, but they never breed mosquitoes. Tropical diseases from the lowlands farther south do not appear in Tibet. In fact, Tibet is remarkably fortunate in its good health, its lack of overpopulation, and its ample and regular food supply.

The usual means of human transportation throughout this portion of Tibet are horses and mules. The yak is the great pack carrier. Owing to the numerous rivers, however, boats are occasionally used. They are made of yak skins drawn tightly over light wooden frames. These boats are quite round and are operated by paddles. The streams are too swift to

make it possible to go against the current, but this does not bother the Tibetans in the least, for the boats are so light that they can readily be carried. The high freeboard and the flat bottoms, too, make them reasonably seaworthy and they are capable of carrying many persons. For downstream trips the boats are useful, and once the destination has been reached, the boats are picked up and set up along the sides of the houses. The life of one of these boats is only one season, whereupon they are all remade.

Trade between Tibet and the outside world is carried on only on a small scale. Hides and wool are the chief exports. Recently a wool merchant with headquarters at Lhasa wrote me asking if I

then wrapped in animal gut and are transported by caravans to the nearest bazaars. This butter is always rancid but is widely used in cooking.

The carpets and blankets manufactured in Tibet are made from yak skins but the quality is so inferior that few are used outside those made for home consumption.

It seems that Tibet is practically self sufficient. Dyes must be imported, but not in great quantities, for Tibetans do not seem to be very fond of bright colors. Homburg hats are getting more and more popular, coming largely from India. The rich do buy food and clothes from China, but aside from these articles little is demanded of the outside world.

The biggest ceremony of the land is the butter ceremony which is held annually. Large effigies of Buddha are set up—all made of yak butter—and are surrounded by many lighted wicks set in the same material. The ceremony, which takes place at night, is extremely grotesque. The lamas wear elaborate and highly colored clothes and enormous masks. The dancing is slow at the start, but increases in speed until it becomes a furious



MAKING PAPER

After beating wood and bark into pulp, it is soaked in water and spread on frames

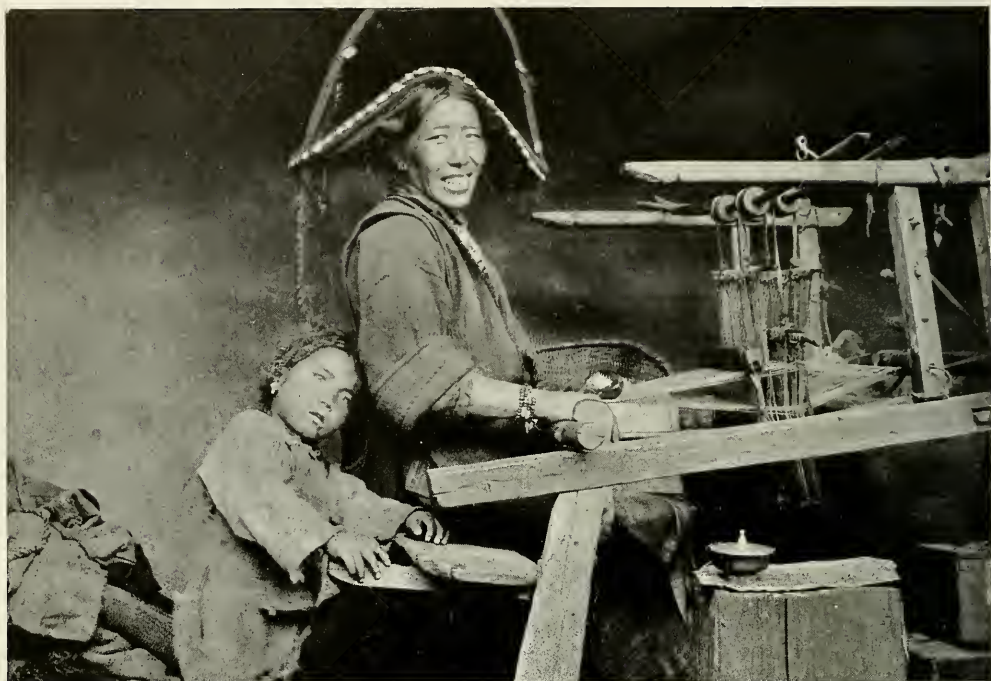
could open a market for him in the United States. Through a Calcutta firm he had in the past sold his wool in Philadelphia, but now he considered "times were hard."

In eastern Tibet clarified yak butter is sold in large quantities to the Chinese along the border. The butter is first properly boiled to reduce its water content and to sterilize it. Large chunks are



MAKING PAPER

The frame with the wood pulp is then set in the sun to dry into coarse paper



A TIBETAN WOMAN WEAVING

All the clothes of the common people are made by the people themselves, the women doing all the weaving. The wealthy, however, buy some food and clothing from China, and India sends some goods

spinning motion. This lasts only a few moments and the dancers then revert to the slow time with which they started. Music of a kind is provided as an accompaniment.

Throughout southern Tibet, if one enters the country under proper auspices, one will always find the population most hospitable and kind. The people have an excellent sense of humor and their good health is always apparent even though they have no regard for cleanliness.

The people are hardy and strong. As a rule they are tall and men of the upper classes in particular are often more than

six feet. It is noticeable that the older they are the darker is their skin which, I believe, can most readily be explained by

the fact that they rarely bathe and that during the long, cold winters they must sit close to the yak dung fire in order to get enough of its ineffective heat. These fires give off a peculiar smoke which seems to darken the exposed parts of the body with which it comes



WOMEN PAPER MAKERS

in contact. Consequently, Tibetans have a much darker complexion than is natural to them.

As caravan men the Tibetans are second to none. In high winds, through snow and

sleet, they will often make astonishingly lengthy marches. They are good packers, and their animals, which seem as sturdy as they, rarely have sore backs. It is pleasant to accost these distant people and to receive their ready smiles.

Here is one portion of the world that seems to have few cares or worries. Shut off by natural barriers, it seems quite capable of taking care of itself. The climate is rigorous, it is true, but that very rigor brings health and keeps out the foreigners who might otherwise migrate

there. The policy of the priests who dominate the country is "Tibet for the Tibetans," a policy quite sensible enough.

It is apparent that the population of Tibet is smaller than it once was. Here and there one comes across ruined villages long abandoned. Still, this is due to the egress of the population rather than the ravages of disease. Some few may have desired to move to

climates more mild, but Tibet will always remain as it is, and is not likely to become an uninhabited region.



A YAK CARAVAN



A TIBETAN BOAT

The boats are merely crude frames, covered with skin. They are light and easily carried, with the result that they are often taken upstream overland to be used on the downstream journey

DOLPHIN AT TAHITI

Capturing a Prize Specimen of the Most Colorful of Sea Fishes

BY ZANE GREY

A SKILLFUL angler having plenty of time, tackle, and money, might startle the angling world with extraordinary results of dolphin fishing in Tahitian waters.

These beautiful fish appear to be few and far between, and not easy to catch. In any day's swordfishing, however, it was rare for us not to raise a pair of dolphin. They travel in pairs, mates I would say, and the male is usually very much larger than the female. We called this male a bull dolphin, I hardly know why, unless for the fact that he fights like a bull and has a head like a bull.

When I stated above "raising dolphin," I meant that during our trolling for swordfish, with two bonito baits out, and two teasers, which are lures dragged behind the boat, we often attracted dolphin and had them rush the baits and sometimes strike them. Even a very large dolphin has too small a mouth to take a six- or seven-pound bonito and really get hold of it.

In the clear blue tropic water dolphin look pale lilac in color. They usually appear far back in the wake of the boat, follow us a moment, and then waver and fade. If a small bait or a feather gig can be put out quickly enough, a strike is certain, and a beautiful, leaping fight is equally certain.

The smaller of these dolphin usually average between forty and fifty pounds in weight. It is while we are trolling for bonito out in the open sea that we usually catch dolphin. They seldom show in near the reefs, and the smaller one of the pair is invariably hooked because it beats the big fellow to the gig. We never had the luck to bait two gigs out when

raising a brace of dolphin. But that would be the way to fish for them.

It is something to sight a couple of dolphin rush the baits and teasers. I know for a positive fact that dolphin can see a silver-headed feather gig, not to say a big, shiny teaser, fully a hundred yards distant. This, however, is not particularly striking in these crystal Tahitian waters. A needlefish can see a gig very much farther than that, and even more marvelous than his vision is the way he shoots out of the water, and in half a dozen incredibly long leaps is right upon the artificial bait, which curiously enough he never takes!

The pair of dolphin may start together, but the big one always finishes behind. You see the flash of the first and then a streak in the water. If you have a sharp eye you will catch the broad, pale bar of the second dolphin and then a long swift bulge on the surface. These fish are fast, almost as fast as a wahoo, which is going some. You will be wild to hook the big fellow, but unless you fish solely for dolphin, you seldom will. I have hooked several that would weigh a hundred pounds. They have a mean way of shaking out a small hook. I raised a couple one day, the larger of which was a foot across the nose, and eight feet long. He was huge and I hesitated to estimate what he might have weighed, but way in excess of a hundred pounds. My native boatmen were not particularly impressed. They had seen larger ones.

This fellow kept striking at my bonito bait, and finally ran off with it. I made sure I would hook him. But as luck would have it the swordfish hook did not catch. That was a hard strike to miss.

For days after that I kept a feather gig out all the time.

The largest dolphin I did catch at Tahiti weighed 63 pounds and considerably beat my world record of 50½ pounds made at the Galapagos in 1926.

This dolphin was some fish. I had out a sailfish rig, baited with a flying-fish. We had sighted a sailfish tail and I was circling round to locate it when I had a solid strike. A gleam of yellow made me think I had gotten hold of a pesky shark and I used language. My boatman Arearea shook his head emphatically.

"No-no Mann!" he said. Mann is the native name for shark.

After a little I decided he did not feel like a shark and I began to wonder what I had on. Not a sailfish, I was equally sure. He did not exactly pull me out of the boat, but on that sailfish rig he embarrassed me, to say the least. I had to sit down in the chair, jam the rod in the rod-socket, and get serious. He gave the tackle all it would stand for some perspiring minutes. Then he started for the surface and I knew we would soon see him. He shot out, high in the bright sunlight, a great, broad shield of blazing gold, and he flopped back to crack like a flat board on the water.

We all did some yelling then. The boys kept it up, but I settled down to

grim work. If I made one single mistake it would be good-bye to that golden bird. He gave a magnificent exhibition of lofty tumbling and, of course, as I had to wind my reel to keep the line taut, I drew him closer and closer, until he was leaping within a hundred feet of the boat—where in the excitement my camera was on him!

He tired soon and I led him in. But at



A RECORD DOLPHIN, CAPTURED AT TAHITI

This huge catch made by Mr. Grey is the heaviest dolphin ever taken with rod and reel, and probably the heaviest ever captured. It was 63 pounds in weight and measured 4 feet 3 inches in length

sight of the boat he hung out a few yards, weaving and turning, the most exquisite of all colorful creatures in the sea. To describe a dolphin in the water is futile. He represented the incarnate coral sea magnified by the dazzling tropic sun.

When he lay on the floor of the boat I was not only struck by the loveliness of his evanescent lines, but by that huge, blunt, queer head. I have never been able to satisfy myself why evolution produced that strange, straight front in the head of a bull dolphin.

This is more of a sticker than the sail

of a sailfish. Its use puzzled me for years until I actually saw a sailfish use his sail as a balance while striking his prey. Then it seemed so simple. A sailfish is swift. He rushes a bait. As he savagely strikes with his bill, he needs a steadying balance to keep him straight and sure. That is what the sail is for. All other uses are subservient and unimportant. The name sailfish is not felicitous.

But why has a dolphin, most colorful of sea fishes, a head like a battering ram? Could it possibly be used to ram his enemies?



MR. GREY EXAMINING HIS PRIZE



The Valley of Lillibridge Creek, New York

SALAMANDERS AND WATER HYGIENE

Recent Investigations of the Effect of Salamanders on Drinking Water

By WILLIAM G. HASSLER

Department of Herpetology and Experimental Biology, American Museum

PHOTOGRAPHS BY N. M. FULLER AND W. G. HASSLER

SECURING and maintaining an adequate water supply for a large city is a tremendous undertaking. Water must be obtained by tapping streams, rivers, or lakes, which are often located at great distances from the points of consumption, and, so far as possible, these sources must be kept clean and free from danger of pollution. Due to their size, however, and to local conditions, this cannot always be effectively accomplished. Of particular importance in this respect are the microscopic, unicellular organisms called bacteria. Many of these are beneficial but others are among man's worst enemies, some of the dangerous kinds likely to be present in water being capable of producing typhoid fever and bacillary dysentery. Steps must therefore be taken to purify the water before it is distributed with the result that it is usually filtered and then treated with various chemicals, principally chlorine, which are known to kill these micro-organisms.

In the case of smaller communities, conditions are somewhat different, for, because so much less water is needed, it is frequently obtained from near-by springs and wells. It sometimes happens that in such places those in charge of the water supply are not aware of the dangers of certain bacteria, and feel that the expense of installing and maintaining proper apparatus for chemically treating the water is more than they can afford. Some others are afraid that the chemicals will leave an objectionable taste, and they maintain that, since the water has been safe for generations past, it will remain safe for several more to come. Thus, many of these communities receive their drinking-water untreated and it therefore becomes the duty of the officials of the state boards of health to see that these water supplies are especially protected.

In testing water in a laboratory the presence of certain types of bacteria, known as colon bacilli, is commonly used



COVERED SPRINGS

A view inside an enclosure, showing the steps that have been taken to protect springs from accidental or intentional pollution

as an index of its purity. These bacteria are comparatively easy to identify in laboratory examinations and, though harmless, they occur in the excretions of animals and man and indicate the possible presence of harmful bacteria such as typhoid bacilli. In general, water showing appreciable amounts of colon bacilli is condemned as unsafe for human use.

Recently, salamanders, lizard-like amphibians, have been under suspicion as a source of colon bacilli in water supplies, and some interesting investigations have centered around them. These creatures occur, often in large numbers, in springs and streams throughout this country. They are especially numerous in the mountainous regions of the eastern states, and therefore it is not surprising that in rural districts they should be found in the springs and sometimes even in the pipe lines of public water supplies.

Their presence received scant attention from the scientific world until a little

more than a year ago, when the Cattaraugus County Department of Health, in western New York State, started to investigate certain peculiar results obtained in the laboratory examination of rural water supplies. They found that certain spring water supplies under their jurisdiction continued to give unsatisfactory laboratory tests, even after drastic steps had been taken to protect the springs from outside pollution. It was noted at this time that salamanders were sometimes found in such springs, and it occurred to Mr. Nelson M. Fuller, county sanitary engineer, that these cold-blooded animals might have some influence upon the occurrence of colon bacilli in the water. He took some of the salamanders to the County Laboratory, where a series of experiments to determine whether such might be the case was immediately begun under the direction of Dr. Edmund K. Kline. These preliminary



ONE OF THE SPRINGS AT GOWANDA, NEW YORK

Salamanders were caught wherever found in the springs and brought in sterilized cans to the laboratory for study



ONE SOURCE OF COLON BACILLI IN SPRING WATER

Purple salamanders, *Gyrinophilus porphyriticus*, were found to act as reservoirs or incubators for colon bacilli, which they give off in large numbers in the water in which they live

experiments showed that these salamanders, placed in sterile water, polluted it with colon bacilli. In order to undertake a more careful study of the salamanders of the region, their habits, and their possible relationship to the problem in question, Dr. R. M. Atwater, county commissioner of health, obtained a grant from the Milbank Memorial Fund. Since this problem extended beyond the usual scope of public health work, he appealed to the American Museum of Natural History for someone to make a herpetological survey of the region and assist in gathering further data on the problem. The writer was selected to carry on this work under the supervision of Doctor Kline.

The first intensive field studies were begun on the third day of February, 1931. During the following three weeks the springs which supply six different towns and villages throughout the county, as well as several isolated, privately owned springs, were examined and salamanders collected from nearly all of them. Deep snow covered the country-side during

much of this time, but the springs themselves were all open and showed an average water temperature of 44 degrees F. at the source. In these springs, frogs of three species were found in a nearly dormant state, hidden in crevices, overflow pipes, and other retreats under water. On the other hand, salamanders were comparatively active. Four species were found inside the enclosed springs, while one specimen of a fifth was taken from the overflow just outside a spring-house. Three of the five species were most common and very plentiful in some of the springs. These were the large purple salamanders, *Gyrinophilus porphyriticus*; the dusky salamanders, *Desmognathus fuscus fuscus*; and the mountain salamanders, *Desmognathus fuscus ochrophæus*.

One hundred salamanders were collected, placed in sterilized cans, and taken to the County Laboratory at Olean, where they were autopsied and bacteriological examinations made of portions of their gastro-intestinal tracts. A small percent-



PREPARING A SPRING FOR EXPERIMENTAL WORK

Mr. Clayton H. Sutton digging out a spring which had seven underground streams flowing into a single basin

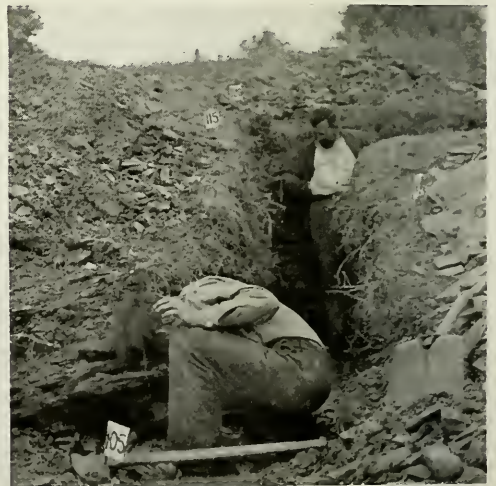
age were found to contain typical colon bacilli, but at that time little or no food was found in the alimentary tracts of most of them. Other tests showed that the skin and other parts of the body normally harbored none of these bacilli. By the end of February representatives of the different species of salamanders which had so far been found in the county were installed in tanks and terraria in the laboratory. These, together with descriptions of their known habits and the results of the field observations, were used as a basis for further studies by the regular health department staff.

The previous summer, when salamanders first came under suspicion, an interesting experiment had been started. Two tanks containing a thin layer of sterilized pebbles had been set up in the County Laboratory. These were fed by small streams of water obtained from the city supply through a mixing chamber. In one tank had been placed a large purple salamander, and at frequent intervals a little sterilized food was added to the mixing chamber to supply food to the sala-

mander and maintain similar conditions in the control tank. Daily tests were made of water from each. These showed that colon bacilli were present almost constantly in the water from the tank containing the salamander but, on the other hand, were only occasionally found in that from the control tank. Colon bacilli continued to be recovered from the salamander tank for 253 days.

Because of this and similar experiments it was felt that more work should be done, particularly with purple salamanders. Little information could be gathered from published reports, so additional field work was necessary in order to secure a more complete knowledge of their habits, and especially their movements, as well as to determine whether they carried colon bacilli to the springs, or merely secured the organisms from the water.

Therefore, early in May, the writer returned to Olean and for two months carried on additional field work. At this time, records were secured of the occurrence, abundance, and distribution of salamanders in warm weather, for com-



DIGGING OUT THE SOURCE OF A SPRING

When salamanders became scarce due to warm weather and the partial drying of this experimental spring, the spring-head was dug out. Marker number 105 indicates the original basin

parison with similar data obtained during the winter. Most of the springs investigated in February were again examined during May and June, as well as several not previously studied. One interesting phase of distribution was almost immediately observed. As the weather grew warmer it became increasingly difficult to find dusky salamanders. Even early in May it was more difficult to find them than it had been in the winter when the cold weather had confined them to springs where the water did not freeze. Later they spread out into moist places near by, and as the streams began to dry they retreated farther into crevices and other hiding places of which they alone knew. This distribution change was not so pronounced in the case of purple salamanders which remained in the streams and springs and continued to be fairly easy to find.

Identification of individual salamanders was made possible by attaching small aluminum tags to their tails. Nearly 200 purple salamanders from four different springs were so marked. It was found that these salamanders wander about considerably, moving up and down the stream beds for long distances and even moving from one spring to another. Of greater importance was the discovery that under certain conditions, they would wander out of the streams and move about on the ground, apparently in search of food; some individuals being found as far as sixty-five feet from the streams.

Autopsies showed that these salamanders fed on almost any kind of insect



AN EXCELLENT EXPERIMENTAL SPRING

More than 200 purple salamanders were obtained from this spring during May and June. Most of these were tagged and replaced so that their movements might be observed. In order to facilitate the accurate charting of these, metal markers were placed every five feet along the stream

they could master. When one purple salamander was observed eating fly larvæ which were living on mammalian refuse, the question of how colon bacilli could get into the alimentary canals of these creatures was answered conclusively.

The quantity of salamanders in any one spring surprised us greatly. Early in the investigations it was shown that large numbers of dusky salamanders could be dug out of crevices in the shale and rock at the source of a spring. However, purple salamanders were never thought to be particularly abundant in any given water course, but repeated nightly visits



TAKING A WATER SAMPLE

Water samples are collected at regular intervals from all springs supplying communities. These samples are taken in sterilized bottles to the County Laboratory to be tested for the presence of colon bacilli. It was this routine measure that led to the investigations involving salamanders

and careful investigations of certain springs served to change our ideas considerably. One hundred and forty-four of these large salamanders were caught, tagged, and returned to one particular spring, and nearly fifty more were observed there, but not tagged. It was strange, however, that there were times when not one of these salamanders could be found. Almost daily visits were made to this one spring and the numbers that could be found fluctuated greatly, but showed a marked tendency to become smaller as the season advanced. Thus we realized that external appearances or occasional visits gave no real indication of the salamander population of a spring.

Laboratory experiments gave an idea of how salamanders might infect a spring. They showed that over a period of 122 days one salamander excreted a sufficient number of colon bacilli per day to contaminate 237 gallons of water heavily enough to be considered dangerous on

every test. It is believed that salamanders act as reservoirs or incubators and, having once been infected with colon bacilli, continue to excrete them as long as there is material (food) in the salamander's stomach or intestines to supply nourishment to the bacteria. Autopsies were performed on a second series of salamanders during May and June. They all showed a marked increase in the amount of food in the stomach and intestines compared to those autopsied in February, and a similar increase in the number containing colon bacilli.

The intensive part of the field work came to an end in July but some field studies and considerable laboratory work connected with these problems were carried on through the remainder of the year. In the latter part of October, during his vacation, the writer revisited the county for a few days. At this time the distribution and abundance of salamanders, especially the duskies, were

found to resemble that of February rather than May and June. In all, during the year, approximately 1400 salamanders, 80 frogs and toads, and 120 snakes were collected in the county. Many of these were tagged and liberated, others were kept for observation and experimental purposes, and still others were sent to the laboratories of the American Museum.

Bacteriological studies failed to show any distinctive characteristics peculiar to colon bacilli recovered from salamanders. The organisms isolated were subjected to several special tests including those which theoretically distinguish "fecal" from "non-fecal" *B. coli* and those which are said to differentiate colon bacilli from warm and cold-blooded animals, but apparently the salamanders excrete the same types of bacteria they ingest, for no changes in bacteriological reactions could be demonstrated even after various strains of colon bacilli had lived for long periods of time in their intestinal tracts. Since bacteriologists are not certain that these differential tests can be relied upon for actual determinations of various kinds of colon bacilli, it is necessary to wait for further knowledge before it will be possible properly to evaluate the results. For the present it is certain only that the salamander does act as a reservoir or incubator for colon bacilli, excreting them in large numbers and for long periods of time after he once becomes infected.

It would seem, therefore, that salamanders must play an important rôle in causing certain water supplies to ap-

pear polluted, thus making it difficult to interpret the evidence of contamination. It is doubtful if a water supply can be condemned simply because it contains these creatures, but the problem of how to remove them from a spring is one that has not been satisfactorily solved. The depth to which they penetrate makes it difficult to force them out, dig them out, or kill them in their retreats. The ease with which they can pass ordinary restraining walls or fences makes it equally difficult to prevent their entering or leaving most springs. Experience may develop ways in which the salamander population of a spring may be reduced by restricting the



READING THE TEMPERATURE AT A SPRING

In addition to information relating to water pollution by salamanders, many new facts were secured during the various seasons regarding the habits of these creatures

food supply available for the animals, or their habits may be modified by treating the area of ground surrounding the spring so that they will be unable to feed there and thus will be compelled to take their food along the underground watercourse, making it impossible for them to carry surface pollution into the spring.

Certainly present methods of protecting springs from surface drainage and from animal pollution will have to be revised so that they include the entire area of ground over which salamanders are likely to wander (all that within a radius of 75 feet). This larger area must be protected both against surface drainage and against pollution by small wild or domestic animals as well as against the influx of additional salamanders. No watercourse or marshy places should extend into it, and the overflow of the spring must be piped outside of the enclosure instead of being permitted to form a small stream within it. The ends of these pipes must be protected by screens

and traps efficient against all forms of animal life, especially salamander larvæ. It would also seem desirable to modify the present practice of encouraging vegetation around the springs, for, by destroying all vegetation and "skinning" the ground within the protected area, it is possible to insure full sunlight and to limit the moisture in the ground, both sunlight and dry ground being antagonistic to salamanders.

Thus we see some of the ramifications which develop and the details which face those public officials charged with the responsibility of maintaining safe water supplies. These studies, careful considerations of heretofore overlooked factors, throw new light on water hygiene and the way to overcome some of the difficulties encountered in the interpretation of related laboratory findings. They also suggest the possibility that other zoölogical conditions, unsuspected at present, may from time to time be discovered, which affect the health and welfare of human communities.



SNAKES WERE OCCASIONALLY OBSERVED IN OR NEAR SPRINGS

*Photograph by
Wilfred Miller*



JIM
THE PHILOSOPHER

TRAILSIDE CROWS AND OTHERS

Birds That Are Happy with Human Companions

BY WILLIAM H. CARR

Assistant Curator, Department of Education, American Museum

AN iridescent, shining black projectile launched itself from the pavilion roof, flew straight as an arrow toward me, and with the utmost confidence alighted upon my shoulder. Then, very close to my ear, I heard strange guttural sounds suggestive of a coffee-grinder in travail. It was early in the day and this was Jim's way of saying, "Good morning!"

Jim was an exceedingly tame crow, and a very wise one, too. He bobbed about for awhile and then began to gently pinch the near-by ear. I reached up and took him upon my wrist. This was precisely what he wanted.

He showed immediate appreciation by first ruffling his wings and then settling down upon firmly clasped toes, murmuring softly and contentedly, and peacefully closing both eyes. How trusting he was, and how perfectly willing to go sound asleep in the sunlight and permit me to stand there for hours, if need be, and serve as an animated perch!

I held the bird for awhile, running my fingers gently over the well-preened head

feathers. But there were other duties of a more pressing nature awaiting, so the warm toes were transferred to the back of a convenient bench and I went upon my way. A tame crow can occupy a great deal of one's time!

During a period of ten years, at least thirty tame crows have stalked intimately in and out of our lives at the Trailside Museum and elsewhere. No two were alike in their manner of winning our affection and esteem. Some were thieves and great rogues, others were impudent, self-satisfied nuisances. However, paradoxical though it may seem, every one was a thoroughly likeable, "humorous," intelligent, and whimsical creature for which we had true admiration and the warmest of friendly feelings.

Jim was, perhaps, the cleverest of all. Among many other accomplishments, he learned to balance on the porcelain edge of a drinking fountain and call, in a loud, urgent voice, until someone came to turn on the water. And woe betide the hand that released the spring-lever control before he had quenched his



Photograph by M. Peter Keane

VOICES RAISED FOR FOOD

Cleo and Mark waiting impatiently for breakfast and shouting lustily in the meantime. They never were silent when mealtime drew near

thirst! Down would come the unerring black beak upon the offending fingers.

This punishment for faulty service was scarcely warranted. Jim performed the drinking act in a prolonged, leisurely, careless fashion that was most trying to one's patience. Fingers holding down the lever would become cramped long before the bird was content. He would take a mouthful, tilt his head heavenward and permit the water to trickle down a dry, red throat, savoring each drop as though it were priceless nectar. Then a few more drops and a few more until the human assistant would become tired indeed. Finally, if the good Samaritan was sufficiently obedient and long-suffering, Jim, having satisfied all inward cravings, would proceed to take a bath! He did this without regard to the far-flung spray and with no thought as to the time involved. Small wonder, then, that we constructed a special bathing and drinking place for him!

Crows do like water in the summer time! We had one pet in particular that spent literally hours in the bird bath each warm day. He would play about with the abandonment of a small child in a puddle, snatching at submerged pebbles or bits of wood, jumping up and down, flapping his wings, and obviously enjoying himself thoroughly. If we interfered with his fun or carried him off, he would show his resentment with shrill protestations and, immediately upon being released, would hop or fly back to continue the sport.

Another pet discovered a more civilized way of undergoing daily ablutions, showing a marked preference for the shower bath system. An out-of-door hose connection gave him the opportunity. Like many a similar faucet, this one leaked due to a discouraged washer that had long since given up the ghost. This dripping water attracted the bird and he was never

happier than when shuffling, turning, and teetering about underneath it. He liked to have the stream volume increased a bit so that a small but steady current poured down. This gave him an opportunity to dash beneath the flow, stand there for a moment, and then retreat, only to repeat the performance many times until the glistening feathers were thoroughly soaked. Sometimes he would "scold" the falling water just before making the leap. He reminded one of a man in similar circumstances who dreads the cold plunge but grits his teeth, shuts his eyes, and endures it, to come out with a gasp of relief and plunge again.

One of the most intelligent crows we ever associated with made his home at the Trailside Craftshop in 1931. His name, for some unknown reason, was "Joe." In the short but lively space of three months he so endeared himself to all of us that his place in life was absolutely secure. I

firmly believe that, had any stranger raised a finger to harm the bird, a general battle would have followed.

The Craftshop was an integral part of the Nature Trail and Trailside Museum system at Bear Mountain. Here we hammered and sawed and did a hundred different kinds of work, day in and day out. Joe entered into nearly all activities and was always in evidence when any new project was afoot. One of the most solemn and quiet days at the Craftshop occurred when, in the morning, it was found that Joe was ill. His head hung down and his wings drooped in utter dejection. No call of welcome greeted us when we went to open his cage. Most disquieting and ominous of all, he refused to eat!

At once we were worried. Joe was carried to a box near the center of Craftshop operations and there he stood mournfully, all day. We went about our work



Photograph by Wilfred Miller

CONTENTMENT

The crow enjoyed being held for a while, and being gently stroked upon its well-preened head feathers

with heavy hearts, as past experience had taught us that when a crow was really stricken, he usually remained that way until the end, regardless of what we might do to save him. After having tried some simple remedies, we telephoned to Mr. Stacey at the Bird House of the Bronx Zoological Park, fifty miles away. Mr. Stacey, with his usual good nature and spirit of helpfulness, no doubt sensed our desperation, for he sympathized with us and then said,

"Try castor oil."

And we did!

The next day Joe was about again. His interest in things gradually returned and three days later he was as much of a nuisance as ever!

One of our "carpenters" at the Craft-shop had a particular liking for Joe and the bird returned this friendship with interest, often to the carpenter's annoy-

ance. Joe had absolutely no fear of such mundane things as chisels, hammers, or saws. When the carpenter used the chisel to gouge chips of wood from a plank or a tree section, Joe would show keen interest in the proceeding. He would hop on to the workbench, approach to a point directly alongside and then, as each hammer stroke drove the chisel home, the crow would grasp a released chip and throw it aside. If the chip was not entirely free, Joe would tug at it, exerting every effort to separate the few remaining fibers of wood. For a time this would amuse the carpenter, though after awhile it became tiresome. Joe would be carried off, but in a moment he would come back, still anxious to prolong the affair.

On one of these occasions we heard the harassed carpenter grumble something to the effect that if Joe continued to



Photograph by Wilfred Miller

"HELPING" THE CARPENTER

Joe is keenly interested in securing each chip of wood detached by the chisel. He grasps them, pulls, and tosses them aside



Photograph by Wilfred Müller

JOE MAKES FRIENDS

Visitors to the Trailside Craftshop were usually greeted by the crow, who appointed himself a committee of one to meet young and old alike

pester him, he would let the hammer slip in the wrong direction. But we knew, perfectly well, that the crow was as safe as could be and that the grumbler would be the first to come to his defense if danger threatened.

Joe was ever the embodiment of a question mark—ever curious. Life among humans was an unending source of entertainment, of involved puzzles and mysteries. From daylight until dark he poked his black, inquisitive head into various matters, always seeking new adventures.

One riddle he could never fathom was why we objected to his propensity for pulling up newly transplanted ferns. During the season, at the expense of much labor, we went afield and collected a dozen healthy, beautiful specimens of maidenhair ferns, to plant beside our water pools. These ferns, along with other specimens, were labelled for the benefit of visitors.

Joe stood by as we did the planting. He cocked his head on one side and his dark, shining eyes did not seem to miss a detail. When the work had been completed and a fine bed of moss had been painstakingly spread on the ground between the ferns, Joe decided to make a personal investigation. He hopped about on the moss and then, before we could prevent it, expertly snipped off the slender, ebony stalk of an unusually perfect maidenhair. The crow held it over his head, umbrella-like, and marched off proudly to deposit his burden at the foot of a maple tree. While we were deploring the incident, Joe, quick as a flash, ran back to the fernery and, before we could dash to the rescue, repeated his depredation. We scolded him roundly and “shooed” him away. He was very angry about this and complained long and loudly. He appeared to think that the ferns had been planted for his own especial amusement.



Photograph by Wilfred Miller

JOE'S PRIVATE DISHPAN

The bottom of the pan was slippery, but the water was *wet*

We were unable to disabuse him of this notion, either. At the end of a week, scarcely a maidenhair fern was left. And, not satisfied with this, the crow had also succeeded in tossing aside nearly all of the moss! When his brain was set upon a thing, neither persuasion nor anything short of locking him in his cage would turn him from his purpose.

Paper bags, especially ones that were



Photograph by Wilfred Miller

FED BY HAND

Mr. Quinn was the crow's favorite companion. Wherever he was, there was Joe

closed, were invariably investigated by the ever active bird. One of his favorite pastimes was that of untwisting a bag that contained nice, bright nails. Joe easily mastered the art of gaining access by carefully pulling the paper folds around and around until the nails were at his mercy. He would pick them out, one by one, and in addition to merely scattering them about, he would manage to fly off with some and hide them in the woodpile, under planks, in the grass, or elsewhere.

The urge and the ability to hide objects was possessed by practically every one of our crows. Some had the habit more highly developed than others but all were adepts at the game. Joe, for instance, would conceal things under any available object. Frequently he would transfer his prize to another place if the first one did not suit. Often a leaf, a piece of paper, or some similar thing would be deposited on top of the hiding place, thus insuring the safety of the now completely vanished article. Excess particles of food would be similarly tucked away.

By far the most unusual result of the exercise of this hiding instinct, or acquired habit, or what you will, was demonstrated by one of our crows whose name was "Blackie." The event took place on the fair ground at Brockton, Massachusetts, where we were holding forth with a tented animal show.

We had been busy in the tent, too much occupied to follow the comings and goings of Blackie. There were snakes to be handled and no end of visitors' questions to be answered. Suddenly, in the midst of things, a little girl ran to my side, tugged at my coat sleeve, and said,

"If you want your crow, you'd better go and get him!"

I went accordingly. Outside the tent there were several large logs set upright, totem pole fashion, to hold a cross piece. The archway served as a formal entrance

to our menagerie. A sizeable crowd was gathered about, and there, on top of the cross beam I saw Blackie, calmly and serenely regarding the assembled multitude.

I rushed to the archway just in time to catch a small boy by the legs as he climbed up one of the vertical posts. The girl danced about excitedly and happily, and the crowd seemed to enjoy the situation. As yet, it was all a mystery to me! Eventually, I convinced the boy that it was to his advantage to tell me the story.

It seemed that Blackie had wandered about until the youth had conceived the idea of placing the bird on the cross bar, "just for the fun of it." This act did not alarm me particularly, but this was not all.

No sooner had Blackie settled upon his new perch than the boy began to throw small bits of wood at him. To the youngster's surprise, Blackie had not resented this target practice a bit. Instead, he had caught the wood fragments and had poked them into a long, deep crack that ran the length of the log. A man then came along and tossed a penny to the crow and this object was likewise caught and deposited in the crevice, whereupon the boy concocted a brilliant scheme. He possessed some pennies of his own. These he tossed, and the crow had equal success in retrieving them. Soon a number of people, attracted to the scene, were seized with the desire to test the crow's ability for their own satisfaction. They began to toss more pennies and nickels and dimes, too!

All of this pleased the boy exceedingly and, after having waited until the people tired of throwing away money, he climbed to the beam, collected the copper and silver, and deposited the coins in his pocket.

Once more upon the ground, he continued to play at catch with Blackie until another crowd appeared. The



Photograph by M. Peter Keane

SECOND CHOICE

A wash basin would do if the dish pan were not available

affair had been progressing in this way for some time before I arrived. What with collecting money that had fallen and that had been caught, the boy had garnered some three dollars and was so delighted with his good fortune, that he had decided to capture the crow and take him elsewhere, in order to enter into the business in a more professional way.

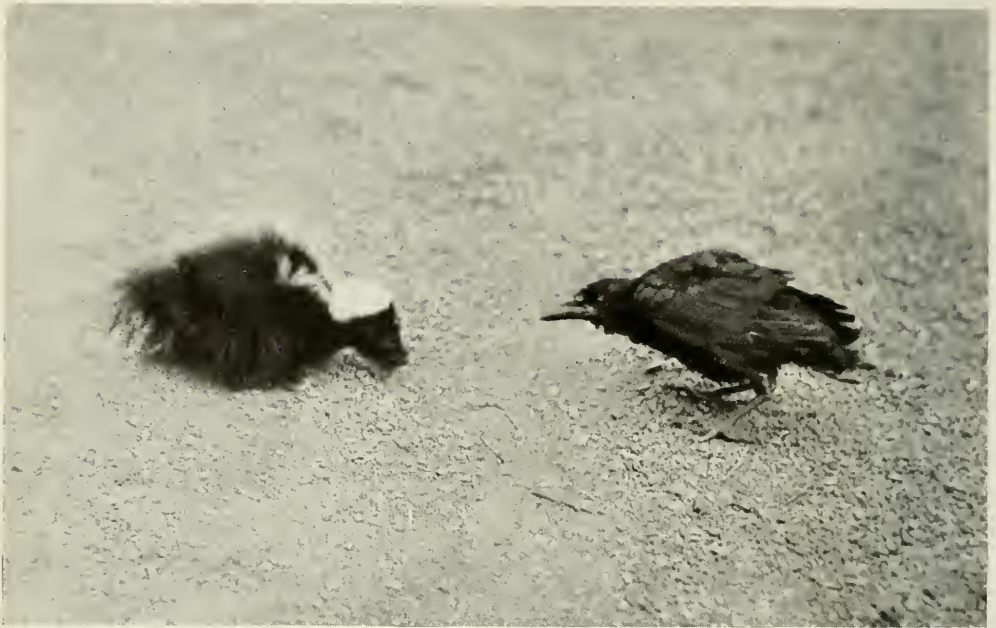
By the time the story was unfolded, I



Photograph by Wilfred Miller

PATIENT BUT WATCHFUL

Joe knew no international barriers—played no favorites; his tastes were cosmopolitan

*Photograph by Fay Welch*

A STUDY IN BLACK AND WHITE

Sachet, the skunk, and Mark, the crow, size up the situation with no disastrous results to either observer

did not know whether to admire the crow less or the boy more! However, I decided that Blackie had earned a rest, and I put him in his cage, much to the boy's chagrin. The youngster became a firm friend of ours before the fair was over, but Blackie had to confine his catching and concealing propensities to other than mercenary ends.

Blackie, by the way, was by no means the best catcher among our crow acquaintances. Joe was a superior one. We have known the latter bird to catch five objects in quick succession without once unloading his beak!

Wild crows, no doubt, are capable in as many directions as are their tame brothers. We have observed many similar traits in both free and captive individuals. One of the outstanding qualities alike in both kinds, is their desire for company. Anyone who has witnessed the autumn conclave will certainly testify to their gregariousness.

Tame crows are not much different in this respect.

Many times, while we were working in the Craftshop, Joe, or some of the other crows, would come to the window outside and plead to be taken in. Joe would stand upon the window sill, or as close to the screening as he could, and beg with a peculiarly wheedling note that usually had the desired result.

At nightfall, too, when we sat on the steps or beneath the trees, Joe would stalk over to us and jump on a knee or shoulder to join in the evening meeting. Often he would follow us about, seeking our companionship. Nor did he always beg for food on these occasions. He showed us, very definitely, that he had no ulterior motives in seeking us out.

We once had a crow by the name of "Mark." This bird not only exhibited a friendly feeling for Trailside humans but for our animal pets as well. He spent hours examining the tame raccoon, the

Photograph by M. Peter Keane

DISINTERESTED

Jim, the crow, posed peaceably for this picture though he was more interested in other things

fox, and the blue jay. Above all, he showed unending curiosity in regard to "Sachet," the patient skunk. This interest was one day rewarded in an unexpected way. It all came about because of Mark's habit of seeking articles that were white in color. White scraps of paper, buttons, metal, or any similar object was sought and tested by Mark's beak. It so happened that Sachet had a white tip on the end of her tail plume, and thereby hangs the tale!

It was early in the morning and Sachet was having her exercise in the field. We had released her from the cage that she might run about in search of crickets, grasshoppers, and beetles. Mark spied her and at once flew down to assist in the grasshopper destruction campaign. Presently he tired of this sport and wandered nearer and nearer to Sachet.



The crow was a silent observer of all that the skunk did until he became aware of the little white tuft of hair that was being drawn over the grass. He watched this phenomenon for a time and then, no longer able to resist the temptation, stalked over, and with a decisive "peck," gathered the tail into his beak.

Sachet, taken completely by surprise, jumped forward, but Mark kept his grip. There was a pause while we stood breathless expecting the worst, for the skunk was in full possession of all her faculties. But nothing happened. Sachet looked around, beheld the crow, and then started off across the field with Mark hanging grimly on. Soon, however, he tired of the sport and released the tail much to our and undoubtedly the skunk's relief!

Mark had more than one miraculous escape. Once he walked



PERFECTLY AT HOME

A much to be desired resting place that often tired the arm but never the crow

Photograph by Wilfred Miller

into our living quarters when a large vessel on the stove was boiling. Without any hesitation, the bird flew straight for it and was about to light in the center of the pot when the cook, with a lightning-like sweep of the hand, brushed him away.

We only wish that all of our crow experiences had been graced with equally happy endings, from the bird's point of

view. Unfortunately, despite every effort to prevent it, tragedy often marks the end of the story. Each time one of our birds die accidentally we insist that never again will we keep tame crows,—there is too much sadness in losing them. We have broken this vow more than once and probably will continue to do so. There is no other bird like the crow!



Photograph by M. Peter Keane

A CROW TALK

Jim had no trace of self-consciousness. He was perfectly willing to assist in any way when classes of bird students appeared



J. MCKENZIE YOUNG
JUST AFTER THE GREAT
BLIZZARD IN MONGOLIA

J. MCKENZIE YOUNG

A Gallant Comrade in the Field of Exploration—A Resourceful
Worker—A Steadfast Friend

By ROY CHAPMAN ANDREWS

Leader of the Central Asiatic Expedition and Vice-Director (In Charge of Exploration and Research),
American Museum

MAC YOUNG is dead. It is difficult for me to realize that, for he was ever filled with *joie de vivre*. Mac always laughed at life, taking the good with the bad, the thick with the thin, never complaining when Fate played him a scurvy trick. Kind-hearted, generous to a fault, loyal, affectionate, sympathetic, faithful to his friendships,—that was McKenzie Young. I shall not write a formal biography of Mac. He would not want that. He was overmodest and if I said anything at all, he would infinitely prefer that I spoke of him as I knew him in the life we lived together.

Our friendship meant a great deal to us both. It was the kind of friendship that never hesitates to ask a sacrifice each of the other, knowing that it will be given gladly. For six years we were companions in the field and out of it. We shared the joys and disappointments, the pleasures and the hardships of life in the desert. In Peking he had a courtyard in the Expe-

dition's beautiful old Manchu palace. We lived there together, Mac and I, in harmony and happiness. Therefore we knew each other as few men ever get to know their fellows.

Mac's life was always full of color and romance. He was a typical rolling stone, gathering no moss, but as he often said, "Who wants moss, anyway?"

He had been in school in Canada and during the first year of the World War he joined the Canadian forces. Hardly did he land in France before his unit went to the front. Wounded almost immediately, he was sent back to England to recover. Twice more he stopped pieces of shell, for he was a gunner in a battery of six-inch howitzers. Those experiences were interesting and he told them well. On our long trips together across the desert, he kept me fascinated for hours with accounts of his big guns and how they fought them in historic battles.

After the war, life in a city was flat



J. McKENZIE YOUNG

This photograph was taken in 1930 just before Mr. Young left New York for China

and stale. Like so many others, he sought excitement again. This time he turned to the Royal Northwest Mounted Police, that splendid patrol "who always get their man." From there a fur hunting expedition took him into the tundras of the Arctic where he learned to know the hazards of a trapper's life. Back in Seattle, robbed in a hotel of his hard won share of the sale of furs, he turned again to the Service. In the U. S. Marine Corps, he went to China and there I met him.

The Colonel of his detachment, my old friend Hal Dunlap, who as a Brigadier-General recently met a tragic death in France, knew and liked him. Colonel Dunlap arranged his detail to the Central Asiatic Expedition when he found that we needed a motor expert. This work is the most arduous of any job on the expedition. At the end of the day's run, when the other men can rest and make themselves comfortable, the motor experts must fill all the tanks with gasoline and inspect every car minutely. If anything is wrong it must be repaired that night. A motor man must accompany every reconnaissance trip. If a car is mired he is the one who gets it out. Always the hardest and the most disagreeable work falls to his lot. Mac did it cheerfully and with skill, never complaining. In the later years I depended upon him more and more for every conceivable task.

During the winter of 1926-7, I was in America. Word came down from the frozen reaches of the Mongolian plateau that our camel herd had been taken by a brigand. Mac knew that the bandit chief was a friend of

mine; that he never would have driven off our camels if he had known that they belonged to the Expedition. So into the Gobi he went. It was forty below zero and he found the bandit's *yurt*. The chief said it was all a mistake and that he would return the camels at once. Mac started back but a blizzard caught him before he was half way to Kalgan. While he was driving in the bitter cold and snow, all the fingers of both hands were frozen. The Wan Chuan Pass, where the trail drops

3000 feet to the lowlands, was a hell of drifted snow and ice. Suffering tortures, Mac somehow got down the Pass and into Kalgan. The frozen bodies of eight Chinese who were caught in the blizzard on the trail were found some days later. Only a man with a magnificent physique and indomitable courage could have got through alive.

At Kalgan Mac waited twenty-four hours for a train. Then in an open steel car packed with Chinese herded like sheep he rode fourteen hours in below zero weather to Peking. By that time he was half delirious with pain. Before he could be persuaded to go to the hospital, he insisted upon sending me a cable that our camels were safe. Devotion to the Expedition and loyalty to me were ever the most important factors in his life. At the hospital the doctors believed it necessary to amputate all the fingers of both hands. Gangrene and certain death would follow if the dead black stumps were left. Mac said "No." He would rather die than go through life with only his two thumbs left.



HALF-WAY TO KALGAN

Caught in a blizzard, Young's car stalled in the snow drifts

Dr. Harold Loucks, the Expedition's surgeon, examined him carefully. His blood was pure, his body as hard and fit as a trained athlete. Doctor Loucks reported that there was just a chance of saving his fingers but that it would mean weeks of pain.

"Let's go," said Mac with a grin.

He did not escape the pain. Night after night I would find him pacing the courtyard. Together we would walk in the moonlight until from sheer exhaustion he could sleep. Thus it was for weary months but no one ever heard Mac complain.

"I'm better," was the invariable reply to his legion of sympathizers.

All Peking paid homage to his splendid courage. Seven months later, when the last operation had been performed, only the ends of four fingers were taken away, and he could use his hands almost as well as ever.

Mac had physical, as well as moral, courage. We had many experiences together which made me feel that he and Walter Granger were the two men of all the world I'd like to have at my side in a serious row.



AT THE EXPEDITION'S HEADQUARTERS
Mac Young with his dog "Pat" in Peking



AT CHAP SER, MONGOLIA
J. McKenzie Young with a Chinese officer of the trail guard

In 1930 we were coming down from Mongolia alone in two cars. We had been warned that the trail swarmed with bandits. When we passed the Mongol village belonging to our caravan men, Bato's brother ran out to signal us. He said that the previous night thirty brigands had killed two Chinese and robbed their cars only ten miles south on the road. They might still be there; he did not know. Mac and I went on with our rifles and revolvers ready for action. We were not asking for trouble, but we did not intend to be driven off the road by thirty Chinese bandits. The cars had been held up near a mud house which had long been a brigand rendezvous. When we arrived, all was quiet and the place seemed deserted, for even the Mongols from several yurts had gone or kept indoors. We went by at full speed and passed Chap Ser in the same way, reaching Kalgan with no difficulty.

A week later Mac went back. He drove one car and Liu Hsih-ku, one of our Chinese, the other. I had a presentiment that something would happen, and asked Mac to be particularly careful on the road. Two days of rain had made the trail like grease. He fought mud all the way where we had driven over a hard, dry terrain. On the second morning after passing Chap Ser, two Mongol children told him that bandits were robbing a caravan just ahead. It was at the familiar place of the mud house.

The ground was so soft that Mac could not leave the road and circle over the hills and he decided to go on. The mud house appeared half obscured by a train of ox carts. Several men stood about. Mac had nearly passed the house when from behind a low wall thirty yards away three Chinese opened fire with Luger pistols. Bullets sang all about him, but



IN THE GOBI

Young was an expert shot, and many times this skill was used to good advantage in protecting the interests of the Central Asiatic Expedition



EN ROUTE TO MONGOLIA

McKenzie Young with Henry Fairfield Osborn, at the barrier outside Kalgan, in 1923

he was not hit. He slowed down, swung about in the seat and took a snap shot at one fellow who was doing the most persistent shooting. His bullet struck a small stone in the mud wall an inch from the man's head. Either the steel jacket or fragments of rock hit the bandit's face. He fell backward, but the other two kept on firing.

Mac dared not take his hands off the wheel, for the car was skidding dangerously. Holding his rifle in one hand like a pistol, he fired three more shots. In the meantime a dozen brigands standing near horses on the other side of the road began shooting with rifles and pistols. Some had mounted and were riding after him when Mac slowed down, took a good aim and killed a horse. That ended the matter. The bandits stopped and galloped away.

When the Expedition returned a month later, they learned that there had been eleven brigands in the mud house. They expected an easy time when the two cars approached, and got the surprise of their lives. Instead of finding sheeplike Chinese

who would have stopped at the first shot, they had figuratively grabbed a viper by the tail which proceeded to sting them unmercifully.

Unselfishness was one of Mac's most outstanding virtues; it is, I may remark, a *sine qua non* for an explorer. Time after time when we have been crossing the desert together, when water was short, when the sun had turned the sand into a glaring furnace, when our throats were parched and our mouths like cotton, I have had to watch Mac to see that he took his share. I have slept with him in the open on the summit of the Altai Mountains where the cold bit like a knife, and waked to find myself with more than my half of the blanket. Those are the things that one never can forget; the things that endear a man to his fellows as nothing else can.

Mac returned to New York from China early in 1931. The Chinese had forced a temporary suspension of the Expedition and, until we could see our way clear to resume operations, the headquarters had been closed.

In August he started to drive alone in his car from New York to California. In Nevada he met two nice-looking young men who asked him for a lift. Mac never refused a kindness to any human being. Of course, he agreed. Near Lovelock they suggested that it would be well to fill his water bottle from a spring beside the road. While he sat in the car, one of the men doped the canteen and offered him a drink. A short time later the drugged water made him so sleepy that he could not go on. He stopped the car beside the road and, while one of the men effusively thanked him for the ride, the other stepped behind, bashed him over the head, robbed and left him in the motor.

He never recovered from the blow. During the following two weeks he complained of an unendurable headache, but

continued on his way westward. On September 3 his body was found in his car in a lonely lane near Eureka, California, with a bullet in the back of his head.

Murder or suicide? The coroner reported it to be the latter. Personally I cannot believe that verdict to be true. Unless it were done when he was temporarily insane from the pain in his head, he never would have taken his own life. Of that I am sure. Mac was only thirty-seven years old and he had much to live for.

With his passing I have lost a dear friend. His place on the Expedition never can be filled. When we return to Mongolia, something vital which we loved will be gone from the life on the desert.



YOUNG'S CAR BREAKING THROUGH THE ICE

It was while driving in the bitter blizzard that caught McKenzie Young on his way back to Kalgan, that all the fingers of both his hands were frozen



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

EXPEDITIONS

TO MONTANA FOR FOSSILS.—About June 1st Dr. George Gaylord Simpson is leaving for a short field season in Sweetgrass County in south central Montana. He will examine the Fort Union Formation, studying the known fossil localities and making a reconnaissance to determine the relative ages of the different fossiliferous strata and in the hope of developing promising new prospects. Although of enormous extent, the Fort Union Formation contains fossils at only a few very limited localities and its age was long in doubt. It is now known to belong to the very beginning of the Age of Mammals, and study of the ancient animals whose remains are sparsely scattered through it is expected to clarify many doubtful points regarding this crucial period in the earth's history.

Some years ago a few fossil localities were discovered in Sweetgrass County and work in these for several seasons yielded to collectors for the United States National Museum material which is proving to be of remarkable importance. The late Dr. J. W. Gidley began work on this material, and after his recent death the director of the National Museum invited Doctor Simpson to undertake a thorough monograph of the whole collection. The present expedition is undertaken in connection with this study.

For forty years the American Museum has been actively pursuing a program of collecting, study, and exhibition of the earliest mammals of the world, and an incomparably fine collection has been brought together.

The work is particularly important because it is these earliest mammals that cast light on the most fundamental problems of the origin, evolution, and distribution of mammalian life on the globe. It is particularly difficult, because these ancient remains are generally very rare, very small, and very fragmentary. The late Dr. W. D. Matthew was especially active in this field, his

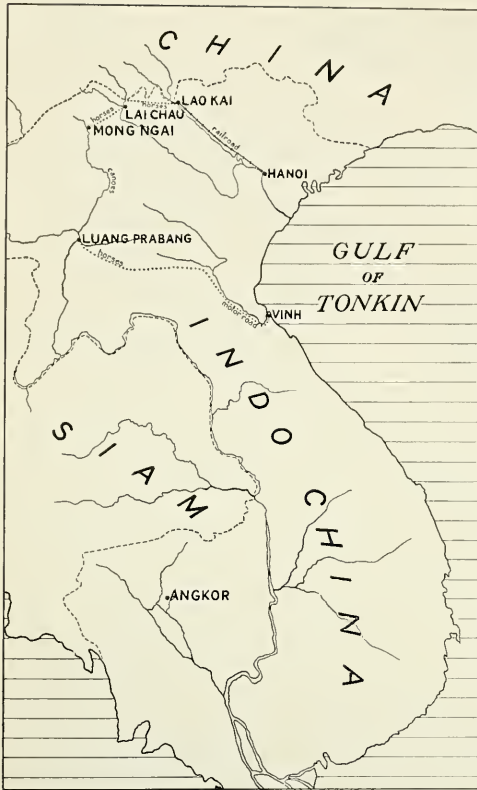
work culminating in a large memoir of the Paleocene Mammals of the San Juan Basin of New Mexico, on which he left a nearly completed manuscript which the Museum hopes to publish soon. Since 1927 this research has been continued by Doctor Simpson, and a number of scientific papers have been published and several expeditions sent out. The most recent of these, the Scarritt Patagonian Expedition of 1930-31, made a large collection of the earliest mammals of South America, and publication of its results has now begun.

The work on the Fort Union faunas is thus very important in a field which the American Museum has made peculiarly its own, and the Museum welcomes this opportunity to further this research program and to coöperate with the United States National Museum.

CENTRAL ASIATIC EXPEDITIONS.—Roy Chapman Andrews sailed on May 7 from Vancouver to return to Peking, where he is going for the purpose of looking over the present Chinese political situation and determining whether to close the Expedition headquarters there. Doctor Andrews may possibly go to Russia and to Semipalatinsk in Russian Turkestan before returning to New York. He is planning no expedition into the Gobi this season.

THE OTTLEY-ANTHONY VENEZUELA EXPEDITION returned to New York early in March and reported a successful trip.

Their stay in Venezuela was brief as they spent only about seven weeks away from the Museum. But in this time they were able to travel more than a thousand miles of roads and trails and to gain some valuable impressions as to local conditions of topography, environment, etc. It was planned to lay the greatest emphasis upon reconnaissance, and the region selected was the mountainous district of Merida where an eastern spur



THE DOTTED LINE SHOWS THE APPROXIMATE ROUTE FOLLOWED BY THE LEGENDRE EXPEDITION

of the Andes is the dominant topographic feature.

Mr. Gilbert Ottley and Mr. H. E. Anthony, the members of the expedition, landed in La Guaira and proceeded at once to Caracas, where the necessary permits to use firearms were secured after the lapse of several days. Venezuela boasts some of the finest roads in South America, and the expedition hired motor transport to carry them and their baggage to the town of Merida, which was reached after three long days of driving, a journey that used to take weeks before the advent of the automobile and good roads.

Operating from Merida as a base, the expedition established two camps in the mountains near by at elevations of about 9000 feet and close to the upper limit of forest growth. A mule pack train was necessary for these moves and a day's work by woodsmen was required to open up an old trail at one of these sites before the upper ridges could be reached.

The dry season was slow in appearing and daily rains handicapped the first weeks' work out

of Merida. Trap lines were set out in both localities where camps were established, but catches were small and the mammals were either very scarce or doing little moving about. Owing to the fact that traps could be set out for only nine nights, there was little opportunity to shift camps and trap lines in the attempt to locate better areas. However, the expedition had the good fortune to secure one species of mammal new to science, a soft-furred mouse of the genus *Thomasomys*, a group in which Mr. Anthony has been especially interested.

In the moves about Merida the party could record observations in three important life zones, namely, the paramo, the temperate forest, and the subtropical forest, and to these were added brief but valuable glimpses into the humid and the arid sections of the tropical zone by the travel between Caracas and Merida. A two-day side trip from Caracas south, past San Juan de los Morros, gave some insight into the strip which borders the llanos and is intermediate in character between these great plains and the more hilly coastal section.

Data on possible future expeditions, when more ample time would permit extensive trapping, were secured and several promising localities were noted.

THE LEGENDRE INDO-CHINA EXPEDITION.—

A letter from Mr. T. D. Carter dated December 4, 1931, mentions the arrival of the Legendre party at Luang Prabang and an imminent appointment with the King. He writes:

Everything has gone well with us so far, although we have been unable to do any intensive collecting. As you can see by the type of animals collected, most of the material was taken as we were on the move. We have been on the go almost continually since our start, which did not aid in the variety of animals collected. We have also had trouble drying the skins as every night everything, including ourselves, would be saturated with the heavy dews and fogs.

After leaving Hanoi we took rail to Lao-kai where we outfitted a horse caravan. Thence to BaXat and to Phong Tho. Here we changed to native canoe and continued to Lai Chau. At Lai Chau we hired more horses and continued into Laos. At Mong Ngai we again resorted to canoes which brought us, with a couple of changes, to Luang Prabang. . . . We hope to reach Vinh at about the first of the year where we will outfit for the southern half of the trip.

In a post card dated February 21 Mr. Carter indicates that the activities of the expedition are drawing to a close. Referring to the picture of the ruins of ancient Angkor-vat on the back of his card, he writes:

Spent three interesting days among these ruins and collected the giant black ibis which Dr. Sanford was anxious to get. Day after tomorrow we should reach Sarjón. Ten days hunting for big game and then home.

So many out-of-the-way places have been visited by the energetic members of this expedition that it has been thought worthwhile to show on the accompanying map as nearly as can be determined the general line of march of the party.

From Hanoi they went by rail as far as Lao Kai on the northern border, thence westward by horse and canoe to Mong Ngai, and south by river to Luang Prabang. The last stage of the first part of the trip was southeast by horse and auto transportation to Vinh close to the coast. After which they visited the southern part of the country, including the splendid ruins of Angkor.

A letter dated March 18 says:

Both Mrs. Legendre and I secured our tigers . . . I saw tigers on four different occasions. The first day after pitching camp, six coolies and myself took a walk down a little-used road looking for tiger signs. We were perhaps three miles from camp when we rounded a bend, and there stretched across the road, basking in the sun, lay a huge tiger. His back was toward us, but he saw us at the very same instant that we saw him, and with one bound he was among the bamboos.

Mr. Carter writes that he is bringing home alive a number of birds and two monkeys, one of which has made the entire trip with them. The Legendre Expedition has secured many hundreds of animals and birds for the Museum collections.

RACE MIXTURE STUDY.—Dr. H. L. Shapiro returned to New York on March 9 after a six-months' trip in the Orient in connection with race mixture and genetic studies.

In Hawaii Doctor Shapiro spent some time in studying the Chinese-Hawaiian population; from there going to Japan for observation of the pure Japanese race in contrast to the Japanese-Hawaiian mixture. He then crossed to China to study a group of controlled (pure stock) Chinese natives. On his return journey he stopped at Angkor to see the ruins there, and visited the Semang pygmies in the Federated Malay States. In future issues of *NATURAL HISTORY* Doctor Shapiro will describe some of the interesting observations he made on this trip.

ETHNOLOGICAL STUDY IN NEW GUINEA.—

Dr. Margaret Mead writes from New Guinea that she is now located in the interior well up on the mountains, where she expects to make a collection to illustrate the life of the primitive tribes in that region. She writes:

We are established at a base camp three days from the government station at Wiwiak. It is right up on the high range of mountains which divide the coastal plain from the central plains drained by the Sepik. The people are so-called Papuans—use the bow and arrow, have Jewish noses, and speak a non-Melanesian language which has at least twelve genders, the characteristic Papuan numerals, the absence of the inclusive and exclusive pronouns and the distinction between near and far possession. . . . We got a house put up in a week for half a bag of salt, half a bag of rice and a pig shot by our "shoot boy," and two dozen small knives. The problem of transporting supplies here is the principal difficulty, but we have three months' more supplies with us and we are able to live pretty much on the country. The government has scattered maize and beans and pumpkin seeds about and the natives eat them very little, but bring them to us. . . . A tablespoonful of salt buys a dozen large taro. . . . It is amusing to think how savage one could make this place sound, with stark naked natives wandering in, spear in hand, to trade a handful of taro for salt. But actually the people are gentle enough. They treat their pigs like dogs, and the pigs act just like

dogs, cringe under abuse, cuddle up to their masters to regain favour, and run away from strange white people in a very human panic.

ASTRONOMY

THE AMATEUR ASTRONOMERS ASSOCIATION.—

The series of radio talks given by the Amateur Astronomers Association over Station WOR ended on May 21 with a talk by Dr. E. E. Free on "Weather and Star-Twinkling." It is hoped that the Association will be invited to give this series again over Station WOR during 1932-33.

The last meeting of the Amateur Astronomers Association was held on May 18, when motion pictures of Jupiter were shown. This was also the Annual Meeting. New officers were elected for the coming year.

THE DEPARTMENT OF ASTRONOMY of the

American Museum is joining with other astronomical divisions in making plans for the eclipse observations on August 31, 1932. This eclipse is the last total solar eclipse to be seen in this country until 2017, and therefore will be the last opportunity for many of us to observe a total eclipse of the sun. The line of totality passes across portions of Vermont, New Hampshire, and Maine,—also cutting the very tip of Cape Cod. Information and exact data concerning the eclipse may be obtained by writing to the Department of Astronomy, American Museum. There are many interesting things to observe during the duration of the eclipse, and also before and after totality.

BIRDS

STUDY AT BARRO COLORADO.—Dr. Frank M.

Chapman returned April 4th from his seventh successive winter on Barro Colorado. He reports that certain of the larger mammals of the island are apparently increasing in numbers and becoming more accustomed to the presence of man. Investigators were present from Harvard, Yale, Johns Hopkins, and Cambridge (England) Universities. Doctor Chapman devoted the greater part of his winter to a study of the remarkable courtship habits of Gould's manakin. The results of his observations will appear in an early number of *NATURAL HISTORY*.

DOCTOR CHAPMAN AND MR. FRANCIS L.

JAKES have sailed for England to select, under the guidance of Lord Grey, for reproduction in a faunal habitat group, a place on the route over which Lord Grey took Theodore Roosevelt in June, 1910, to study English birds.

DOCTOR ROBERT CUSHMAN MURPHY, who

is now in England superintending the packing and shipment to the American Museum of the Rothschild collection of birds, delivered on

April 4, before the Royal Geographical Society, a lecture on "The Humboldt Current and the Peruvian Coastal Islands."

EDUCATION

PRIVATE SCHOOLS EVENINGS.—Two additional very successful programs for students of private schools were given at the American Museum on the nights of April 8 and April 15. On the first evening students from The Buckley School for Boys, Collegiate School, and St. Bernard's Preparatory School attended; the second evening the Allen-Stevenson School for Boys, the Browning School for Boys, and the Lawrence-Smith School were represented.

At eight o'clock on each of these evenings a motion picture "The Depths of the Sea" was shown. This was followed by a talk by Dr. Roy Waldo Miner on collecting corals on the bottom of the sea, in which he described experiences with the diving helmet and the Williamson submarine tube while making studies of under-sea life off the Bahamas. Beautifully colored slides and motion-picture films, some of which had been taken under sea, illustrated his talk. The guests were then divided into groups with guides from the education department and taken to the Hall of Ocean Life, where Doctor Miner, assisted by his associates in the department of marine invertebrates, showed the work that has been done thus far on the Coral Group. The Fish Hall was next visited where Dr. William K. Gregory and several members of his department explained some of the exhibits. In the Darwin Hall guides were stationed before certain exhibits, such as the tree of life, radiolarians, undersea paintings, fossil corals, and groups illustrating Darwin's work. At the end of the evening Mr. H. O. Müller of the Museum's staff gave a demonstration of glass blowing, and light refreshments were served.

THE PUBLIC HEALTH EXHIBIT at the American Museum has been transferred from Education Hall, which was designed for temporary exhibits and not for permanent ones, to an alcove on the first floor of the west central wing of the American Museum. The new arrangement brings out much more clearly the principal features of the exhibit. The public health collections, which were developed under the direction of Prof. C. E. A. Winslow, are in great demand for instructional purposes by the medical schools and biological classes of high schools.

MEMBERS VISITING DAY

FOURTH ANNUAL MEMBERS' VISITING DAY.—The evident enjoyment and the favorable comments from members led the American Mu-

seum to arrange for another Members' Day this year. It was held on April 27. At this time members and their friends had the opportunity of intimate glimpses "behind the scenes" of the extensive work which their contributions help to support. The special feature of the occasion was the opening and private view for members, of an exhibit of the work of the Museum's corps of artists and sculptors. In addition the school service facilities of the Museum were inspected, and under the guidance of the staff the visitors were conducted through the new hall of Peruvian archæology. Finally the tour included preparation studios where work on new exhibits is in progress.

Following the inspection, tea was served in Education Hall. Dr. George H. Sherwood, director of the Museum, extended the greetings of the institution and made a brief address. An instrumental trio furnished music.

SCIENCE OF MAN

WOOD CARVING FROM ALASKA.—The department of anthropology of the American Museum recently received an interesting wood carving from the Sheldon-Jackson School in Sitka, Alaska. The carving was found in a cave near the school by six little boys who had set out on a treasure hunt. Each of the boys has written a letter to the head of the department, narrating his experience in connection with the find. With the carving were some human bones, and, in addition, a skull to which hair and dried skin were still attached. To quote from one of the letters:

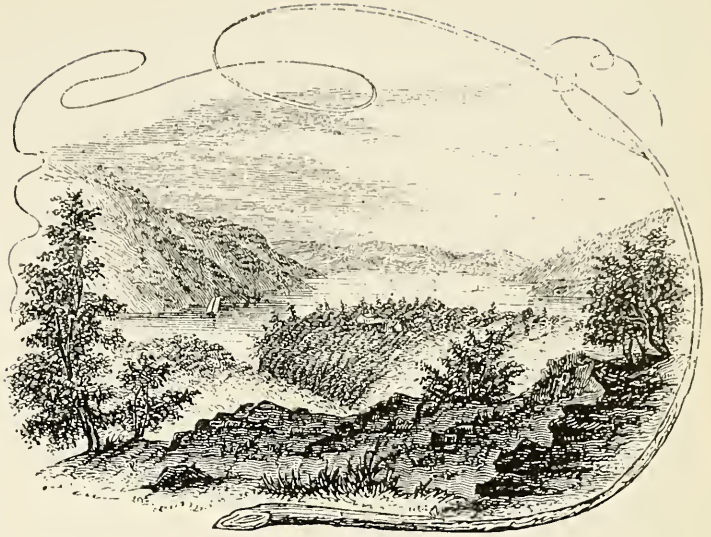
One afternoon some of the boys decided to go to the cave to hunt treasure, so we started. We entered the cave and began to play around. It happened that one boy felt something springy under his feet. We all gathered round and began to dig. In about five minutes we uncovered a board and when we took up the board saw a box underneath. We were anxious to see what was in it. As soon as it was opened, we said, "Bones"! We were all disappointed. We thought it would be full of gold. When we saw the bones we got scared and for a minute did not know what to do. Finally we thought of taking it back to our rooms to let teacher see it. So we did. We told her we found a treasure. When she opened the box, she got scared. We did not sleep much that night because of the bones, but after that we forgot about it."

LIBRARY

AMONG the outstanding recent accessions in the American Museum Library is *Florida Bird Life* by Arthur H. Howell, with its magnificent Jaques illustrations. The volume came through the generosity of Mrs. Carll Tucker. Sir John Marshall's three volumes on *Mohenjo-daro and the Indus Civilization* cover the archæological excavations of the Government of India between the years 1922 and 1927, which have so completely revolutionized the conception of the early Aryan civilization. Another early civilization is represented by the first four publications

VIEW NEAR FORT
MONTGOMERY, BEAR MOUNTAIN,
NEW YORK, 1860

The present Trailside Museum is built on the site of the house shown in the middle of the picture. The "Aeorn Trail" is in the ravine back of the house. From a pencil sketch by Tice, *Pictorial Field Book*



of the Maya Society, comprising *An Outline Dictionary of Maya Glyphs* and facsimiles of three Maya codices.

NATURE TRAILS

A NEW BEAR MOUNTAIN NATURE TRAIL.—

The Bear Mountain Trailside Museum which is being operated by the department of public education of the American

Museum in coöperation with the Commissioners of the Palisades Interstate Park, has developed a new nature trail which was opened to the public on May 15 of this year. Mr. Raymond H. Torrey, who is known to many readers of *NATURAL HISTORY*, has prepared numerous accounts of the historical associations and importance of the whole region, and *NATURAL HISTORY* is indebted to him for the following excellent description of the historical background of the ravine through which the new trail runs:

"A deep, wooded, rocky ravine, where, 155 years ago, a thousand British and Hessian soldiers swarmed through the brush and up the ledges to overwhelm the small garrison of Orange County militia, in Fort Clinton, is the scene of the peaceful and educational pursuits of the Nature Trails operated by the American Museum of Natural History in Bear Mountain State Park. Where these farm boys repulsed the enemy all afternoon of October 5, 1777, in a hail of missiles from the enemy infantry and light field guns, and heavier shot from the British warships in the Hudson, until dark when a bayonet charge drove them from their rude fort of logs and earth, children and adults, students and teachers now ramble over the trails to see the trees, flowers, mosses, lichens, insects, birds, animals, and other natural features in this ravine, once bloody from dead and dying and terrible with the fierce cries of the foes in hand to hand combat.

"The whole area of the Nature Museum and Trails, covering about fifty acres, between the Hudson River and West Shore Railroad, Bear Mountain Bridge and State Highway 9-W, in Bear Mountain Park, was part of the battle-

ground of Fort Clinton, when the British, Hessian, and Tory force of 2000 men, sent up river by Sir Henry Clinton, in a belated attempt to succor Burgoyne at Saratoga, and led by Sir John Vaughan, landed at Stony Point, climbed over Dunderberg, descended into Doodletown Valley, and advanced, on both sides of Bear Mountain, upon the forts on both sides of the mouth of Popolopen Creek. These works of logs and stone, Fort Clinton on the south side, Fort Montgomery on the north, were built to defend the great iron chain hung across the river to keep the British ships from ascending it. Fort Clinton fell first, and the remainder of the garrison swam the creek to Fort Montgomery. The Americans held out there until late evening when they were forced to flee. Yet they punished the attackers so severely that they slowed up the British expedition, which was thereafter ineffective except to burn and ravage some of the communities along the river, before news came through the lines that Burgoyne had surrendered, when it then ingloriously fell back down the river to New York.

"The story of the gallant defense of the Orange County militia is told in labels on the History Trail, on the top of the ramparts above the ravine, which was a natural defense of the fort on its southerly side.

"The bottom and sides of the ravine are used in a new feature of the Nature Trails, which have entered their sixth year of educational service at Bear Mountain. A winding trail, up and down ledges, along a little brook, has been constructed under the direction of Major W. A. Welch, general manager, and John J. Tamsen, super-

intendent, of the New York divisions of the Interstate Park. It is a half mile long, although located within a V-shaped ravine covering only a few acres.

"This is called the "Acorn Trail," by Mr. William H. Carr, assistant curator, department of education, American Museum of Natural History, who has been the director of the Bear Mountain Museum and Nature Trails since they were established in 1927. It differs from the two miles of trails elsewhere in the area, which are labelled with various natural features in place, in that it has no lettered legends, but only numbers, which relate to a key chart provided at the nature museum. Visitors have an opportunity to test their knowledge of natural history, and their capacity for readily learning the names and descriptions on the key chart, when they go over the Acorn Trail. They may keep score on themselves, as they pass the numbered exhibits, and get a rating when they return to headquarters with their results.

"There is ample material for the study of botany, geology, animals, and birds, in this Acorn Trail Ravine. More than 250 flowering plants, ferns, mosses, and lichens may be found in the moist, shaded hollow. Examples of the ancient Grenville gneisses and limestones, included in the Highlands granite, evidence of a sea so ancient that hardly a trace is left of its shore lines, are well shown. Many birds nest in the trees and brush, and squirrels, chipmunks, and mice make their homes there.

"The general program of the Nature Museum, which has been built up by Mr. Carr in the past five years to become one of the most notable of such outdoor educational enterprises in the world, is being maintained and amplified. This includes guidance and instruction for the tens of thousands of visitors, some of them teachers from other states and countries; lectures at the seventy-five group camps in the Harriman Section of the Park, and coöperation with the regional museums maintained by the park camping department.

"The American Museum of Natural History has issued a series of booklets, written by Mr. Carr, showing the development of the Nature Museum at Bear Mountain. The 1932 issue is called "Trailside Family" and includes a map drawn by Merle V. Keith, showing the various features of the nature trail area. Each shows the increasing public response to the undertaking, year after year, and the solution of problems of management and outdoor education."

HISTORY OF THE EARTH

OUTLINE MAPS OF THE WORLD.—A new edition of a homolographic base map of the world in four colors has just been issued by the American Museum. The first printing of this map in black and white appeared in July, 1931. The addition of colors has not only increased the clarity of its features, but added to its value. Land areas are shown in buff; the continental shelves to a depth of 200 meters are pale bluish-green; ocean depths to 4000 meters are pale blue, and greater depths are a deeper shade of blue.

The striking features of this outline map are two hemispherical projections set side by side but not joining. The Old World continents with 90° E. as the median meridian occupy the left half of the map. The New World continents with 90° W. as the median meridian appear on the right side. To obviate the dismembering of a continental mass, such as Africa, Asia, or North America, by a bordering meridian, marginal 15 degree strips have been added to the two sides of each hemisphere. Each of the two projections is thus 210 degrees across instead of the normal 180 degrees. The marginal strips are without doubt a decided advantage for certain purposes. One striking anomaly that arises, however, is the appearance of New Zealand on both projections.

A third map, on this same projection, has been prepared by overlapping the two projections at the intersections of the 180th meridians and 60th parallels, north and south of the Equator. The features of the Old World projection have been retained, while the overlapping portion of the New World and parts of the Pacific Ocean have been deleted. This superposing of corresponding portions of the two projections brings the continental areas of the Behring Strait region into their proper relative positions and obliterates the twin appearance of New Zealand. This map is particularly well adapted for plotting the migration of land animals.

Four of these outline maps on the homolographic projection, which represents the earth as barrel-shaped, are on sale unrolled and flattened at the Library of the American Museum. The series to date is as follows:

Map 1, 18×32" in size, two separate projections, in black and white;

Map 2, 18×32" in size, two separate projections in four colors;

Map 3, 9×16" in size, two separate projections in black and white;

Map 4, 9×13½" in size, two projections overlapped with the Pacific Ocean partially incised, in black and white. —CHESTER A. REEDS.



LIVE INSECT CAGES WITH SLIDING MAGNIFYING GLASS

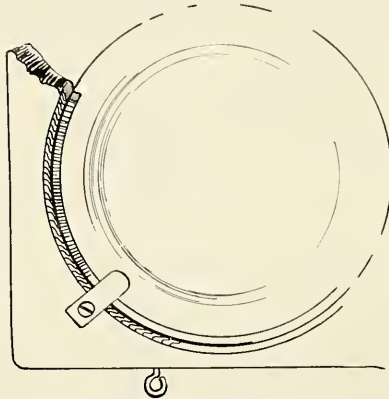
The wires upon which the traveling frame slides are fastened firmly to the table edges. Right-angled brackets aid in holding supporting posts. Individual cages are not fastened to the table top

IN the March-April issue of NATURAL HISTORY MAGAZINE, in an article entitled "Adventures With Trailside Insects," a photograph was shown of the insect display at the Bear Mountain Trailside Museum. This display included a sliding magnifying glass that could be passed before the various cages containing living insects.

A number of subscribers have asked how such a display could be constructed for their own animals or for use in connection with nature-lore educational work. Mr. William H. Carr, the author of the article, has written the following simple instructions which may be carried out easily by anyone interested in building these boxes.

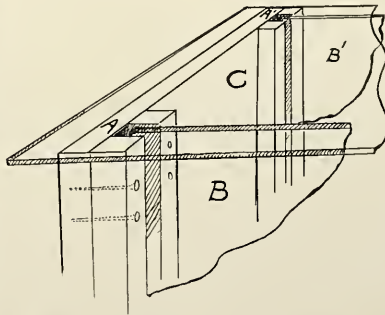
INDIVIDUAL INSECT BOXES.—These are eight inches square over all. Square pieces of solid wood (preferably one-inch white pine) are used for the sides and bottom. The front, back, and top are glass pieces held in narrow grooves, which are constructed with one-half inch square pieces of white pine stripping, fastened to the sides with small brads and glue, as shown in "A."

"C" denotes the sides of the cage, and "B" the glass in front and back. Of course the dimensions may vary considerably. Photographic plates, four by five inches, from which the emulsion has been cleaned, will do very well, and the cage may be built to size accordingly. The



SLIDING FRAME DETAIL

A circular groove suffices to hold the magnifying glass. Small metal tabs fastened with a screw will prevent slipping



DETAIL OF CAGE CONSTRUCTION

This diagram shows how the glass plates are seated in the upright grooves

grooves should be far enough apart to enable the glass to slide up and down easily.

TO INSTALL THE MAGNIFYING GLASS IN THE FRAME.—Five-inch square pieces of white pine, one-and-a-half inches thick should be used. The hole must be drilled or bored in the circle to correspond to the size of the magnifying glass. Discarded stereopticon lenses are excellent for the purpose. A groove one-half inch deep for the sides of the opening will serve to hold the glass. Four small metal tabs screwed in place as indicated will fix the glass firmly. The track to hold the sliding frame, as shown on this page is made with two uprights eight inches high. Stretch two wires across these at the top and bottom as indicated, and fasten them to the ends of the table. Ordinary screw-eyes, two in the top and two in the bottom of the frame—will keep the magnifying glass in place on the track.

The uses of this type of exhibit are many. Visitors are encouraged, through physical effort, to assist themselves in gaining more intimate knowledge of living, active creatures. The actual magnification of the specimens, while not great, is sufficient to enable the observer to gain some insight into the detail of outward form, which otherwise would not be apparent to the naked eye. The cost of all materials should not be more than five dollars.

ANNUAL REPORT

THE SIXTY-SECOND ANNUAL REPORT of the Trustees of the American Museum was issued on April 1. It contains a concise summary of the activities of the Museum for the year 1931. A different method of presentation has been adopted this year. Part I, President Henry Fairfield Osborn's section, pages 1 to 18, deals with the general policy and plans for future development. Part II of the Report is devoted to the achievements for 1931, treated under the five main phases of the Museum's work, namely: Exploration, Research, Printing and Publishing, Preparation and Exhibition, and Education.

NEW PUBLICATIONS

Search. By Lincoln Ellsworth. 1932. Brewer, Warren, and Putnam, New York.

LINCOLN ELLSWORTH, in his recently issued volume, *Search*, has told the story of his life with especial emphasis on the fascination that the empty spaces of the unexplored North have always had for him. But in the telling he has revealed himself as more than an explorer—as more than even a great explorer—for combined in him with the urge that forced him to face hardship and danger on the snow and ice of the Arctic, are more than a few of the characteristics that must go into the making of poets.

Fascinating though the Arctic has always been for Mr. Ellsworth, it was far from easy for him to find his way into its cold and dreary wastes. Adventuring in the Arctic is no everyday affair to be attempted by amateurs. And Lincoln Ellsworth, despite his interest in exploration, was, as a boy, far from physically fit for the work that so attracted him. Thus, in addition to the tasks usual for explorers, he had, as well, to build his body into the efficient machine it finally became.

Even the story of his early activities in the Canadian West, in Montana, Alaska, South America, and elsewhere is far above the average, but it is naturally the story of his two great expeditions by air with Amundsen in which the book reaches its climax. One can hardly imagine a more trying adventure than that experienced by these men and their companions, when, forced down in a lead in the Arctic by their diminishing supply of gasoline, they found themselves not only far from the Pole, which was their goal, but almost impossibly far from any place of safety. The twenty-five days that were spent there on the ice, cut off from the world and with no assurance that they could ever safely return, could have been spent in sanity only by a group of extraordinary men. And having, as a result of almost unbelievable effort, escaped from that danger,

these very men went instantly about the preparations for their dirigible flight across the Pole, and brilliantly succeeded where formerly they had as brilliantly failed.

Throughout this delightful and unusually valuable volume one cannot fail to read much between the lines. In telling the story, Ellsworth presented as well, though unconsciously, much of his own character. The foreword by Gilbert Grosvenor, and the introduction by Harold T. Clark tell more than a little of the author, and add much to the volume, but from Ellsworth himself, in the things he has told and in the things he has failed to tell, comes the most convincing pictures of himself, for despite the quiet modesty that is so much a part of the man, one sees clearly that here is one who belongs among the group of great men who, since the days of Prince Henry the Navigator, have penetrated farther and farther into the Great Unknown in their efforts to make the whole world known and useful to mankind.—H. D.

The Coming of Man: Pre-Man and Prehistoric Man by George Grant MacCurdy, Ph.D. The University Society Inc. 1932. New York.

WHEN the story of the earth during a period of three billions of years can be compressed into 110 pages (exclusive of index, references, etc.), as was done by Dr. C. A. Reeds in *The Earth, Our Ever-changing Planet*, it would seem a simple matter to condense the story of man during his brief two millions into at least a like amount of reading space. Actually, everyone knows that the smaller the divisions of a subject, the more elaborate it becomes; and the activities of man during his short tenancy of the earth are out of all proportion to the vast but slow processes of nature that preceded him.

Consequently Professor MacCurdy has made a notable achievement in having told the story of "The Coming of Man" in 144 pages, including 58 illustrations of man's handiwork. The use of several charts and outlines has assisted the author greatly in presenting his immense amount of material within these limits.

The book is a history of prehistoric man and his doings, paradoxically up to date. It includes a discussion of the most recent additions to the fossil records, *Australopithecus africanus* and the Peking Man (*Sinanthropus pekinensis*), described respectively by Dart and Davidson Black. After a survey of the important fossil remains of man in all parts of the world, the author begins the story of man's rise through successive periods of culture to the opening of the modern period. In discussing the beginnings of this culture the author states clearly his own belief as to where it began (page 44):

"There is every reason to assume that the cradle of the human race was not only somewhere in the Old World, but also north of the equator."

In the cultural chronology the several epochs are grouped under the Palæolithic, Mesolithic, Neolithic, Bronze, and Iron Epochs, and these stages in man's progress are amply illustrated with examples of his flint tools and scrapers, hand-axes, harpoons, painted pebbles, etc. Professor MacCurdy notes the pronounced line of cleavage both in regard to physical evolution and cultural evolution between the Mousterian or Middle Palæolithic and the Aurignacian,—between Neanderthal and Cro-Magnon man. The Neanderthal used tools largely fashioned by natural forces,—the hammerstone and the sharp-edged flint, while the Cro-Magnon added to this primary kit the bone or ivory needle, the dart thrower, the bone point and the harpoon, and developed his cores of flint into gravers and knives. He also used color to beautify his work. The successive epochs of Upper Palæolithic culture did not add many new forms but elaborated the original tools into objects of art and beauty.

In picturing the products of man's rising culture the salient features of his domestic life are also shown, his changes in habit and living conditions. The line between the pre-Neolithic and the Neolithic stages is marked by a momentous change. Up to that time man had been a hunter, a fisher, a "food-gatherer"; but with the opening of the Neolithic period, he became a "food producer," which profoundly changed his mode of life and opened limitless possibilities.

Professor MacCurdy calls the change from the Stone Age to the Age of Metals the most revolutionary step ever taken by man. "It meant the discovery of a new world so far as cultural advancement was concerned." After the comprehensive chapters on the Bronze and Iron ages the rest of the book is concerned with man's ways of life, his habitations, his fortifications, his clothing, art, and religion. "The Taming of Fire" makes a short but compact section, while language, music and writing, labor and industry, domestication of animals and plants, invention and commerce, medicine and metallurgy mark the ascending treads of the "staircase of culture."

—W. K. GREGORY.

What Bird Is That? A Guide to the Birds of Australia. By Neville W. Cayley, Vice-President of the Royal Zoological Society of New South Wales. Angus and Robertson Ltd., Sydney, 1931, 8 vo, pp. xx, 319, 36 Plates, 14 half-tones, 1 map.

THE first step in any study consists of learning names. Ornithology has its vocabulary, which may be learned from labeled specimens in a

museum, or from a book well illustrated and small enough to be carried on excursions. Twelve years ago Dr. Frank M. Chapman offered a little volume designed to fit the coat pocket, with eight colored plates showing in a seasonal arrangement all the land birds of the Eastern United States. The book answered the question that served as its title: "What Bird is That?"

The question is asked the world over, yet it is a surprise to see a new bird book from Australia with exactly the same title. The coincidence may not be altogether an accident. Mr. Cayley has undertaken to answer the same question for the vast area of Australia. Naturally, his book will need a very generous overcoat pocket, for it is surprising what a vast amount of information he has managed to compress within its covers. Thirty-six plates are needed to accommodate 708 kinds of birds that are shown. Each plate has a chapter of explanation, where technical and English names will be found, as well as a statement of distribution and notes on habits, nest, and eggs.

The scientific names are those of the Official Checklist of the Birds of Australia, the species alone being listed, without mention of the geographic races. The characters of such races could scarcely be shown in the color plates, and their inclusion would have expanded the volume unduly. Besides the birds native to Australia, a list of eleven species is given which have been introduced from Europe and the Oriental Region.

In order to facilitate the finding of the illustration of any given bird, they are arranged largely according to the kind of country they usually inhabit, whether heavy forests, open forest, scrub-lands, grass-lands, heath-lands, open spaces, lakes, streams, swamps, beaches, or ocean. Fourteen photographs explain the appearance of the different environments. In a few cases, also, one plate shows the largest land birds, or members of some easily recognized family such as the pigeons, birds of prey, parrots, or honey-eaters. The arrangement is eminently practical, and there are few cases where the illustrations will not readily distinguish the species. Perhaps among the shearwaters and petrels the difficulty is greatest, but where the birds look so much alike it would be hard to do better. It may be regretted that in many cases the family allegiance of the birds is not indicated in their names, as for example when the lyre-tails are shown in company with the mound-builders.

Altogether, Mr. Cayley is to be complimented most highly on providing one of the best field books on birds available for any great region of the world. No wonder that the Gould League of

Bird Lovers of New South Wales is proud to sponsor this book. The Gould Leagues in Australia evidently correspond to the Audubon Societies in America. Their watchword may well be repeated: "Education is more potent than legislation in the matter of bird preservation."

—J. P. CHAPIN.

Illustrations of Japanese [Aquatic] Plants and Animals. Vol. I: Animals. Fisheries Society of Japan, Tokyo, 1931.

THE ever active Fisheries Society of Japan is issuing this work in two volumes in folio size in commemoration of the fiftieth anniversary of its foundation. The work is being done under the supervision of a committee of seven of the most distinguished Japanese students and writers on the fauna and flora of their country. The drawings in Volume I were made by Kumatarô Itô.

The present volume consists of fifty plates in color (three of mammals, one of turtles and forty-six of fishes), there being from three to ten figures on each plate. The plates are apparently done by the three- or four-color process. Opposite each plate is a brief description in Japanese and English of each animal. The descriptions, while accurate, are non-technical and are readily understandable to the layman. There is an excellent index.

As to the accuracy of the drawing and coloration of these 300 to 500 figures, the writer hesitates to speak because of ignorance. Some of the sharks are not well done, but it is impossible to get good figures of such large fishes. Figures

have to be drawn from faulty photographs or from skins. The greater number of these drawings of sharks seem to be well done and for them scientists must be thankful. The teleosts or bony fishes, which make up forty-one of the plates, are much better done, some of them excellently so. These fishes are smaller than the sharks, can be kept in aquaria or tanks, and in painting them the artist has a fairer chance.

Color figures of fishes are a great desiderata, hard to make, expensive to reproduce, costly to purchase. The value of these plates to scientists and to all who desire to know how Japanese fishes look in life is very great.

Volume I is now ready for distribution, Volume II (Plants) will be issued this spring. Publication in America is through the press of Stanford University, California.—E. W. GUDGER.

Kamongo. By Homer W. Smith. The Viking Press. 1932.

A CLASS of air-breathing fish four hundred million years old, that get drowned if kept too long under water, and present important data bearing on the evolution of kidneys, lured an American physiologist from his laboratory and sent him into strange corners of the world. On the way home he and his shipmate, an Anglican priest, enter the lists of philosophical controversy. The "Padre" stoutly defends his faith in Design and Purpose, while the Scientist attacks crude anthropomorphic readings of the evidence and sets up the great god Chance as the sphinx of destiny. A real contribution to natural history and a lively presentation of the Riddle of the Universe.—W. K. GREGORY.

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total membership 11,830.

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Mr. FRANK PHILLIPS

Life Member

Mr. ROBERT MARSHALL

Annual Members

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Mesdames GEORGE A. BRAUN, SANDFORD D. FOOT, H. LAZARUS, ELIZABETH S. MEKEEL, AMELIA BERNDT MOORFIELD, MARSHALL CARLETON PEASE, MARY L. PECK, CHARLES SCHWEINLER, GENE TUNNEY, J. DONALD YOUNG, ANNA C. ZINGER.

Misses RITA HOCHHEIMER, THEODORA F. MALLABY

Doctors FREDERICK I. ALLEN, WYMAN R. GREEN

Messrs. H. LAWTON BLANCHARD, THOMAS HENRY CLARKE, Wm. SHEFFIELD COWLES, JAMES A. EDGAR, PHILIP GOODELL, LAWRENCE J. MACGREGOR, HARRY D. MADDEN, ALEXANDER E. O. MUNSELL, RAMON E. OZIAS, HENRY A. REVELT, CHARLES F. RICHARDS, SOMERS M. RUTLEDGE, A. C. STAMM, ALFRED J. STERN.

Associate Members

Mesdames H. N. COHN, FRANK PHILLIPS, MAY C. W. SETTLE.

Misses ANNA P. BRADLEY, ROSEMARY CROCKER, ROLENA DOWDEN, JEAN C. GOFF, MARIAN HUCKINS, CHARLOTTE E. LICKELL, JOSEPHINE NATHAN, DOROTHY V. NICHOLS,

LILLIAN A. NORTON, LUCY REARDON, RUTH SPARES, ANNE LOUISE STEGER, ESTELLE SUMNER.

Doctors GEO. W. BARBER, O. W. BRANDHORST, JOSEPH L. FEWSMITH, S. GONZALEZ, JEAN LOUIS PERROT.

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Masters THAYER A. SMITH, JR., IRVING LEHMAN STRAUS.

THE AMERICAN MUSEUM OF NATURAL HISTORY

FOUNDED IN 1869

SIXTY-ONE 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.

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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. Nearly 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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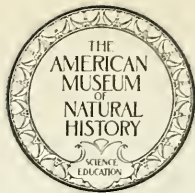
Series of illustrated lectures held on alternate Thursday evenings in the autumn and spring of the year are open only to members of the class of \$10 annually or higher or to those holding tickets given them by members.

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 have been constantly in the field for years, gathering information in many odd corners of the world. During 1931 twenty-three expeditions visited many distant portions of the globe. In 1932, however, owing to the limitations of funds, expeditions will necessarily have to be eliminated except as they are financed by gifts. In this work of exploration, consequently, the American Museum especially needs the generous help of its many friends in order to further the scientific work of the institution. Contributions to this phase of the work of the Museum are of more than usual value, and the Museum will be glad to discuss any angle of its delayed program of exploration with anyone interested in aiding this work financially.

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 108,000 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 coöperating 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 augment greatly the Museum's work, not only in New York City public schools, but also throughout the United States. More than 27,945,076 contacts were made with boys and girls in the schools of Greater New York alone, and educational institutions in more than thirty-three states took advantage of the Museum's free film service during 1931. 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

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NEW YORK, N. Y.

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FRENCH CANADIANS OF ISLE D'ORLEANS

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BLAZING THE TRAIL

SEVERAL hundred wild ducks of twenty or more different species find sanctuary on Lord Grey's ponds at Fallodon, in Northumberland. Here they are not only insured protection from their enemies, but a sympathetic consideration for their welfare is shown which accords them the status of personalities. It follows that the history of every individual bird as a member of the Fallodon colony is minutely known. In *NATURAL HISTORY* for September-October Lord Grey will write of a pair of canvasback ducks and their offspring that were fortunate enough to come under his care. The article will be illustrated by photographs recently made by Dr. Frank M. Chapman, at Fallodon.

THE recent gifts to the American Museum of the splendid series of carved jade donated by Dr. I. Wyman Drummond, have rendered timely the article on "Jade: Its Mythology and Symbolism Expressed in Its Carving," which is to appear in the next number of *NATURAL HISTORY*. Herbert P. Whitlock, curator of minerals and gems at the American Museum, who has written this article, has drawn largely upon the colorful myth and legend surrounding this famous "jewel of heaven."

IT is common knowledge that large numbers of Chinese in and about Canton live on small boats. It is less commonly known, however, that this very real "floating population" is estimated to number from 150,000 to 300,000 souls. Nor is it widely understood that they form a kind of outcast or pariah population. They form a distinctive feature in Cantonese life, and Dr. H. L. Shapiro, of the American Museum's department of anthropology, has written an unusually interesting and valuable article on this strange racial group, the origins of which are unknown even to the scientists who have studied them. This important article will appear in the next number.

READERS OF *NATURAL HISTORY* will have seen the occasional reports in the Notes of the Legendre Expedition which, during last winter, crossed Indo-China. *NATURAL HISTORY* is able to announce for the next number an article by Mr. Sidney Legendre descriptive of the expedition and its experiences.

IN the last number of *NATURAL HISTORY* there appeared an article by Mary L. Jobe Akeley on her experiences among the Canadian Rockies. The second article promised by this author on the same subject will appear in the September-October number.

ATRUSTEE of the American Museum, Mr. C. Suydam Cutting, has recently returned from the Andaman Islands, which lie in the Bay of Bengal between India and the Malay Peninsula. Near important trade routes as these islands are, it is strange that they are so little known popularly, and stranger still that the pygmy natives have been written about so rarely. This is no doubt due to the fact that they resent the intrusion of foreigners. We are glad to be able to promise for the next number Mr. Cutting's article about them.

FRENCH Canadians of Isle d'Orleans," the cover of this issue of *NATURAL HISTORY*, is the reproduction of a painting by Arthur A. Jansson. The scene represents a somewhat freely conceived idea of the Isle d'Orleans. This island is situated in the St. Lawrence, and is inhabited by the descendants of French immigrants of the Seventeenth and Eighteenth Centuries. The life of these people is still strongly reminiscent of the French peasantry of Normandy and Brittany whence most of the Isle d'Orleans families are derived. Having been isolated on their island, the villagers represent a pure French stock adjusted (in the course of two centuries) to the Canadian *milieu*. For this reason they are of considerable interest to students of man.

HOW and through whom was the secret of iron-smelting brought to ancient man in Southern Africa? While excavating for evidences of prehistoric man in a group of caverns in northern Rhodesia, Sig. Nino del Grande and Prof. Raymond A. Dart of the University of Johannesburg, made the interesting discovery that about 5000 or 6000 years ago one of the caves had served as a workhouse for iron smelting. Sig. del Grande tells the story of this find in the September-October number of *NATURAL HISTORY*.

SEVERAL additional articles of current interest will also be included in the next issue of *NATURAL HISTORY*.

VOLUME XXXII
NUMBER 4

NATURAL HISTORY

JULY-AUGUST
1932

The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor



A. KATHERINE BERGER
Associate Editor

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THE CONQUEROR OF MIKENO

Father Van Hoef amid the mossy groundsel trees and lobelias at 13,500 feet on Mount Mikenó, during his first attempt to scale the peak. Nowhere save in tropical Africa does one see such grotesque vegetation in Alpine regions. Here it is difficult to fix any tree-line, for when other species have disappeared, the tree-groundsel continues up to 14,000 feet and more, before they dwindle in size and in number. A very young groundsel is seen growing out of the moss in the foreground, and a tall lobelia stalk on the left

(See "*Climbs in the Kivu Volcanoes*," Page 356)

VOLUME
XXXII

NATURAL HISTORY

NUMBER
FOUR

JULY-AUGUST, 1932



THE FRENCH POPULATION OF CANADA

A Study on the Possible Effects of Environment
on the Stability of Human Types

BY H. L. SHAPIRO

Associate Curator of Physical Anthropology, American Museum

IN 1759 Wolfe conquered the French on the Plains of Abraham, and Quebec, the very rock of New France, dropped into the expectant hands of the British with the inevitability of a ripe fruit. Four years later the Treaty of Paris officially recognized this victory of British arms, and a vast province, like a pawn on a chessboard, changed hands without even the perfunctory sanction of the population whose destinies were concerned. But, in spite of this change in political allegiance, the population of Quebec has continued to be overwhelmingly French. It is here that France made her deepest mark in the ultimate carving out of the New World. Not only are the inhabitants of the province of Quebec, with some exceptions, French in nationality, but, what is more striking to the casual visitor, they are French in language, in customs, and in spirit.

But obvious as are the general affiliations which the visitor can so readily see between France and her former colony, there are to the more initiate eye of the Frenchman many ways in which his American cousins differ. That the French

Canadian speaks with a peculiar accent and in a patois, said to be archaic French, that he has adopted customs suited to his environment need not surprise us. It is much more extraordinary that Quebec has remained essentially French after 170 years of British control, and that she has resisted cultural absorption by the populous and aggressive civilization to the south which has for generations attracted many of her youth. It should be the task for some social historian to analyze this remarkable resistance and homogeneity of French Canada; to estimate the cohesive power of the Church, the isolating effects of a different language, the arterial nature of the St. Lawrence, and the integrity of the French heritage; and then to deduce what force or perhaps combination of forces has been able to maintain Quebec as an entity.

The cultural aspect, however, of French Canada, as fascinating as it was to us last summer, was not the lure which had induced us to spend a busy summer on the isle d'Orleans. The nature of our interest centered rather on the physical type of the French Canadian. In order to make



STREET SCENE IN QUEBEC

This photograph was taken in front of the Basilica and shows some characteristic architecture

clear exactly why this should be a subject for speculation and investigation, it is necessary to become more general in our horizon, to return later to a more special scrutiny of a very small part of Quebec—the isle d'Orleans.

During the last three centuries millions of emigrants from Europe have come to the North American continent to seek new homes. This stupendous migration, which is perhaps the largest in the history of man, reached a peak at the end of the last century and in the first years of the present one. It seems probable that this mighty tidal wave of humanity is at last on the ebb, but it has left on the shores and high in the interior of North America more than 100 million of its descendants. The advance guard found on its arrival a *milieu* which was profoundly different from anything to which it had been accustomed. There were new foods to be utilized, a wide range of climate to which

to adjust oneself, and a social and economic fluidity inconceivable in Europe. Later, although there was, with the increase of wealth and material civilization, a natural tendency to approximate European conditions as closely as possible, nevertheless a special distinctiveness, arising from historical and natural factors has continued to exist. Given such a situation, it is natural to ask what, if anything, has happened to these children of European settlers. Do they look as their ancestors did on their arrival in America, or like their contemporaneous cousins in the Old World? Have their habits of thought, their temperament, their psychology been altered by association with ideas and customs of a novel character? The American traveler in Europe knows the ease with which his nationality is detected by those whose livelihood depends on his patronage. But is this the revelation of his clothes, his

manners, his expression, or is it the actual physical structure of his face and body? To reduce such ponderings to an alternative proposition: is the physical type a stable entity or is it malleable by environmental changes and stimuli? It is evident that on the definitive answer to this question depend not only public opinion but also the philosophical and methodological concepts of students of race.

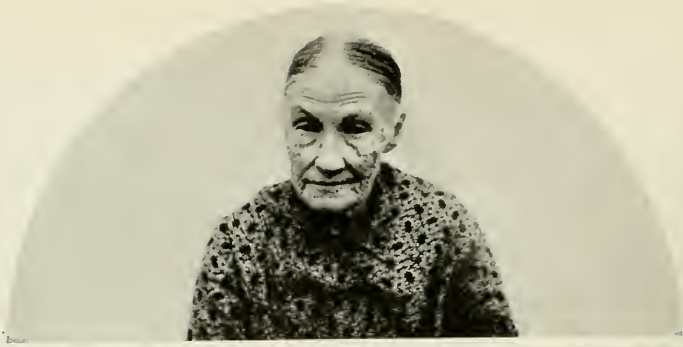
There are three ways by which a population may change its original physical character. The numerical balance of various types which go to make up a population may be disturbed with the result that one may become relatively more prolific and thus alter the average characteristics of the total population. For example, an unusually severe environment may be lethal for one strain, while ameliorated conditions, improved

medical care, or better nutrition may preserve to maturity a larger proportion of another strain which formerly tended to be eliminated. A population may also change its average character by mixture with new stock. Illustrations of this form of altered average characteristics may be found in populations arising from race mixture. The American Negro, the Spanish-Indian populations of South America, the Dutch-Japanese, and the mixed Hawaiians are a few of the numerous examples of this kind. And finally a change in *milieu* may act directly upon the development of the original strains either to produce or inhibit characteristics latent in the germ plasm without changing the balance of reproducing types. To be sure, it is conceivable that even under this last condition certain strains may be more susceptible than others to environ-



ENTRANCE TO LAVAL UNIVERSITY

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UNE FAMILLE SAINÉ
DE SAINTE FAMILLE



This group does not include all the living members of this family, but it does represent each of its four generations. Above is the great-grandmother; immediately below her to

the left and right are her daughter and son-in-law; below them are their two sons and a daughter; the woman in the circle is the wife of the man above her; below her is their child



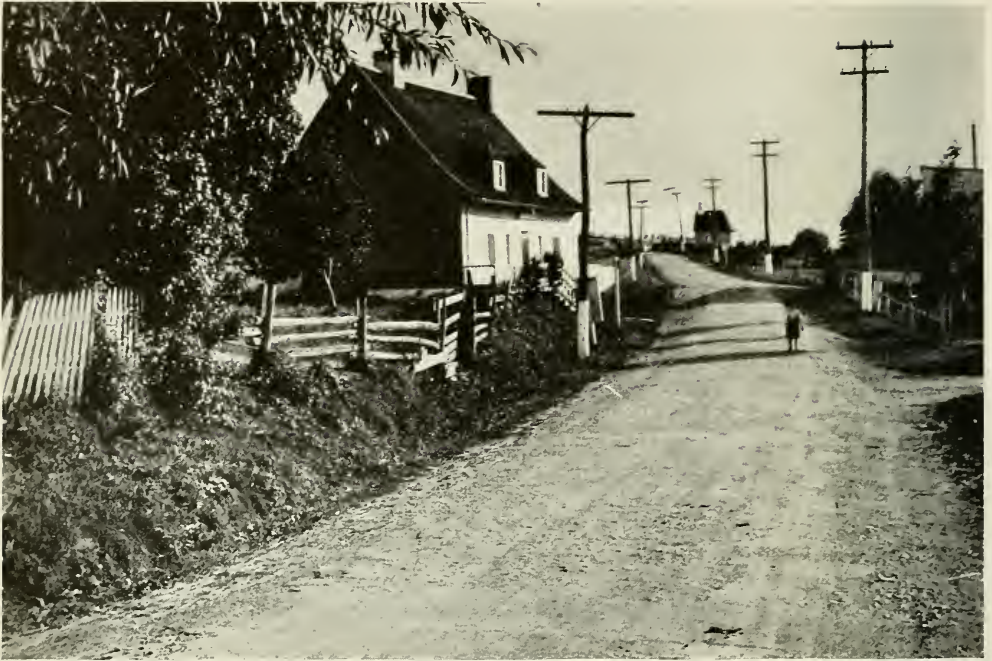
FARMHOUSE AT STE-FAMILLE

One of the typical whitewashed stone cottages that are numerous in Quebec



AN ANCIENT MANOR HOUSE

The manoir Mauvide-Genest is a relic of former days on the isle d'Orleans. It has been restored by its present occupant, a descendant of the original builder, who has added a chapel to the rear end of the house



STE-FAMILLE, ISLE D'ORLEANS

This is the main road on which the scattered houses of the village abut

mental factors. Furthermore, it is not only conceivable but very probable that combinations of these processes may be active simultaneously.

That the first two processes are going on in the United States is discernible to even the casual observer. Not only have the older related stocks such as the English, Scotch, Irish, and Dutch intermarried, but even the newer strains are entering into the general mixture. At the same time there have been marked changes in the birth-rates of a number of the elements in our population. In general the older stocks have reduced their reproductive rate. There is, of course, some evidence that the more recent immigrants are following in the same path of restricted birth-rates, but before an equilibrium is reached there will have been a change in the balance. The ultimate effect of these forces lies outside the scope of this article. The third process of population change does, however, concern us.

One of the first to call attention to the fact that bodily form may be modified in the children of immigrants was Professor Boas. About twenty years ago he pointed out in a notable report small but consistent changes in the stature and head diameters of the children of Sicilian, Jewish, and Bohemian immigrants to the United States. More recently Hrdlicka has canvassed the eastern states for subjects of old American stock in order to determine what combination of traits characterized them as a group and to establish whether or not they had departed from their ancestral type consequent to their prolonged exposure to the American environment. Both these investigators were unfortunately handicapped. Boas was unable to compare his immigrant group and their offspring with the ancestral group from which they were derived, so that the possibility of selection cannot be eliminated. That is to say, the immigrant parents themselves



YOUNG FRENCH CANADIANS

The young man on the left is clearly Breton in type, as displayed in his broad head, wide face, and nose



FRENCH CANADIAN TYPES

The reader may notice the resemblance to a Normand in the man on the right, and to a Breton in the woman at the left



LOOKING TOWARD THE LAURENTIAN MOUNTAINS FROM STE-FAMILLE

The tri-steepled church, which is the center of the village, may be seen in the middle of the picture

may represent a selected and variant group from the ancestral population toward which the American-born offspring are merely reverting. There is much to be said against this being the case in spite of its dialectical possibility. With regard to Hrdlicka's data we notice that the minor changes which he has signalized in the old American stock are to some extent paralleled in England, and that his population sample represents a mixture of English, Scotch, Irish, Dutch, French, and a few other less significant elements. It becomes, therefore, impossible to make a definitive statement with regard to any putative environmental origin for the differences which he has specified.

Even a cursory search revealed how difficult it was to find anywhere in the United States a group who presented the two desiderata for an investigation on the stability of physical type. In the first place it was necessary to discover a population which had been long settled in one area in order to allow sufficient time

for complete adjustment. Secondly, we wished to find a group which had remained unmixed with other elements and were fairly homogeneous in origin in the beginning. Such a group we found on the isle d'Orleans, an island situated in the St. Lawrence about six miles downstream from the city of Quebec.

The first mention of the isle d'Orleans was made by Jacques Cartier on his second voyage down the St. Lawrence in 1535. Somewhat later, in 1542, Roberval was said to have landed there with three ships and to have temporarily settled on the island. When Cartier first saw the island, he named it the island of Bacchus because of the numerous vines which he noticed growing there. But neither Cartier's name nor "St. Laurent" nor the Indian name, Minigo, remained fixed. The isle d'Orleans became the permanent name by which the island was known.

Our first concern in the decision to undertake a field study of the population of the isle d'Orleans was to discover to what

extent the stock living there was unmixed either with Indian or any related European strains. The island appeared never to have been the permanent abode of Indians. It was uninhabited in 1639 when Mère Marie de l'Incarnation visited it, although early accounts speak of its being used occasionally as a camping site by Hurons. The first permanent white settlers were Éléonore de Grandmaison and Monsieur de Chavigny who established themselves in the fief of Beaulieu in the western end of the island. This date is given as 1648. In 1651 some refugee Hurons fleeing from the attacks of the Iroquois were transported to the island. More than 600 were included in the colony, but very soon after their establishment on the island a surprise attack from the Iroquois drove them back en masse to the protection of Quebec, leaving the

island to the handful of French settlers. From these historical records, which are decisive, it seemed clear that Indian admixture could be eliminated as a factor influencing the physical type of the natives of the isle d'Orleans.

The archives are equally unequivocal on the absence of any whites except French among the settlers on the island. The ownership of the island itself went through various vicissitudes which would be too tedious and discursive to relate here. Until the British occupation it remained in French hands, and settlers from France were encouraged to become tenants on the feudal estates into which the island had been divided. In 1683 Ste-Famille, the oldest parish on the island, contained 394 individuals divided among 51 French families. A century later Governor Haldimand ordered a



FIRST SIGHT OF THE ISLE D'ORLEANS

As one approaches the island the wooded hillsides meet the expectant eye. The white structure is a lighthouse



THE BEAUPRÉ COAST

The St. Lawrence River and the fields of Beupré on the north shore of the river

census to be taken. Boisseau, who executed the commission, found that the parish of Ste-Famille comprised 431 inhabitants of French origin. After 1763, when the British assumed control, the stream of migration from France, which never had been very voluminous, ceased altogether. The population of the island, however, continued to increase by natural means and without the aid of immigration. The young men of the island married girls of their parish and only occasionally a daughter of another island parish. Much more rarely did the swains of Orleans seek wives from the remotely related families on the mainland. The evidence, therefore, is overwhelmingly positive that the population of the isle d'Orleans has been established on the island for at least two hundred years and is derived almost entirely from France. The antiquity of many of the present families was dramatically emphasized during the Quebec Tercentenary celebration in 1908 when medals were awarded to heads of

families that had retained title to their lands for two hundred years or more. Thirty-one families were so distinguished from the island of Orleans. Names such as Premont, Drouin, Vaillantecoeur, Blouin, de Blois, Marquis, Gagnon, Morency, Letourneau, and Turcotte, which distinguish a large part of the present population, were already existing on the island in the Seventeenth Century.

The greater number of the families on the isle d'Orleans originated in the northern part of France, particularly from Normandy and Brittany. Clamecy en Nivernais, Londigny, Combray, Mortagne, and Ventrouse figure as birthplaces of some of the earliest settlers. But these early pioneers were usually unmarried men. The demand for wives in the dominantly male colony was answered by the government sending out prospective brides. An initial experiment of dispatching girls from orphan asylums in large cities proved unsuccessful. Healthy, strong peasant girls from Normandy and

Brittany proved more suited to the rough conditions of a pioneer settlement. M. J. Edmond Roy gives this description of "the King's daughters," as they were called.

The future wives, brought over from France under the supervision of matrons, had hardly arrived at the port of Quebec than they found themselves already established. The King put in each bridal basket a dowry of fifty pounds. The weddings usually took place during the months of September and October. If one consults the archives of the parish of Quebec and the records of the notaries, one finds, each year, about that time, long lists of marriages and their contracts.

We may discover from these records that a large number of the "King's daughters" established themselves on the isle d'Orleans.

All these circumstances combined to make the isle d'Orleans an admirable place

for my purpose to study the stability of the physical type of the French Canadian. Ste-Famille was selected because it seemed of all the parishes on the island to be best suited to our investigation. Not only is it the oldest parish, but it is also one of the most populous and least affected by mainland contacts. Having already undertaken a study of the children born in Hawaii of Chinese and Japanese parents, I was particularly eager, when the opportunity arose, to visit the isle d'Orleans in order to make a parallel investigation on another stock in a totally different environment. This opportunity came from the Laboratory of Anthropology in Santa Fé which permitted me to make Ste-Famille the scene of a field course in physical anthropology.

The Chateau Frontenac was the meeting-place late in June for our party which



ANCIENT CHURCH AT TADOUSSAC

A tablet informs the visitor that this is the oldest church in America. It was built in the Sixteenth Century when Tadoussac was a trading post



REAR VIEW OF THE CHURCH AT TADOUSSAC

This church and its surrounding graves recall more primitive days in the history of Quebec

consisted of four graduate students and myself. The city of Quebec was a perfect introduction to the character of the country and the people. With its cobbled streets and gloomy, formal, stone houses, heavily shuttered, Quebec seemed like a provincial city in Normandy. In the lower city we embarked on the ferry which makes regular trips to the isle d'Orleans. As we approached the island, we began to feel misgivings at the reception which we might and, probably would, meet from the suspicious islanders. But temporarily we could not but forget our trepidations in the enfolding pastoral beauty of the island as we approached it. Along its center extends a beautifully kept woods which supplies the natives with their fuel for the long, hard winter. On both sides and stretching to the shore were the farms arranged in long parallel strips variegated in color by the diversity of the crops. A drive of about twelve miles to Ste-Famille from St-Petronille, the landing place, gave us a more intimate glimpse of the

country, only to increase our first enthusiasm. Yoked oxen, bent peasant-like figures in the fields, and pleasant whitewashed stone cottages heightened the impression that France still existed here in the New World. Quarters had been arranged by correspondence so that as we neared Ste-Famille we began to speculate on the nature of our home for the next two months. Our unanimous wish was that it prove to be one of the more charming, if perhaps less comfortable, stone cottages such as we saw along the road. Our wish was granted, for when we turned into the path that led up to the house of our hostess, we saw a perfect example of French Canadian domestic architecture. Long and one story in height, it had a steep, pitched roof with deep overhanging eaves above which two dormer windows projected.

The family of our hostess was a typical one and consisted of four generations, from the gentle and active octogenarian great-grandmother to the creeping off-

spring of the recently married George. Five additional adults in a house already full must have seriously inconvenienced the family who, however, good-naturedly transferred their sleeping quarters to the attic which was arranged like a dormitory. But the size of "our family" we soon learned was in no way remarkable. Not only are natural family clusters of several generations, inhabiting one house, common enough, but we discovered that the number of children frequently reached prodigious figures. Proud parents would exhibit their common efforts arranged in stepped sequence like a flight of stairs. And very useful, indeed, these youngsters prove to be. Even the three- and four-year-olds can help in harvesting the strawberry and berry crop, while the older ones carry heavier burdens adjusted to their age and sex. No one who can assist in the multifarious duties of the farm is idle. During the long winter when the

fields are covered by snow, the men are busy with the stock and routine farm-yard occupations, while the women practise their ancient household crafts and industries. For the latter there is a market for excess productions. Handwoven woolen blankets, homespuns, and rag rugs are the most general of the crafts.

During the busy summer months work proceeds without cessation except for Sunday. On this day the islanders devote themselves to the Church which occupies a dominant position in the life of the French Canadian. But the Church is more than a sabbatical institution. The parish priest impinges on the humblest concerns of his flock, and guides and advises them on their secular as well as spiritual affairs. Usually the parish priest is wise from long experience with the human difficulties of his parishioners, and since he is frequently the only educated



THE MORNING MILK

The milk is taken each morning to a community creamery where it is converted into butter for the Quebec market. The use of carrying sticks is as common here as in France



MOUTH OF THE SAGUENAY RIVER

One of the noblest rivers in America, the Saguenay pierces the north shore of the St. Lawrence and passes between precipitous cliffs and primeval forests into the heart of the Laurentians

man in the village it is natural that he is also the leader of the community.

Our reception by the natives of Ste-Famille was friendly but somewhat reserved. Only after we had been scrutinized and had shown a desire to become acquainted did they drop their restraint. But despite our progress with most of the villagers, there remained a few suspicious die-hards who persisted in regarding us as up to no good. One stout, and perhaps otherwise amiable, lady was convinced that our measurements of her sons and daughters were to be utilized for the next war. According to her conviction the national government was taking a census of available man power. Needless to say we were decidedly not welcome under her roof. Only one incident developed which might have been serious. This was the result of a similar misconception by a recently married young man who chased one of the party off his premises and threatened him with a pitchfork. But these were exceptional events which served to heighten the cordiality of the

remainder of the villagers, all of whom we left with regret and many of whom seemed to be sad at our departure when the summer was over.

Most of the farms are small and regularly laid out in rectangular strips. These holdings are not larger than can be adequately managed by one family, and since all available arable land has been apportioned for generations, the excess population had been forced to migrate. Usually one son remains on the ancestral farm, the others are set up in a trade or business in Quebec or less frequently in Montreal. The inheritance of the farm is not by primogeniture but is ordinarily a matter of circumstance. By this regulatory system of migration the population has been maintained around a constant number—700 or 800—without any reduction in birth rate.

Our last week in the province was spent at Ste. Anne de la Pocatiere on the south shore of the St. Lawrence. Here we secured a check series to compare with our population from Ste-Famille. Al-

though Ste. Anne is a considerably larger center than Ste-Famille, we found the same characteristics which had impressed us among the people of the isle d'Orleans. Leaving Ste. Anne we motored up to Riviere du Loup where we crossed to Tadoussac on the north shore. A trip up the Saguenay River and back along the north shore of the St. Lawrence emphasized anew the homogeneity of the habits and manners of the inhabitants of Quebec.

The material of our investigation consists of a large series of measurements and observations, including measurements of the head, face, and body, as well as data on the hair, eyes, skin, and a number of other non-mensurable traits. Hair samples were taken for analysis by Dr. Mildred Trotter, and detailed information on vital statistics was also secured which will enable us to estimate something of the physiological activity of the group. Wherever possible our data were obtained by family groups, which permits not only additional analysis of the population but presents a truer picture than is otherwise available. At this writing the material is still in the process of study, so that it is impossible to hazard even a tentative guess on the nature of the final conclusions which may result. But the work

has, however, progressed far enough to permit a brief description of the population with which we dealt. We found that the characteristic stature is a medium one—between 165 and 166 cm. This is roughly equivalent to 5 feet 5 inches and is close to the general average for Frenchmen. The trunk is moderately long in proportion to the total stature. The mean gross head dimensions we found to be about 186 mm. in length and about 156 mm. in width. These measurements give a cephalic index which is over 83.0, approximating the mean for Brittany and somewhat higher than the average for Normandy. The hair color is usually dark brown and straight, although there is a tendency toward a slight wave. The eye color is slightly more often brown than mixed blue and brown, while pure blue eyes occur in only about 15 per cent.

The final and more detailed results will, it is hoped, provide an opportunity for extensive comparisons with the ancestral population in France from which our subjects were derived. By such studies as these we may be eventually more favorably situated to form significant conclusions on the dynamic changes which environmental stimuli may induce in the bodily form of man.



THE ROCK OF QUEBEC

The city of Quebec is built on a rocky formation that is projected into the St. Lawrence, making an almost impregnable natural fortification



The pointed cone of Karisimbi, rising above the heavy *Hagelia* forest near Kabara

CLIMBS IN THE KIVU VOLCANOES

A Visitor to the Parc National Albert, However Specialized His Aims, Finds
Himself Thrilled by the Extraordinary Beauty of the Region

By JAMES P. CHAPIN

Associate Curator of Birds of the Eastern Hemisphere, American Museum

THE elevated volcanic district where the Congo, Uganda, and Ruanda meet is fast becoming a Mecca for students of the natural sciences. Now accessible by automobile from the White Nile and from Lake Tanganyika, it seems destined to be—in more ways than one—the “hub” of central Africa, another Aix-les-Bains.

Many years had I to wait before my turn as pilgrim came. The region was familiar to me from books, and even before the war, on a muddy road in the Ituri forest, I had heard its praises from friend Andersson. Going home on leave from the Kivu, he and his armed escort were convoying the precious little boxes of gold produced by the Kilo Mines. Then there was a trader, who had photographs of Grauer's gorillas; and among my companions on the ship back to England, two American prospectors for a Belgian min-

ing company, who had been looking for gold in the Kivu.

My longings were aggravated when other friends, Doctor Bequaert, Carl Akeley, Major Collins, and Doctor Phillips, came home and told of the marvels of the Kivu. Years went by, and then at last my day was approaching. It was November in 1926—fateful month. De Witt Sage and I were on Ruwenzori, our next objective being the far-famed Volcanoes. The Akeleys, who had been so kind to us in Nairobi, ought to be there already. But it might be several months before we could expect to set eyes on a volcano.

With clouds often hiding the snows of Mount Stanley, only two miles distant, what hope had we of a view of mountains one hundred and twenty miles to the southward? One never knows.

At the “Camp of the Bottles,” only

1200 feet below the snow-line, the morning of November 27 broke clear and cold, with a heavy hoar frost. I lit my oil-stove to dress, and went out to join Muri-bati and admire the snows under the first rays of the sun. From the white peaks and glaciers of Mt. Stanley my gaze wandered down into the Semliki valley, and then followed the silvery windings of the river southward. The waters of Lake Edward gleamed in the distance—never to be seen again during my stay here—and still more wonderful, its whole western shore lay in view. Now I must have rubbed my eyes, for beyond the far southern end rose three mountainous masses: the Kisale Mountains, which divide the Ruindi and Rutshuru plains, and then two flat-topped cones which could be identified only with Namlagira and Niragongo, the two youngest of the volcanoes. The remaining peaks were hidden behind a mass of clouds.

At such a distance any attempt at photography was vain, but with field glass and fountain pen I hastened to

sketch this memorable scene. With the warming day it faded into the mist. Little did I suspect that those clouds were hiding the spot where my friend Carl Akeley had been laid to rest only a few days before.

Many weary miles on foot, over the mountains west of Lake Edward, weeks of waiting for carriers, and finally we began to approach the goal. On our way we met Coolidge and Whitman, of the Harvard Medical Expedition. Their companions were still on the volcanoes.

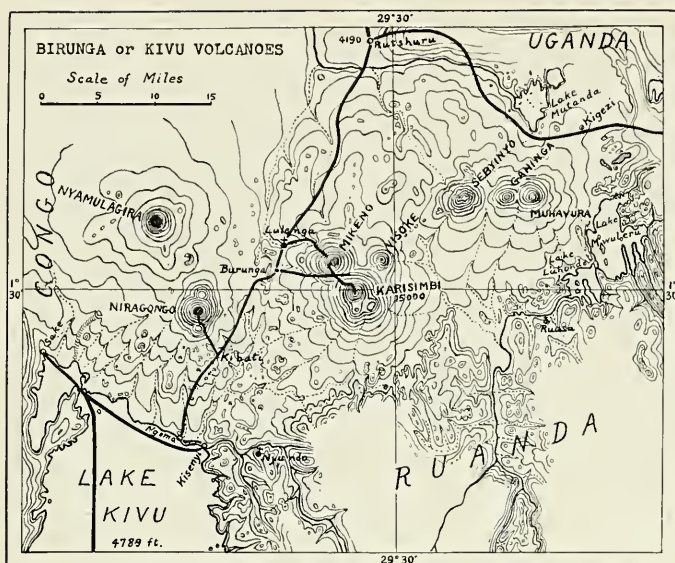
Our second view of the volcanoes, late in March, 1927, was from the top of the escarpment near Kabasha. The Kisale Mountains now rose in the foreground, but beyond them most of the volcanoes were hidden behind thick cumulus clouds, only the flat top of Niragongo standing out distinctly. Not in the least do I regret that no automobiles had yet reached the country between Lake Edward and Lake Kivu.

Two days later, as we trudged up the Rutshuru Valley late in the afternoon,



A RARE VIEW FROM THE HEIGHTS OF RUWENZORI

Beyond the broad reaches of Lake Edward rise the western mountains of the Kivu group. Redrawn by Arthur A. Jansson from Doctor Chapin's pen sketch at 13,800 feet on west Ruwenzori



SKETCH MAP OF THE VOLCANIC REGION

The National Park and adjoining Reserves now occupy the better part of the rough mountain country. A solid black line marks the expedition's route

the whole volcanic range stood out in panorama ahead, and turning about to the northward, I caught a glimpse of the snows of Stanley and Baker on Ruwenzori. But from the volcanoes themselves I never could see so far again.

At the post of Rutshuru the volcanoes, still about twenty miles away, were often clearly visible. Here we met Bequaert, Theiler, and Linder, of the Harvard expedition, and with them I made a trip eastward to Kabale in the nearest corner of Uganda to get some supplies. On our way we climbed from the lava plain near the eastern group of volcanoes up an escarpment to Behungi at 8500 feet, and there viewed the volcanoes from a new angle. Mt. Muhavura was the nearest, 13,300 feet high. No doubt this was the first of them ever viewed by European eyes. In 1861 Captain Speke, about eighty miles off in Karagwe, observed "some bold sky-scraping cones" on the western horizon, the highest of which was known there as Mfumbiro. Not until thirty-three years later were the moun-

tains first visited by a white man, Count von Götzen.

The natives who live close to the volcanoes call them collectively "Birunga," a Ruanda word meaning volcanoes. One of them is a "Kirunga," and since some are supposed to be the abodes of supernatural beings, they are named after the tutelary spirit. "Kirunga tsha Nyiragongo" and "Kirunga tsha Nyamulagira" (Volcano of Nyiragongo and Volcano of Nyamulagira) are commonly abbreviated to Mt. Niragongo and Mt. Namlagira.

Going eastward, the other principal mountains are as follows: Karisimbi—referring to its summit when covered with snow, which is compared to shells; Mikenko—perhaps from a word meaning poor, because it has no shells or cowries—also known as "Mukuru Mubi"—the big bad one; Visoké—this name is not used by natives, but the real name is somewhat obscure; Sebyinyo—perhaps meaning "the father with big teeth," because of its serrate top; Gahinga—supposedly meaning "the little one who farms"; and Muhavura or Muhabura—"the guide," since it is a landmark to the eastward. A great spirit called Lyangombe is said to reside on Karisimbi, or as some claim, on Muhavura. He may also have a lodging on Mikenko.

These were the best derivations that could be supplied by the White Fathers of Lulenga. Doctor Derscheid has given these names very thorough study, and he may be tempted to correct some of the explanations. But for my present purpose it seems just as well to use the spellings in

general usage among Europeans. They differ slightly in some cases from the correct forms.

Hunting is strictly forbidden in the Parc National Albert, but as Rutshuru is on the main road to Lake Kivu, two more parties stopped at this station while we were there. Colonel Fenn and several companions had collected a gorilla west of Lake Kivu for the British Museum, and Messrs. Babault and Deprimoz later secured one at the same place for the Paris Museum. Big game and gorillas were not among our desiderata. We were commissioned to study the birds of the volcanoes, and were therefore granted permission to collect such specimens as were essential.

On the way to the higher peaks we stopped at the Mission of Lulenga, now world-famous, it may truly be said, for its hospitality. Father Van Hoef, the Superior, after living for about ten years at the base of Mikeno, was anxious to

climb to the very top of this virgin peak. A few months before, Doctor Derscheid had all but scaled it, and so it was decided that I would go up with Fathers Van Hoef and Van den Houdt. De Witt, my companion, fell ill, and remained at the Mission under the care of Father Provoost. Soon he was well again.

As native guides we had Maguru and Ndahobari. Maguru was a man of middle age who could proudly exhibit letters of recommendation from nearly all the visitors of recent years, Barns, Akeley, and Burbridge among them. I later added mine, and it was well deserved. Ndahobari was a younger man, still making himself a good name. So off we went on June 4, 1927, two of our men carrying a sixteen-foot bamboo ladder, which Derscheid had said would prove useful.

Lulenga nestles on a grassy slope at 6000 feet, not far from the bottom of a dry valley which was buried in a flow of lava in 1905. Red clovers amid the grass are



TWO GREAT EXTINCT VOLCANOES IN THE CENTRAL GROUP

Mikeno, to the left, and Karisimbi, seen from the old lava plain to the west, where now passes the motor road from Rutshuru to Lake Kivu. Photograph by Father Provoost



THE EASTERN GROUP OF VOLCANOES

A view from the escarpment at Behungi, on the road entering the district from Uganda. Muhavura on the left, then Gahinga, and Sabinyo. Morning mists lie in the lava-strewn valley

reminiscent of home. With its back to the foot of Mikeno, the mission looks out across the broad lava field to the rounded smoking cone of Namlagira. Mikeno has really two peaks, but the one nearest Lulenga is far lower than the main pinnacle. So we first skirted the mountain on the west, and started up from Burunga, an extinct village, so to speak, represented only by a tumble-down rest-house. The lower slopes of the mountains have been largely denuded of forest by the native farmers and herdsmen. Only at 7200 feet did we really enter a mountain forest, and very soon the first thin shoots of bamboo made their appearance.

On all these mountains the vegetation changes with the altitude, and the transitions are rather abrupt. Our path led up to the saddle between Mikeno and Karisimbi, an uninhabited spot known as Kabara, now sacred to the memory of Carl Akeley. Up to 9200 feet the way

was through mountain bamboos mingled with trees. Here the bamboos do not attain the size of those on Ruwenzori. Violet plants with long stems climb four and five feet up into the bushes.

At 8500 feet we began to see a notable tree, *Hagenia abyssinica*, with pinnate leaves like those of sumach. Rare on Ruwenzori, it is one of the glories of the Birunga, and above the bamboo zone it becomes the predominant tree, forming majestic forests. At a similar level on Ruwenzori there are only heath trees and a thick, wet carpet of moss.

Ruwenzori has a savage, lonely splendor, but the Kivu Volcanoes are both pictorial and hospitable. When the mists part, one appreciates Akeley's feeling that this was the earth's most beautiful spot. On Ruwenzori a gorilla, if there were any, could find nothing edible above the zone of bamboos. On Mikeno and Karisimbi, beneath the ancient *Hagenia*

trees, there is a succulent growth of sorrel, wild celery, and other herbs at least waist-high. Mosses, ferns, and beard-lichens in abundance adorn the trees. Such are the enchanting woods that surround Akeley's grave at Kabara. The open glade in this saddle has flowers simulating stunted goldenrods, and real buttercups and thistles.

All was saddened, it is true, by memories of the friend from whom I had parted at Nairobi only eleven months before. We were deeply touched by the tender care that had been lavished by Mary Akeley on Carl's last resting place. Arriving in the afternoon, we camped at Kabara. The night was chilly, and as I listened to the eery, croaking chorus of hyraxes, it was only natural that I kept thinking of the friend who had passed from here to eternity. By day the guardians of the spot were a resident pair of white-naped ravens. Tracks of elephants and buffaloes were all about, and frequently along the paths one noticed the soft footprints of leopards in the dark volcanic soil.

Time was so limited for my good friends of the Mission that we must make haste up Mikeno. Derscheid's track had been obliterated, but we climbed the ridge nearest Kabara, and leaving the great *Hagenia* trees behind at 11,700 feet, we soon came to groups of tree-heaths. These strongly suggest junipers, but bear tiny bell-shaped flowers, and are most apt to grow on rocky outcrops. On this heath-crowned ridge at 12,300 feet we passed Derscheid's old camp, and at 13,000 feet set

up our tents amid the tree-groundrels, on a springy floor-mat of *Alchemilla*. These trailing woody plants bear a deceptive likeness to small gooseberry bushes, and have many near relatives in Europe. The groundsel trees, with their corrugated bark and bunches of huge leaves, scarcely betray their relationship to the modest herbs of the genus *Senecio* unless they happen to be bearing clusters of their yellow composite flowers. Nights now were cold, and we were glad to gather around a table with a Primus stove glowing beneath it.

We had studied the cliffs that rose im-



VASSAL AND LORD IN THE KIVU

Two natives Doctor Chapin met on the road. The stocky Muhutu on the left was undoubtedly the servitor of the taller Mtusi

mediately ahead. They looked well-nigh insurmountable, and Maguru, who had certainly come this far with Derscheid, pretended to know nothing of the steep slopes ahead. We realized that Derscheid and Wimbilia Bill, Akeley's faithful camp-boy, had gone much higher. Choosing a likely spot where there seemed to be a way up on some inclined mossy ledges, we found perhaps the only practicable route, and old footprints that must be Derscheid's. To get on the first ledge we were aided by our ladder. It would have been

impossible, anyway, to carry it higher.

During the night the thermometer had fallen below 35°. At daybreak the peaks of both Mikeno and Karisimbi were white with frost. After getting on a ledge, we climbed obliquely to a narrow ravine leading at right angles into the greater gulch that seams the southern face of Mikeno. Turning to our left, we followed this upward. At about 14,100 feet, at the foot of a serious rocky step in the gully, we left our five natives, and clambered up. Reaching the upper end of the ravine, at

14,300 feet we were obliged to turn to the right on a sharp ridge, and now found ourselves in a dense fog. The courageous missionaries were badly hampered by their cassocks, and could go no higher.

"Next time," said Father Van Hoef, "I'll come up with breeches like yours."

This was very much of a "dare," and I could not turn back just yet. Ahead was a stiff slope of soft lava, clothed with a thin covering of moss and a few small grasses. The ground-sels had all but disappeared. One had to dig all ten fingers into the moss, feel for footholds, and hope something would stick. More often the shallow layer of moss would pull loose. Sometimes small bowlders came with it, and went bouncing down the steep face of the mountain into the fog. Misery loves company, for company gives courage. I confess



BATWA VISITING LULENGA MISSION

The pygmies who roam the forests of the volcanic country use far larger bows than those of the Ituri. Photographed by Father Provoost



A DOMESTIC SCENE NEAR KIBATI

The woman on the left is peeling green bananas before cooking them; the one on the right is threshing kaffir-corn. Behind the hut grow manioc bushes, a further food reserve

I climbed but a hundred feet higher. Now came the finale—it began to hail.

Supposedly I was at 14,400 feet, but I can only give this figure with reserve. Above our night's camp I could rely only on the aneroid, and the total height of Mikenö is usually given as 14,553 feet. I doubt that I was as close to the top as that would imply. Either I am in error, or the mountain is somewhat higher.

Leaving a tin film-tube I turned back. We knew that Derscheid had marked his highest point with two cartridges; these we had not seen. Hurry we must, for our black men's teeth were chattering as they crouched under their blankets in the ravine below. Nothing shivers like an African on a high mountain. They seemed to lack courage enough to descend. Even a missionary at such times has a parental boot; it started the men on our way. But none of us would have cared to walk barefoot in a half-inch of hail-stones. Soon we were down to the tents,

and then went on to Kabara before night-fall.

The sequel was more satisfactory. Returning to Lulenga, the determined Father Van Hoef had his breeches made. Six weeks later, with another priest and two Belgian friends, M. and Mme. Léonard, he renewed the attack. The dry season had arrived, and I had left. Derscheid's cartridges were found some twenty feet above my film-tube; and then, roped together, Van Hoef's party climbed in another fifty minutes to the very summit. They were undoubtedly the first mortals ever to set foot there. The natives have no pride in scaling the highest peaks, especially not of the "Big Bad One," where the fearsome Lyangombe may be paying one of his visits. Doctor Derscheid deserves full credit for having pointed out the only way up, and with another white companion he would no doubt have succeeded in making the last few hundred feet.



MIKENO SEEN FROM KARISIMBI

The true form of a mountain cannot be seen from its own slopes. This view was from above Lukumi

After the departure of my jolly comrades for Lulenga, I decided to leave Mikeno to its proprietary spirit. I had scarcely seen a bird there, and Karisimbi, an easy climb, rose a few hundred feet still higher. First I had camp made at Lukumi, on a level shoulder of Karisimbi at 12,000 feet. It may be the remains of an old crater, and has several small pools of clear water. We were again above the *Hagenia* zone, in a mixed open growth of tree-heaths and tree-groundsel, a delightful camp if you have a good, light tent, an efficient oil-stove, and woolen underwear.

When the sun shines there are large steel-blue Dartmouth sunbirds, like those of Ruwenzori, a splendid turaco, a

mountain buzzard, and a surprising number of other birds. Once a huge, martial eagle sailed over. By night wood-owls hooted. Birds and mammals both find food much higher in the Kivu than on Ruwenzori.

Lukumi in clear weather offers a glorious view of Mikeno. With the field glass I could follow our trail of a few days before, and make a sketch of it for memory's sake. To the summit of Karisimbi there remained only 3000 feet, an easy morning's climb—if it didn't hail. We chose a clear daybreak, but at 6 A.M. a cloud cap formed on our goal. A cold east wind was blowing across the meadow at Lukumi. As we climbed the even slope above it, the heaths became dwarfed, and finally disappeared at 13,200 feet. Above this level we began to notice another kind of tree-groundsel with white fuzz on the under side of its leaves. This species prospers with frost

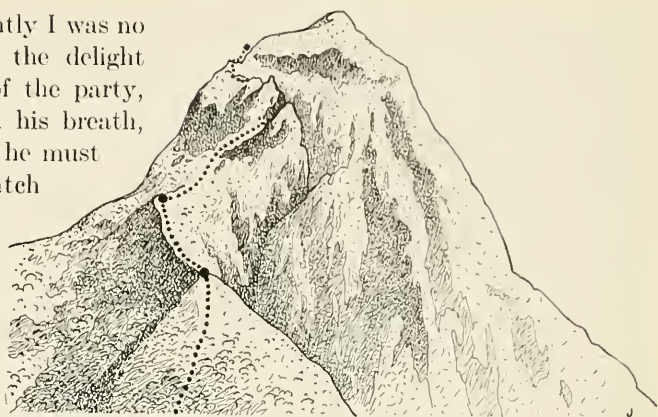
the year round.

Despite the chill in the air, the open alpine zone is very pleasant. Would that the sun might shine more often. Again we trod the springy carpet of *Alchemilla*. Patches of straw-white immortelles, and others with blossoms silver-white varied with wine-red, adorn the scene, as do also the tall *Lobelia* spikes covered with green-and-purplish flowers. Many of the tree-groundsel bore bunches of yellow blooms. Looking back at the Lukumi meadow, we saw two black buffaloes grazing there; and buffalo tracks ran far up the peak.

After holding my breath a moment to steady the field glass, I found myself

panting desperately. Evidently I was no seasoned mountaineer. To the delight of the younger members of the party, Maguru sat down to regain his breath, and fell behind. Afterward he must hurry more than ever to catch up. At 14,000 feet the groundsels were smaller, and soon we were walking on bare earth and pieces of lava bearing patches of blackish moss and flat dark-brown lichen. This is the area so often whitened by snow and hail, yet there is one last patch of dwarfed *Alchemilla* and grass only about thirty feet below the summit.

A little before eleven o'clock we arrived at the very top. A stone cairn contained mementos of previous visitors, among them several of my particular friends. Looking down to the south, whenever the drifting mists permitted, we could see another meadow there like Lukumi, with at least five small ponds—probably more. The sun seldom peeped through our cloud-cap, the temperature at noon was



THE WAY UP MIKENO

Doctor Chapin's sketch from Lukumi, redrawn by Arthur A. Jansson. Along the dotted line the lower round spot marks Derscheid's camp, the second one that of the expedition, and the square spot Doctor Chapin's stopping point

40°, and there was no view of Lake Kivu or the other mountains. We were alone in the clouds.

The altitude of Karisimbi, as given on many maps, is 14,780 feet. My best efforts with the boiling point thermometer gave me 15,019. I do not care to quote the aneroid reading, but it was not lower. Aneroids may grow giddy if carried too high. Yet I do believe this mountain rises to approximately 15,000 feet—not an impressive height to an alpinist; but for a naturalist it marks the uppermost level of plant life in Africa, except for lichens on the rocks.

No live bird was there to greet us on the summit, but among the bowlders we found the weathered remains of several small birds, possibly bulbuls. Father Van Hoef later sent me one from the apex of Mikeno. A jaw-bone of a buffalo was mute evidence of another complete but fatal ascent. Not more than thirty feet below the cairn lay a very surprising victim, a weather-beaten monkey with skin and skeleton intact. More remarkable still, it proved to be not one of the "golden monkeys" that live in bands way down among the bamboos, but *Rhinostigma hamlyni*, a gray owl-faced monkey with



FROST AT CARL AKELEY'S LAST CAMP
At daybreak the herbage at Kabara was often white with ice crystals



KARISIMBI FROM A SHOULDER OF MIKENO
The heath-covered ridge on which the party had climbed held a white cloud on its lee side

a narrow white stripe down the nose to the upper lip. The stripe suggests the owl's beak.

Its habitat remained a mystery for many years. The first two specimens were received in Europe alive, without record of origin. In 1914 Lang and I had bought a third specimen, young and very tame, in Stanleyville. Only in very recent years had it been found to dwell on the long mountain chain west of Lake Kivu. So far as I knew no one had ever encountered it in the Parc Albert. Animals have a way of dying on mountain tops, where their remains are apt to be preserved. On

the crater rim of Kilimanjaro at 19,000 feet, a mummified leopard was found by Stauffacker, an American climber.

Our return to Lukumi required only two and a half hours. Few birds are seen above 12,600 feet, even of the large sun-birds that feed at *Lobelia* flowers. Back once more at Kabara, I felt embarrassed. What would I say at home when my friends asked about gorillas? I had been living too high up to find any, but they just wouldn't understand. It seems that gorillas are most abundant down near the bamboos, yet there were some at 11,000 feet. We saw many old tracks and beds. So just before leaving, I devoted two days to the most celebrated animal of the Birunga. The first day luck was all against us, we came back to camp without seeing any fresh sign of an ape.

The next and last day we found a track of the evening before, and following it, a bed. This was at noon, and I had a notion that an old bachelor gorilla would rise early and roam afar. Ndahobari was much more cautious. He walked just ahead of me, carrying the rifle I had been urged to take for protection only. We had not gone 600 yards from



CAMP IN THE GROUNDSELS OF MIKENO
The two White Fathers in the highest camp, without a level spot, but soft *Alchemilla* under foot



BEFORE THE TENT AT LUKUMI

Tree heaths and giant groundsels cut off the view, but in themselves were strikingly graceful. The tent-fly, moved forward, sheltered the boxes that served as a table

the gorilla bed; I had picked up a small chameleon and was holding it in one hand, meanwhile reading the aneroid in the other. Not a thought in my head of meeting a gorilla just then. Suddenly Ndahobari stopped and took a step backward, with one word:

"Ngagi!"

There he was, an old man gorilla with gray sides to his back, twenty yards ahead. The vegetation swayed, and he walked off in dignified silence. We walked after him for about ten minutes, his black head in sight most of the time. No threatening move, no noise. He was reserved but civil; we just hadn't been introduced. At length I decided not to intrude any longer, and sat down to write the little story in my notebook. Now I had the answer ready for the friends at home.

We may have stayed there five minutes before we noticed that the old boy had also seated himself in his garden of sorrel and wild celery. He could see us, of course, on the slope where we rested, and finally he stood up. This was best of all. I had my glass on him as he turned toward us, and I stared back most brazenly. I do not recall a trace of malice in his black face, nor even now did he indulge in the slightest profanity. If we enjoyed even a nodding acquaintance, it terminated as his black head and shoulders disappeared again in the foliage, and he moved off. I silently wished him long life and a good appetite for his raw vegetables. To me the wild celery has a horrible flavor of parsnip. I prefer spinach, but demand it be cooked.

Doctor Derscheid has estimated the gorillas on the volcanoes at 600 or more.



THE SUMMIT OF KARISIMBI

Bare earth and lava boulders encrusted with lichens cap the great peak. In the cairn visible at the top, Doctors Derscheid and Bequaert, and other visitors had left records

This minimum number will scarcely be disputed by anyone. On the long ridges west of Lakes Edward and Kivu, and northwest of Lake Tanganyika, altogether an enormous mountain area, there must be many times more. Captain Absil, our best authority on the Lake Edward country, seems to think there are many thousands in his area, as does Martin Johnson. Surely not one third of the gorillas that have been shot in the eastern Congo in recent years have been killed for museum collections. It is scarcely time for us to indulge in statistics, rather let us rejoice that this great population of gorillas is receiving ever increased protection. Akeley's hopes are being realized.

Our time limit in the Kivu had nearly been reached. My last quick climb was to the crater of Niragongo. Namlagira would be much more attractive to a volcanologist, but it lies far off the track, and its relatively new lava is just begin-

ning to be colonized by scrub. There would be few birds. Niragongo, on the other hand, is encircled by a good forest, though it has no bamboos.

I believe that these mountain bamboos spread very slowly, for they flower only after a long period of years, and then the patches that have borne seed wither and die. The seeds may be eaten by finches and weavers, or by francolins, but this would not propagate the bamboos. How indeed do they ever reach a new isolated mountain, since they cannot grow in any intervening valley below 7000 feet?

Neither has Niragongo a zone of *Hagenia*, and only a few trees of this sort, relatively low down in the forest. At 9100 feet the forest gives way to a well defined tree-heath ring, which continues up to within a few hundred feet of the rim of the crater. This rim is at 11,370 feet. Above 9900 feet the heaths are mingled with tree-groundsels. Finally, at the top,

there are only small patches of dried grass on the gray lava.

The guide this time was a very small man from Kibati, his name Mutwa meaning dwarf, though I doubt if he was of pure pygmy stock. We carried water with us, for the supply along the way was dubious. When we camped at 9200 feet a man went up to look for it, in a little rocky gully that sometimes retains rainwater in its deeper hollows. He brought back bad news. A band of elephants passing that way had drunk the pool dry.

From our camp we could see Karisimbi only dimly through the mist, and beyond it the jagged top of Sabinyo. For a moment the apex of Muhavura showed, and then the clouds hid them all.

As we climbed higher, next morning, we had a view down into a green crater meadow on the south slope. It seemed to be verdant with lobelias. The upward way, while steep, was without an obstacle.



AN ALPINE CHAMELEON

This species keeps to the higher levels, and this one Doctor Chapin held as he watched a gorilla



A THREE-HORNED CHAMELEON

A species very numerous about Lulenga, at the base of the mountains. They are usually greenish

Soil overlying the lava became thin, the heath bushes smaller, and even the tree-groundsels did not flourish. Near the top, where the slope seemed to rise at a 45-degree angle, the small heaths were actually dead and brown.

Then we came to the rim, and tried to look down into the vast pit from which the lava had overflowed to build a great mountain. At first the mist was too dense. We waited more than an hour, in a breeze chilled to 41.5°. More chattering of African teeth. Gradually the air cleared a little, disclosing a broad, circular crater with inner walls dropping sheer to a hard level floor five hundred feet below us. We scarcely had a fair view of the opposite side, but it seemed almost three quarters of a mile away. In the middle of the smooth floor a great oval pit now became visible, from which rose a steady column of steam. It is due, I believe, to the boiling of rainwater which seeps down



NIRAGONGO AND NAMLAGIRA FROM RUTSHURU

They form but the western third of the volcanic panorama there. Namlagira, to the right, is the lower of the two, but being still active, may yet grow higher

in the cracks of the lava floor. No sulphurous odor like that of Vesuvius was noticeable. We never saw any nocturnal glow from Niragongo; the red-hot lava of Namlagira alone colored the clouds with pink after nightfall.

Niragongo has a history, but except for native reports such as those recorded by Speke, it dates back only to 1894, when Count von Götzen first visited Lake Kivu, and overcoming the fears of the blacks, climbed to this crater. For years it has been a place of pilgrimage. Kirschstein, the geologist of the Mecklenburg Expedition in 1907-8, gave it particular attention and obtained the best photograph of the crater I have seen. In 1911 Kassner wrote that a cairn on the summit held a tin box with a book for visitors to sign! There is still a visitors' register hidden there, now wrapped in broad strips of banana fibre and damp through and through. The cold preserves it from mildew.

The earliest entry in the present book was by Prince Wilhelm of Sweden, on March 7, 1921; but other signers included Governor Marzorati, the Duchess of Aosta, and Prince Leopold of Belgium. Many of my own friends had preceded me: Major Alfred Collins, Doctor Schouteden, Doctors Strong, Shattuck, Bequaert, and most of the other members of the Harvard Expedition, Miss Sharp of Colonel Fenn's party, and Doctor Derscheid. An autograph hunter, unless he had a very exceptional conscience, might be tempted to "collect" this whole little rain-soaked book. Perhaps, indeed, one has, for it is five years since I saw it, and many more celebrities have passed there.

We waited in vain for the sun to show itself, and finally turned downward to the village of Kibati, on the southeast. Near here, in the early part of the World War, ran the line of battle; and in a well-kept cemetery lie ten brave Europeans, nine of them Belgian and one Norwegian, who

gave their lives to keep the Congo for Belgium. On the hill at Ngoma, overlooking Lake Kivu, the trenches were still conspicuous. Ngoma was the Belgian boundary post at the outbreak of hostilities. Now the station at Kisenyi is the administrative center, busy with peaceful affairs in the cool shade of its eucalyptus trees.

There we awaited the arrival of the "Kibati," a tiny steamer which would take us down the Lake. As we traveled southward over the emerald-green waters of this jewel of a lake, set in rugged highlands, Niragongo alone favored us with a

farewell through the haze that reigns in the dry season of July and August. Soon it was lost to view, and the stack of our wood-burning steamer proved itself a miniature volcano, pouring a rain of villainous sparks over our iron awning and upon the barges in tow.

We tied up for the night at the island of Kwidjwi. Ahead lay new country for us, and another long mountain ridge began to show itself on the western side of the lake. There, too, are bamboos and gorillas, but no such breathless pinnacles and awesome craters as among the Birunga.



THE MISTY CRATER OF NIRAGONGO

In 1907, as photographs show, there were two rounded pits in the floor, only slightly joined. Now they have coalesced into one great oval chasm



Beating the Bast with a Clublike Instrument

BARK-CLOTH MAKING IN CENTRAL CELEBES

A Primitive Art From Which Paper Making Has Evolved

BY H. C. RAVEN

Associate Curator, Comparative and Human Anatomy, American Museum

THE Koelawi men, women, and children arise when the day begins to break and the narrow valleys of their mountainous home are filled with white mist, and all the vegetation, as well as their thatch-roofed houses, are covered with drops of dew. They make their toilette at the nearest brook or river. The man then goes to gather his palm wine, known as *toele* or *baroeh*, that during the night has been dripping from the cut fruit stem in the top of a sugar palm and has been caught in a bamboo or gourd container, where fermentation is already under way. Meanwhile his wife prepares the morning meal, or if there is a half-grown daughter, she may do the cooking while the mother alternately beats bark-cloth and nurses a baby.

Bark-cloth making is probably the most interesting and noteworthy industry

of the people of northern Central Celebes. Apparently the people of the Koelawi district make more and better bark-cloth than is to be found in any of the other districts, viz., Bada, Besoa, or Napoe.

In Koelawi the beating of the bark-cloth with its familiar "pung-pung-pung" may be heard daily throughout nearly the whole year from dawn to dusk. The principal or most commonly used bark is that of the waringan tree, a species of *Ficus*, which is known to the Koelawi people as *Noenoe*.

The waringan is common in the jungle about Koelawi. Sometimes the women and children, especially girls, cut the branches of the waringan into short pieces, tie them in bundles, and carry them on their backs to their homes in the same manner in which they carry firewood. Should the place where the waringan is

found be some distance from the kampong, the bark is first stripped or peeled from the limbs and branches and then bundled and carried to the kampong. Usually when the branches are simply cut in pieces and carried to the kampong to be peeled, the branches are afterward dried and used as firewood.

After the bark has been peeled from the limbs and branches it must again be peeled, that is, the rough outer surface is separated from the bast, the fibrous layers which are used in the making of the cloth.

The next stage is the boiling of the bark, which takes considerable time and loosens up the fiber to such an extent that it seems almost like pulp. It is then placed in a stream or brook where it remains covered by water. The action of the

water continues to loosen up the fiber and wash away the sap, or at least some of it. The time usually occupied in boiling and soaking the bark amounts to three or four days. At the end of this time it is soft and very much disintegrated, although all the pieces of bark have been kept lying in one direction.

The next and most important stage consists of pounding and beating this pulpy mass, which is four or five inches in diameter and about two feet long, until it broadens and lengthens, finally measuring from five to eight feet in length and about eight to ten feet in width, doubled, or sixteen to twenty feet single width.

The pieces of bark-cloth used for dresses are made in cylindrical form, like a Malay sarong, but instead of being sewed up the side, the bark-cloth is



FOUR GIRLS OF THE VILLAGE OF PANGANA

More and more woven cotton cloth is available to the people of Central Celebes who readily appreciate its superiority over bark-cloth. In the above photograph two of the girls are wearing bark-cloth jackets and bark-cloth skirts, while the others are wearing woven cotton clothing



PEELING THE BARK

One of the first stages in the manufacture of bark-cloth is the separation of the outer bark from the fibrous inner layer or bast. Each woman has beside her a bundle of bark. As the rough outer part is peeled off with the aid of a large knife the fibrous bast is placed on the mats in the foreground



MAID OF THE MOUNTAINS

The head band is of bark-cloth, embroidered and covered with mica. The spreading part is of bark-cloth which has been folded and dyed bright colors. The jacket is of fine quality bark-cloth dyed maroon red, streaked with a sweet smelling black gum upon which have been stuck flakes of mica. The skirt is of heavy bark-cloth, dark brown in color. The hand bag is of the same material as the jacket and is decorated with a geometric design in bright colors. The necklace is of beads interspersed between bars made from a shaft of chicken feathers



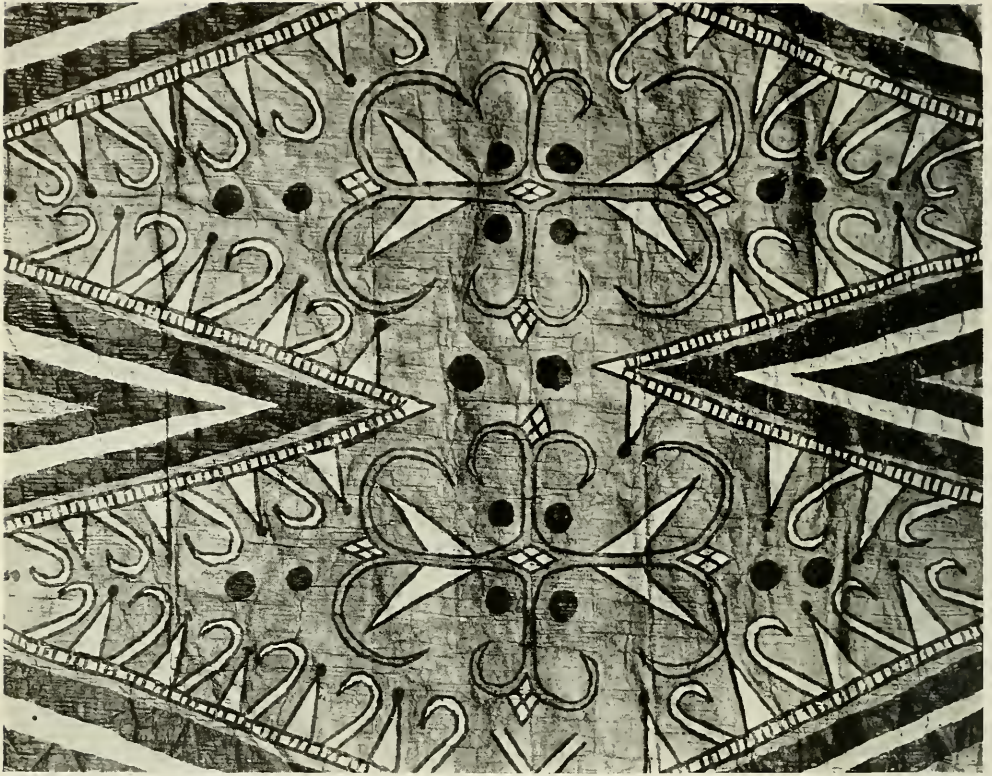
THE FINAL BEATING

After the bast has been boiled and soaked in a stream, it is placed on a plank and beaten with a clublike instrument which is grooved on its flat surface. The final stages of the beating are done with instruments made of stone with rattan handles. At first stones with coarse ridges are used and later finer ones



THE FULL DRESS

The people of Central Celebes wear full dress upon the slightest occasion, and at such times the woman fastens a huge bouquet to the back of her skirt. It is always the back of the jacket that is most decorated, while often the front is left entirely plain. Perhaps this custom has something to do with the habit of these mountain people in following narrow, winding paths, single file through the forest, at which times the woman walks ahead and the man with his spear on his shoulder follows, that he may guard her and also admire her decorated dress and bouquet.



DESIGN ON A BARK-CLOTH BAG

Dr. Walter Hough has shown that these designs are conventionalized from a drawing of the head and horns of the common water-buffalo of the region. (Specimen U. S. N. M. No. 304121 collected by H. C. Raven at Toare, Bada District, Central Celebes, 1917—Courtesy United States National Museum)

pulped or felted together; therefore, for a Koelawi woman's skirt no sewing is required. The pulp or bark is first placed on a plank, which has a wooden prop under each end, and is beaten with an instrument made especially for the purpose from the very hard wood of the trunk of the sugar palm (*Arenga saccharifera*). The face or lower side of this instrument is deeply grooved. This instrument serves to flatten the pulpy mass and make ridges over the entire surface. When the pounding of the pulp begins, the mass is rather soft and contains much water. Most of this is squeezed out by the above mentioned instrument, which leaves ridges that give strength enough to keep the mass from falling apart. The use of this instrument is continued until the pulp has

become quite spread out and about six millimeters in thickness. Sometimes two wooden instruments are used, one with very coarse grooves and, later, one with finer grooves.

At this stage the pulp is transferred to another plank which is bolstered up at the ends with pieces of the trunk of a banana plant, for, when the mass of material is thinned, there is not sufficient to prevent a painful stinging of one's hands, as the instrument used strikes the plank with only the thin material between, and the banana trunk props are resilient. In this position the beating is continued but with another instrument consisting of a square or slightly oblong piece of stone ranging from two to three inches in width by two and one half to three and one half in

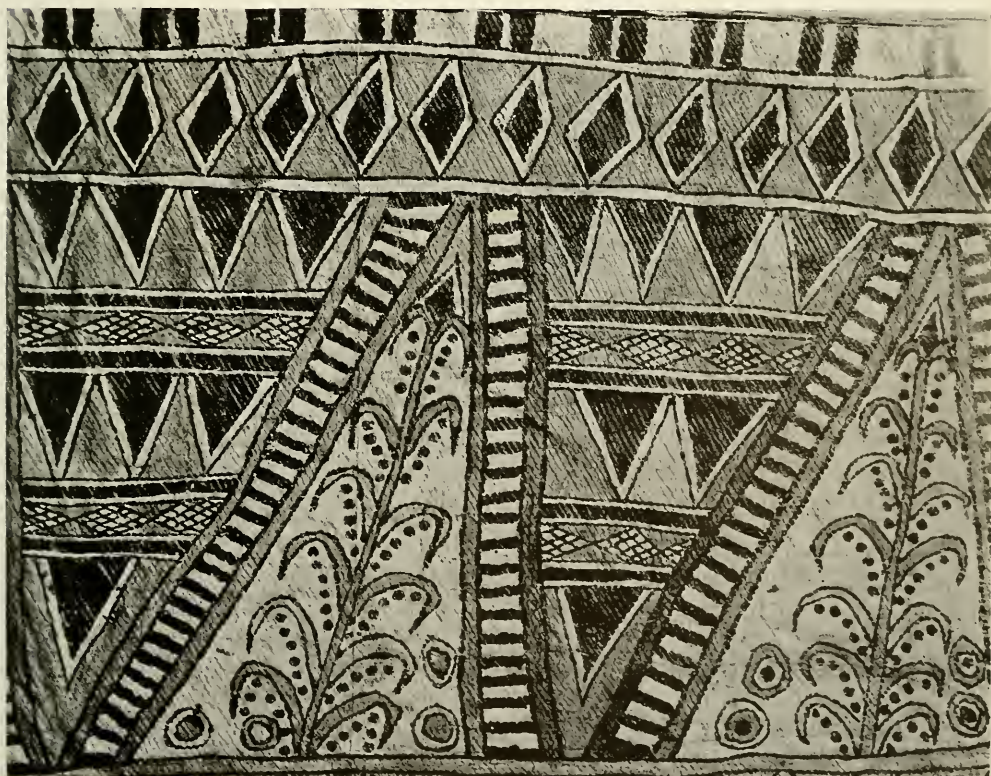
length and one to one and one half in thickness. The two greatest surfaces of these stones are covered with ridges. The largest stones have very coarse longitudinal ridges and grooves on one surface and smaller longitudinal ridges and grooves on the opposite side, while on another stone there are horizontal ridges and grooves; there are also stones on which the grooves are diagonal.

A piece of rattan is doubled around this stone, fitting into a shallow groove that has been especially ground for the reception of the rattan, which serves as a handle and is very efficient, as it is strong and limber. The Dyaks of Borneo make rattan handles for their stone hammers in this manner.

The bark pulp is beaten alternately

with first one and then another of these stone instruments. The whole surface is first beaten with the instrument having the coarsest ridges, then this operation is repeated, using the instrument with the finer ridges, and so on until the instrument with the finest ridges has covered its entire surface and the former mass of pulp has spread until finally it is about as thick as corrugated cardboard; it is then dried and becomes much thinner and rather stiff. Bark-cloth is usually dried by spreading it on smooth ground about the houses.

Bark-cloth made from the bark of the waringan tree is dark brown in color, but the natives often dye it black by covering it with very black mud. Sometimes they dye black bands on the bark-cloth, mak-



BARK-CLOTH OF THE FINER VARIETY MADE IN CENTRAL CELEBES

At the present time, besides the local dyes of vegetable origin, the natives are using the imported aniline dyes. (Specimen No. 304117 collected at Toare, Bada, Central Celebes by H. C. Raven—Courtesy United States National Museum)

ing many folds, so that the mud comes only in contact with the parts which it is desired should become black.

Occasionally the women induce their men to gather some branches from which they may strip the bark, but as a rule bark-cloth making in Celebes is left entirely to the women and girls.

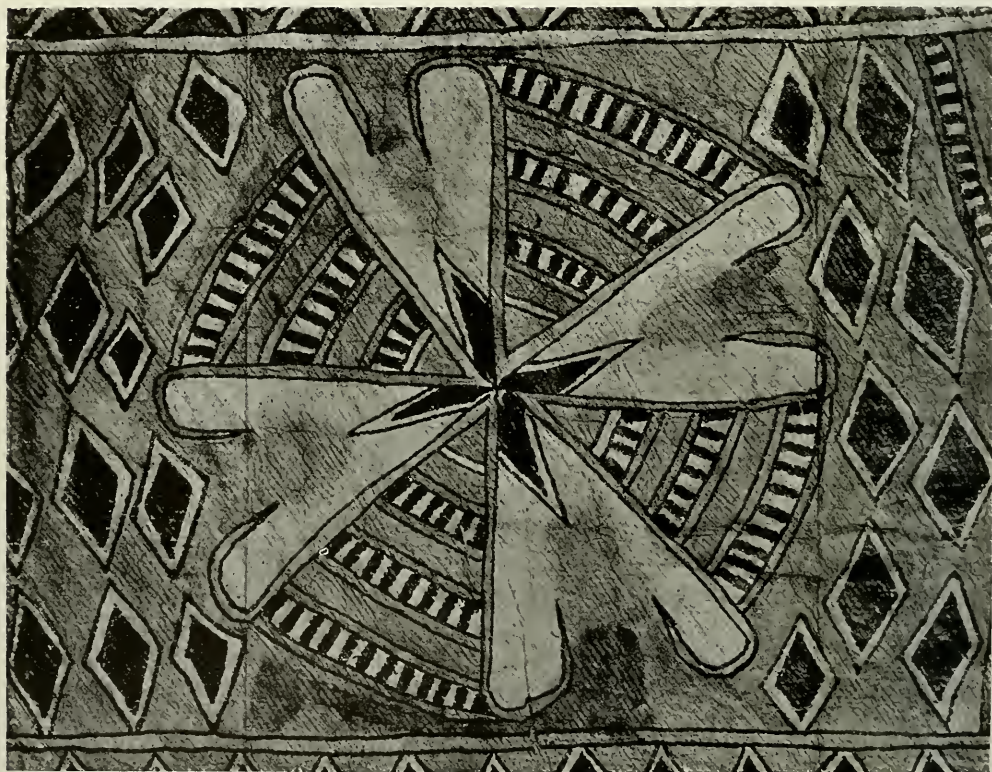
A thin, white bark-cloth is sometimes made in various sized sheets and pieces. The white bark-cloth is made from the bark of small light-barked (mulberry) trees or saplings in some places and is called *tinoeboe*. This bark-cloth is used to make jackets and head cloths for women and girls, and scarfs and head cloths for boys and men. When used for these purposes, the white bark-cloth is, as a rule, dyed various colors and painted with

many and very varied designs. The people of Bada are more skillful in decorating bark-cloth, than are the inhabitants of any of the other districts of the above mentioned region.

The bark-cloth made from the waringan and called *noenoe* is used by the women for dresses or skirts and to make jackets for daily use when working about their homes or in the fields. The Koelawi name for a skirt is *topi* and their name for jacket, *halili*.

The *halili* is sometimes dyed dull red, using red leaves as a dye, then streaked with a sweet smelling, black, resinous gum upon which many small flakes of mica are stuck, giving a very glittering effect.

In Koelawi it is customary to have a double fold in the skirt; to produce this



BARK-CLOTH SHOWING THE RIDGES ON THE MATERIAL

The texture is controlled by the manner in which the bark is beaten with ridged stone implements. (Specimen U. S. N. M. No. 304117, collected at Toare, Bada, Central Celebes, by H. C. Raven—Courtesy United States National Museum)

double fold two belt strings are used. It is very interesting to watch a Koelawi woman arrange this peculiar bark-cloth skirt, for it is supposed to be exactly the same length front and back and all the ruffles of about the same size. The men sometimes use a bark-cloth loin cloth when working in the jungle or fields and small boys seldom wear anything else.

The Koelawi women told me that a large piece of bark-cloth can be pounded out in two days, though to do it in that time would require a woman's undivided attention. As a rule they spend several days beating one piece of bark-cloth, for they will work for an hour or so, then leave it while they attend to their routine household duties.

During the time that the pulp is being beaten it must be sprinkled with water to prevent its becoming too dry. Usually banana leaves are used, as these are always at hand and serve very well.

The bark-cloth, or at least some of it, that is made at Bada is not so good as that from Koelawi, owing to the difference in preparation. In Bada the bark is not boiled at all, or not sufficiently boiled, and not allowed to stay long in the water, with the result that the Bada bark-cloth is much stiffer, more like paper and does not wear well.

Large pieces of bark-cloth also serve as



WORKING DRESS

A cloth skirt, bark-cloth jacket, and a bead head band make up this girl's attire. In the little bark-cloth bag at her waist she carries her betel nut, pepper leaves, and chewing tobacco

blankets and other coverings. It is used for this purpose in all the districts of Central Celebes by the people who make it. On several occasions I made use of pieces of bark-cloth as saddle pads.

Bark-cloth makes fairly good clothing, but has a very great disadvantage, namely, that it cannot be washed, for in contact with water it acts the same as paper.

During the harvesting season one seldom hears the women beating bark-cloth; at this time all their energy is devoted to pounding and otherwise taking care of the



THE DISCUSSION

At intervals during the preparation of bark-cloth, girls may gather and talk over the manner in which they intend to use this particular piece of bark-cloth and how it is to be decorated



THE PARTY DRESS OF A BESOA GIRL

The young lady's costume includes a brightly colored head band, black gum dots on her cheeks, a bead necklace, a black and white jacket, and a tightly woven grass anklet



rice. Koelawi women are hard workers and very industrious. It is difficult to say of just what their daily work consists, but it is certain that a woman with two, three, or more children to care for has no spare time on her hands, unless she be one of the more fortunate few who possess slaves.

In Borneo the Dyaks of various tribes make bark-cloth, but all I saw was beaten from single pieces of bark. One of these pieces I remember discussing with the Dyak who made it. He had made it from the bark of the "*ipoh*" or upas tree (*Antiaris*), the same tree that furnishes them with the sap with which they prepare the blowpipe darts. This particular piece of bark-cloth was about five feet long by four feet wide, rather thick, and of a bright yellow-brown color. Many of the Dyak men of the interior of Dutch Borneo wear bark-cloth wound round their heads. It is all made the same, from single pieces of bark usually not more than thirty inches wide and six or seven feet long. Most of it is made white by squeezing and rubbing the juice of a large, very sour, wild citrus fruit on the bark as it is beaten, and later bleaching it in the sun. Hose and McDougall in *Pagan Tribes of Borneo*, Volume I, page 220, state that the Dyaks of other parts of Borneo make it similarly, the men alone doing this work. Thus as now practised in Borneo, bark-



HOME FROM THE GARDEN

This maid on her return from the rice field brings some firewood, a coconut, and some vegetables tucked in a fold of her bark-cloth skirt

cloth making is a very simple process and one that is dying out due to the importation of woven cloth.

In a perusal of the literature on the South Sea Islanders I was struck with the similarity of the manner of making bark-cloth in the Tonga Islands as I saw it done in Celebes and as described on pages 288-290 of Volume II of John Martin's *Account of The Natives of the Tonga Islands*, which he compiled from the communications of William Mariner and published in 1817. I therefore



THE DECORATED BARK-CLOTH HEAD BAND

A band is made by splitting off the hard outer surface of a piece of bamboo. The inner part is then flexible and is made into a stiff band. This is covered with a piece of bark-cloth on which various designs have been painted

quote the following from his account:

FABRICATION OF GNATOO. This substance is somewhat similar to cotton, but not woven, being rather of the texture of paper: it is prepared from the inner bark of the Chinese paper mulberry tree, and is used for dress and other purposes.

A circular incision being made round the tree near the root, with a shell deep enough to penetrate the bark, the tree is broken off at that part, which its slenderness readily admits of: when a number of them are thus laid on the ground, they are left in the sun a couple of days to become partially dry, so that the inner and outer bark

may be stripped off together, without danger of leaving any of the fibers behind. The bark is then soaked in water for a day and night, and scraped carefully with shells for the purpose of removing the outer bark, or epidermis, which is thrown away. The inner bark is then rolled up lengthwise, and soaked in water for another day; it now swells, becomes tougher, and more capable of being beaten out into a firm texture; being thus far prepared, the operation of *tootoo*, or beating, commences. This part of the work is performed by means of a mallet a foot long, and two inches thick, in the form of a parallelopipedon, two opposite sides being grooved longitudinally to the depth and breadth of about a line, with intervals of a quarter of an inch. The bark, which is from two to five feet long, and one to three inches broad, is then laid upon a beam of wood about six feet long, and nine inches in breadth and thickness, which is supported about an inch from the ground by pieces of wood at each end, so as to allow of a certain degree of vibration. Two or three women generally sit at the same beam; each places her bark transversely upon the beam immediately before her, and while she beats with

her right hand, with her left she moves it slowly to and fro, so that every part becomes beaten alike; the grooved side of the mallet is chiefly used first, and the smooth side afterwards. They generally beat alternately; early in the morning, when the air is calm and still, the beating of gnatoo at all the plantations about has a very pleasing effect; some sounds being near at hand, and others almost lost by the distance, some a little more acute, others more grave, and all with remarkable regularity, produce a musical variety that is very agreeable, and not a little heightened by the singing of the birds, and the cheerful influence of the scene. . . .

The account of the manufacture of bark-cloth at Tahiti in 1769 as recorded by Captain (then Lieutenant) James Cook which W. T. Brigham quotes in his monograph "*Ka Hana Kapa, The Making of Bark-cloth in Hawaii*," in the 1911 Memoirs of the Bishop Museum, is also remarkably similar to the present practise of the people of Central Celebes.

Bark-cloth making in its most highly developed form is now carried on in Polynesia. The art has also attained a high degree in Celebes.

The literature of this subject indicates that the art had its beginning somewhere in southeastern Asia and was carried to the various islands of the Pacific by the Mongoloid people ancestral to the Polynesians as they pushed eastward from the East Indian region.

The preparation of bark-cloth seems to be related to the manufacture of paper. It may be thought of as a primitive art that preceded and from which paper-making has evolved.

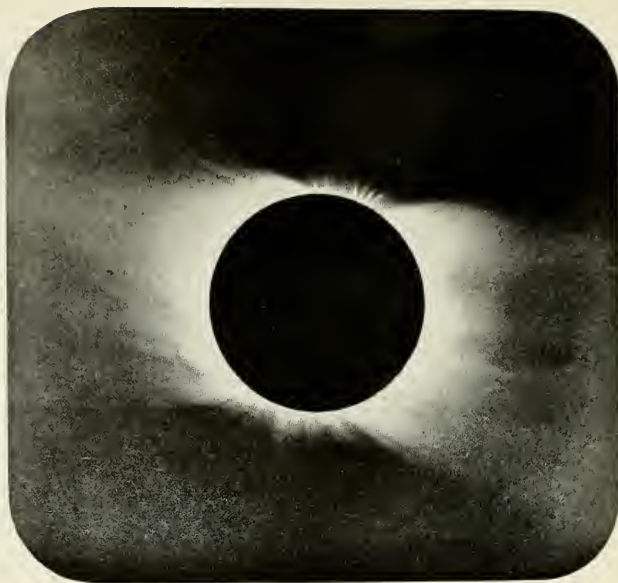


A beautifully decorated piece of light colored bark-cloth covers his twisted long hair.

In his lips is a big quid of tobacco, and his teeth are blackened by the use of betel

AN OLD MAN OF GIMPOE

*Photograph by H. C.
Wilson, Southern
Pines, N. C.*



TOTAL SOLAR ECLIPSE
MAY 28, 1900

THE TOTAL ECLIPSE OF THE SUN AUGUST 31, 1932

The Darkening of the Sun That Will Be Apparent to Observers in
Eastern Canada and New England This Summer

BY CLYDE FISHER

Curator of Astronomy, American Museum of Natural History

A TOTAL eclipse of the sun is without doubt one of the most awe-inspiring spectacles ever observed by man. Its beauty and impressiveness must be seen to be appreciated, and this opportunity comes rarely to those who remain in one place on the earth's surface. A few of our professional astronomers, by traveling thousands of miles, have enjoyed the privilege of viewing a number of total eclipses.

A great army of laymen, however, will welcome the forthcoming eclipse of August 31, 1932, since its path of totality will pass across Hudson Bay from the northwest, and from there southeastwardly to New England, and on across Vermont, New Hampshire, Maine, and a little of eastern Massachusetts, out into the Atlantic Ocean.

For mid-eastern New Hampshire totality will begin just before 3:30 P.M., Eastern Standard Time, and will last a little more than one and one-half minutes. The path of totality will be slightly more than one hundred miles wide.

Those who saw the total eclipse of the sun on January 24, 1925, will want to repeat the unique experience, and those who were not fortunate enough to see the last one occur in northeastern United States, will be all the more anxious not to miss this one, for it will be many years before another favorable one occurs in this part of our country.

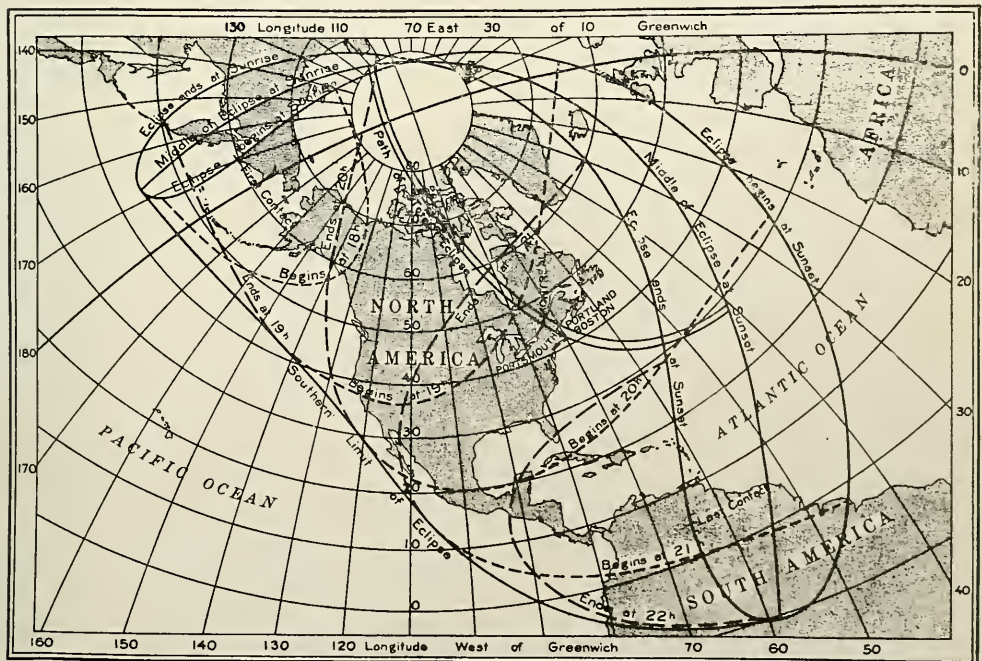
As is well known, the cause of a total eclipse of the sun is the passing of the moon between the earth and the sun. On August 31 next the main disk of the sun will be completely hidden by the moon,

which of course is opaque, but around the disk of the dark moon we shall be able to see the glorious corona, admitted to be the most beautiful feature of a total solar eclipse. The greenish silver rays of the corona extend outward from the sun to a distance of more than one million miles. The streamers at the poles of the sun are shorter and of characteristically curved shape. Those between the poles, which may be known as the lateral streamers, are usually much longer.

At the base of the corona may be seen great prominences extending thousands of miles above the surface of the sun. These are fantastic and very variable in shape and size. In color they are red or scarlet. As shown by the spectroscope, these solar prominences contain hydrogen, helium, and calcium. In fact helium was discovered by means of the spectroscope in solar prominences at the total eclipse of 1868, twenty-seven years before the element was discovered on the earth.

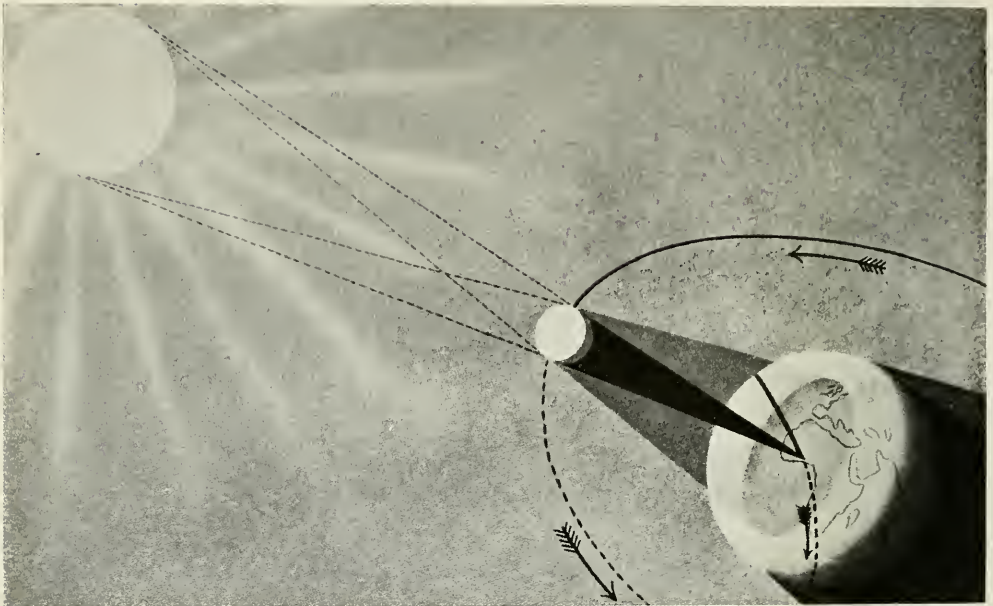
Besides the corona and prominences, other things for the amateur to look for are the shadow bands which are pretty surely a terrestrial phenomenon, and are to be seen immediately before and after totality. Although these shimmering bands are not very distinct, I saw them plainly as they moved slowly over the snow at the eclipse of 1925. At the forthcoming eclipse of next August, it is suggested that observers use a white sheet spread on the ground or observe them against the side of a white-painted building. No one has yet been able to photograph the shadow bands satisfactorily. Possibly some one will succeed this year.

The approaching shadow of the moon is an impressive phenomenon, which may be best observed from an airplane or other elevated vantage-point. It is well to remember that it moves with great speed,—about 2967 feet per second, or nearly thirty-four miles per minute,—and that it will come from the northwest.



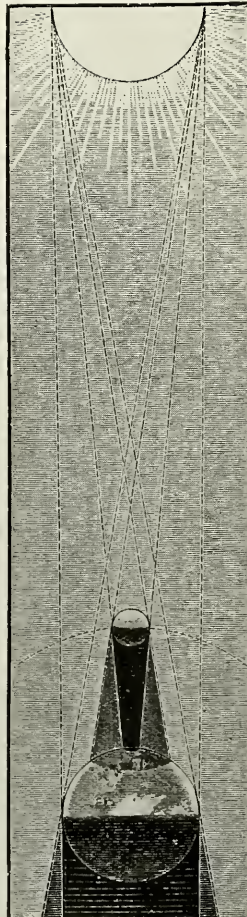
AMERICAN EPHEMERIS DIAGRAM

With data (Greenwich Civil Time) for the August eclipse. The narrow path of totality is seen extending from the polar regions through Hudson Bay and ending in mid-Atlantic



ABOVE.—DIAGRAM WITH THE SUN (CORNER), THE MOON, AND THE EARTH. THE PATH OF TOTALITY IS REPRESENTED BY THE HEAVY BLACK LINE AT THE APEX OF THE MOON'S SHADOW CONE.—FROM PHILLIPS AND STEAVENSON, *Splendour of the Heavens*.

Baily's Beads are usually to be seen at the beginning and end of totality. They are caused by the breaking up of the light of the edge of the sun's disk by the rough, mountainous character of the moon's surface. They are the last glimpse we have of the sun's disk just before totality begins, or the first glimpse of the sun's disk at the end of totality. A single Baily's Bead produces the so-called diamond-ring effect, which is shown in Mr. Howard Russell Butler's superb painting of the eclipse of 1923, to be seen in the Astronomical Hall of the American Museum. (Published as part of frontispiece in color in *NATURAL HISTORY*, July-August, 1926).



LEFT.—REPRESENTATION OF TOTAL ECLIPSE (NOT DRAWN TO SCALE). THE BLACK TRUNCATED CONE REPRESENTING THE MOON'S SHADOW GIVES THE REGION OF TOTALITY. THE OUTER SHADED PORTION SHOWS THE REGION WHERE THE ECLIPSE IS PARTIAL. FROM FLAMMARION, *Popular Astronomy*.

During totality it will be of interest to note the planets and bright stars in the vicinity of the sun. Jupiter will be northwest of the sun and less than five degrees distant. Mercury will be about fifteen degrees a little north of west of the sun. Regulus, the first magnitude star in Leo, will be between Jupiter and Mercury. Spica, the first magnitude star in Virgo, will be about forty-five degrees southeast of the sun.

Other things being equal, the most favorable place from which to observe the eclipse is in the middle of the path of totality, because the totality lasts longer there. However, the probability of cloud and fog should be considered. The summit

of Mt. Washington is within one and a half miles of the center line, and on account of its elevation (6290 feet) will be a favorable place, if the sky is clear, but the prospects for clear weather there are not so good as at many other places.

For further data those interested are referred to the following: "Eclipse of August 31, 1932. Probability of Clear Sky and Some Available Locations," in *Popular Astronomy*, November, 1931; "Total Eclipse of the Sun, August 31, 1932," published as a Supplement to the *American Ephemeris*, 1932. United States Naval Observatory, Washington, D. C.

Since so many total eclipses of the sun have been observed by professional astronomers in various parts of the world, one naturally wonders why expedi-

tions are still sent thousands of miles for the purpose of studying these phenomena. On the average a total eclipse of the sun occurs somewhere on the earth about once in three years, and the average length of totality is less than three minutes, so that an observer may have an average of about one minute a year for this study, provided that he is able to go to the various parts of the earth where the eclipses occur.

The study of the flash spectrum of the sun, which can be observed only at the beginning and at the end of totality, furnishes evidence of great scientific value concerning the condition of the lower solar atmosphere and the elements of which it consists. Already more than two-thirds of the elements found on the earth have been discovered on the sun by means of the spectroscope.



TOTAL SOLAR ECLIPSE OF JUNE 8, 1918

An excellent photograph of the inner corona and a fine display of prominences, made with a 38-foot camera at Lowell Observatory Station

While it is believed by some astronomers that all three of the astronomical tests of the Einstein Theory of Relativity have been met, there are some who feel that bending of rays of light from the stars as they pass near the sun should be tested further. One set of photographic plates in this experiment can be secured only during a total eclipse. It is hoped that one or more of the eclipse expeditions will try this again at the coming 1932 eclipse.

The problem of the sun's corona is still unsolved, and the only time it can be seen or photographed is during a total eclipse

of the sun. The green line in its spectrum which has been given the name of *coronium*, is still a mystery.

These are a few of the reasons why the professional astronomers still observe and study eclipses.

To the amateur, the weird effects, the sheer beauty of it all, are sufficient appeal. The ability of the astronomer to predict with great accuracy an eclipse years ahead of its occurrence is also most impressive to the layman. The total eclipse of 1925 gave great impetus to the popular interest in astronomy, and no doubt the coming eclipse will have a similar effect.



TOTAL ECLIPSE OF JANUARY 24, 1925, PHOTOGRAPHED BY CLYDE FISHER
FROM NEW YORK CITY

THE ANTIQUE USE OF GEMS

The Appeal of Color and Rarity of Certain Minerals to Primitive as Well as Modern Man—Their Use as Charms, Symbols, and for Personal Adornment

By H. P. WHITLOCK

Curator of Minerals and Gems, American Museum

AMONG the ancient expressions of human culture which have been handed down to us throughout the ages, we find ample evidence that our prehistoric forebears began to appreciate the decorative value of gems and precious stones at an extremely early stage in their development.

The subtle charm that holds a Twentieth Century woman spellbound before a jeweler's window doubtless prompted Mother Eve to devise ways of hanging these vivid scraps of color about her person, and of these decorative devices which have developed into our present day forms of jewelry, the necklace is without question the most ancient. From such rough assemblages of strung-together gem pebbles as the garnets found in a Bohemian grave of the Bronze Age to the most elaborate creations of the modern jeweler's art, we can trace in unbroken sequence throughout the ages, and in most of the countries of the ancient world, the evolution of the necklace.

It would be highly interesting if we could conjure up a pageant of necklace wearers of all periods and races, but since

this is beyond the powers of even our modern magic, we must content ourselves with the consideration of those relics that have come down to us from the past, a handful of beads here, a tarnished and battered brooch there, all that is left to tell us of forgotten beauties whose charms they enhanced before Helen wore her star-sapphires or Cleopatra her emeralds or Mary Stuart her garnets.

Among the Germanic tribes that roamed over Central Europe half a millenium before our era, amber washed up on the eastern shore of the Baltic and roughly shaped into round beads was a standard medium of exchange. A necklace of these rude, uneven, amber lumps was found in a grave of the period of about 300 B. C., in Hallstatt, Austria. Surely it would require but little imagination to picture such a barbaric trophy as the im-

mortal necklace of the goddess Freyja, the famous "Brisingamen" of Norse mythology.

The Gallo-Roman inhabitants of France in the Third and Fourth Centuries A. D. were lovers of fine apparel and jewels. The necklace beads of delicately colored



THE MOST PRIMITIVE NECKLACE

This small handful of rough garnet pebbles was found in a Bohemian grave of the Bronze Age. Aside from the fact that every pebble is drilled, there was no attempt to shape them into beads. (Specimen in the N. Y. State Museum, Albany)



ROCK CRYSTAL BEADS FROM CENTRAL AMERICA

Representing a very early stage in the evolution of the necklace. They were probably made about the beginning of our era

agate and orange-red carnelian of this period show a wide range in quality of workmanship but are, on the whole, much better shaped than those of the softer amber of the previous example. Moreover, the heavier strings, some of which contain beads as large as an inch and a half in diameter, were undoubtedly worn by men.

The agate, carnelian, and rock crystal used by these early French lapidaries may well have come from France, since these stones are to be found today on French soil

Turning to Persia we find necklace beads, fashioned out of a number of stones, whose rough shape and lack of finish indicate an early period in the development of this civilization. From Afghanistan came the deep blue lapis lazuli, one of the earliest stones to be used by man, and here wrought into roughly angular unpolished forms, mere lumps of stone with the sides rubbed smooth. From Europe came caravans bearing amber from the Baltic which was carved into flat cylindrical beads with rounded

sides, quite different in appearance from those of Central and Northern Europe. And most important and significant of all, from the ancient mines near Nishapur in northeastern Persia came the turquois which has so long been associated with Iranian culture, and which was carved into necklace beads, whose rude, thickened disks suggest those made today by the Navajo and Pueblo Indians of our own Southwest.

Almost incredibly old are the long, cylindrical beads of Chinese jade which represent one of the earliest uses to which inhabitants of the "Flowery Kingdom" put their national gem stone.

Only one civilization other than China has made use of jade for personal adornment. Necklace beads of jade, irregularly



AN EARLY PERSIAN NECKLACE

This string of necklace beads was fashioned from rough lumps of lapis lazuli, brought by the trading caravans from Afghanistan

rounded but nicely polished, have been found among the remains of the Zapotec culture of ancient Mexico which flourished at about the beginning of our era. Earlier beads from Central America are very roughly fashioned out of rock crystal, and a very recent excavation has brought to light beautiful necklace jewelry from Mexico in which brilliant, translucent, green jade has been combined with gold in a manner that would do credit to a modern designer.

In the bazaars of India, Ceylon, and Burmah, there sit today, as their forebears have sat for centuries, the East Indian gem cutters, fashioning necklace beads from the gem stones of their countries. Sapphires, rubies, garnets, a rich wealth of color go into these necklaces, the elements of which are sometimes roughly faceted, but more often of somewhat irregular rounded shape, following the time-honored custom of the East, that strives to produce the largest and heaviest gem possible from the fragment of material used.

The necklaces which have come down to us from the higher development in culture of the later Egyptian dynasties show a very considerable scope in the materials used. Amethyst, lapis lazuli, carnelian, turquoise, jasper, rock crystal, garnet, and even emerald were freely combined with gold to produce bead jewelry forms of great taste and charm.

It is quite significant that Egyptian gem cutters seemed unwilling to alter such regular crystal forms as the hexagonal prism of emerald by cutting them into round or prolate beads. These forms were usually preserved intact in the bead design, and whereas the beads fashioned from amethyst, carnelian, or amazon stone were made spherical or cylindrical, the six-sided prisms of emerald were simply pierced in the direction of their axes, and left otherwise unworked.

The reason for this may lie in the reluc-



AN ANCIENT CHINESE NECKLACE

These cylindrical beads are roughly carved from Chinese jade. They belong to the legendary past of that fascinating old corner of the Orient. (Specimen from the Drummond Gift)

tance of the artificer to waste any of the material of the rarer and consequently more precious stone, or possibly some symbolism may have been attached to its regular natural shape. At least this treatment of emerald may be observed not only in Egyptian jewelry but also in that of Cyprus and Etruria.

From the necklace composed of strung beads it is but a step to one in which the roughly shaped stones were encased in a metal setting. In Egypt we find this advance taking place at quite an early stage, as instanced by an example in the collection of the Metropolitan Museum of Art, where a small, square plaque of gold enclosing an oval carnelian forms the middle element of a double string of *unset* carnelian beads.



TWO NECKLACES OF AGATE

The Gallo-Roman people of France in the early centuries of our era fancied agate for their necklaces, some of the heavier of which were worn by men. These two come from the Department of Gard in Languedoc

From very early times until approximately the period of Ptolemaic kings we find the Egyptians making use of a sort of mosaic of gem stones, turquois, and lapis lazuli, set in thin gold boxes, the latter being shaped to the design so that, when the whole was polished, it had somewhat the aspect of the cloisonné work of Russia.

The transition from such primitive combinations of gem stones with the precious metals, to the more elaborate settings of Greece, Rome, and the later cultures of Europe and Asia is both easy and obvious, and once made, the development of jewelry forms was simply a matter of that artistic progress which follows so closely upon historic and political progress. As the needs of an ever advancing civilization called for more and more varied ornamentation of

dress and person in gold and silver, it was inevitable that these ornaments should be embellished with gem stones that had already become familiar to man through the medium of earlier and simpler jewelry forms.

A striking instance of this adaptation of the earlier to the later usage is to be found in the necklace that constitutes the ceremonial trapping of a Vizier of Morocco of the middle of the Eighteenth Century. The roughly rounded aquamarines that furnish the larger jewels for the medallion settings that constitute this regalia are pierced, clearly indicating that they were once strung together to form a necklace of beads of a much earlier and more primitive type; how much earlier we can only conjecture.

The use of various minerals as materials from which objects for personal adorn-

ment were made, ancient though this use is, does not constitute the only, nor even the most deep-seated side of the question of the antique use of gems. It is safe to assume that from the very earliest period, when people began to recognize the beauty of certain stones, they also began to ascribe to them certain supernatural properties as amulets and talismans. And as far back as we can trace, they wore some material token in the form of a stone to guard them from the ills of life, real or imaginary. The wearing of such amulets is, in all probability, older than the wearing of jewelry, and, no doubt, the one grew by insensible steps out of the other. It was essentially a natural and logical act for the primitive man who found an



BEADS OF DEEP, FIERY, INDIAN GARNETS
The necklace beads cut by the native gem cutters of India, Burmah, or Ceylon have a character of their own



DEEP BROWN COPAL BEADS

The natives of the west coast of Africa, the country of "Trader Horn," made and wore this necklace of copal, which was their substitute for amber

attractive or unusual bit of stone to ascribe to it occult powers. As he advanced in culture, he shaped these bits of stone into increasingly regular forms, and finally as an added fetish, he scratched on them images of his gods and invocations to them. A talisman was supposed to be endowed with wider and more general powers than was an amulet, the function of the latter being to ward off evil. The addition of a magical combination of words would make either a talisman or an amulet a "charm."

Some of the earliest amulets of which we have any knowledge are the little stone cylinders that were used among the Assyrians, Babylonians, Persians, and Hittites, as seals. These cylinders, some of which date as far back as 4000 B.C., are carved from various minerals, such as steatite, serpentine, hematite, lapis lazuli, jasper, amazon stone, chalcedony, marble, and rock crystal. Many of these materials

are esteemed today for their beauty as mediums for small carvings, proving that modern taste in this matter is at least founded upon ancient precedent.

The engraving was of course incised, both because this was the easiest and most obvious way of engraving hard materials, and because the impression made by rolling such a seal over a suitable soft substance was more natural and more easily read.

Considerable skill was displayed by these early lapidaries in cutting their

designs, which included figures of gods, men, and animals, as well as inscriptions in cuneiform characters. The inscription often gave the name of the wearer, the name of his father, and the name of his god. The significance of this sequence becomes apparent when we consider that the official name given to every man upon coming of age placed him under the protection of a god, who forthwith made his abode in the body of this particular man subject to his good behavior. But should he be so unfortunate as to sin against his

fellow men or against the gods, the divine presence left him and he immediately became the prey of some one of the seven devils.

Asiatic cylindrical seals of this type were not set in rings as are those of our day, but were hung around the neck, or fastened on the arm. A typical example of a Babylonian cylinder from among the small but representative series in the Morgan Gem Collection, is carved from limpid rock crystal and is approximately 3000 years old. This is engraved with an image of the storm god Rammon, who was identical with the Rimmon of the Old Testament (2 Kings, v. 18). He is here represented in a short robe holding a scepter in one hand, and accompanied by his wife, Sahla, whose figure in a long, flounced dress is shown on both sides of him.



FROM NORTH AFRICA

A string of old and crudely shaped necklace beads. The pale green aquamarines which compose its elements are similar to those which adorn the large medallions in the necklace on page 395



RICH AND COLORFUL

The necklace of a Vizier of Morocco of the period of about 1750. The aquamarine gems of the large medallions have been pierced and were at one time a string of beads like that shown on page 394

In Egypt the most popular amulet was the well known scarabæus or scarab, the somewhat conventionalized image of a large black beetle regarded as a symbol of resurrection and immortality, since it was believed that no female of this insect existed. These carved beetles were engraved, as were the Asiatic seals, the inscription being cut on the oval underside of the conventionalized figure in ideographic characters.

Scarabs were even more typically amulets than were the cylinder seals of Babylon and Assyria, for although they commonly bore the name of the wearer, they were in many instances inscribed with magical charms taken from the Book of the Dead. Beautifully worked funeral or heart scarabs were often made from green jasper, amethyst, lapis lazuli, amazon stone, carnelian and serpentine, while the more precious emerald and turquois were not without representation

among these figures of the sacred beetle that replaced the heart in the mummies of the Egyptian dead.

It was believed that when the soul of the deceased came to be judged before Osiris, his heart was weighed in the balance held by Anubis against his good or evil deeds in life. Consequently the charm inscribed on a heart scarab invoked the gods of the underworld to deal leniently with the heart of the dead. An example inscribed on a scarab of green feldspar would read¹

Oh ye gods who seize upon Hearts, and pluck out the whole Heart, and whose hands fashion anew the Heart of a person according to what he hath done, Lo now let that be forgiven to him by you.

Hail to you, Oh ye Lords of Everlasting time and Eternity.

Let not my Heart be torn from me by your fingers.

¹Quoted from *The Magic of Jewels and Charms* by Dr. George F. Kunz, p. 319.



A NECKLACE FROM ANCIENT CYPRUS

Showing a charming combination of gold with agate and carnelian beads carved as turtles. This use of gold and gem stones reflects strongly Egyptian influence. (Specimen in Metropolitan Museum of Art)



EGYPTIAN OR SYRIAN NECKLACE

Of the Sixth Century A.D., Rough prisms of light-colored emerald are used as beads, alternated with pearls in a gold setting. (Specimen in Metropolitan Museum of Art)

Let not my Heart be fashioned anew according to the evil things said against me.

For this Heart of mine is the Heart of the god of mighty names, of the great god, whose words are in his members, and who giveth free course to his Heart, which is within him. And most keen of insight is his Heart among the gods.

Ho to me, Heart of mine; I am in possession of thee, I am thy master and thou art by me; fall not away from me; I am the dictator to whom thou shalt obey in the Netherworld.

Among the peoples that were influenced by Egyptian culture, the scarab gradually became more highly conventionalized, losing much of its resemblance to a beetle as it lost its symbolic and esoteric significance. Thus we have the scaraboid, an oval dome-shaped seal, inscribed on the flat underside as was the scarab, but no longer with the magic charms of Egypt. In other words the scaraboid, a purely ornamental engraved stone, is literally the "stepping stone" between the scarab and the modern form of seal. A form of engraved amulet that came into use in Persia about the Eighth Century, and

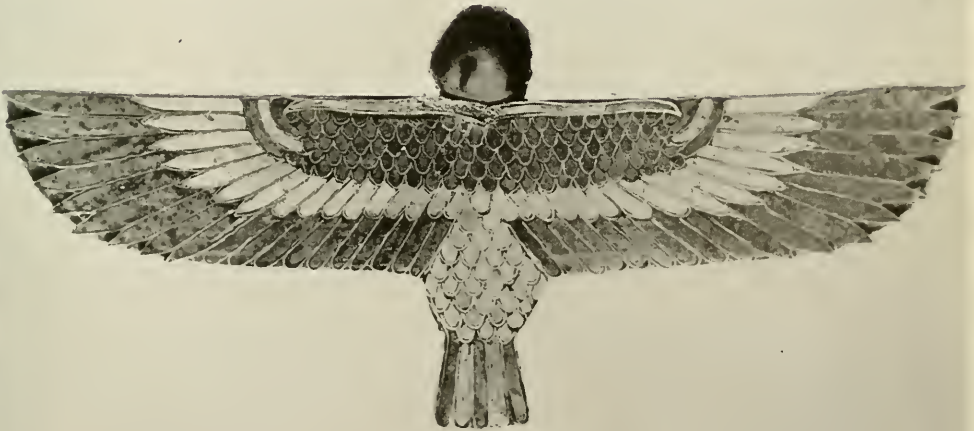
that reached its culmination in elaboration from the Sixteenth to the Seventeenth Centuries, was made from polished, flat slabs of chaledony and carnelian, varying in size and shape, but rarely more than two and a half inches in longest dimensions. These Persian seals belonged to the Moslem culture, and since the Mohammedan code forbids the depicting of natural objects, the engravers of these amulets were restrained from using the symbolism employed by peoples of other faiths. As a consequence they all bear texts from the Koran inscribed in Arabic characters, the engraving in many instances being beautifully executed. The quaint Arabic letters that look like some glorified kind of shorthand, are highly decorative, and were embellished with loving care by the Moslem engravers.

The smaller and older examples are mostly oval or more rarely cushion-shaped and were lettered with incised



AMETHYST BEADS

A necklace of the early Christian Era (4th-6th Centuries) showing strong Egyptian influence. (Specimen in Metropolitan Museum of Art)



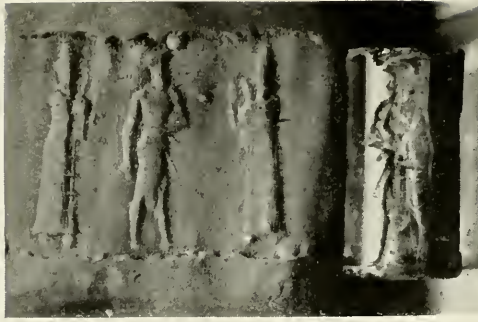
AN EARLY EGYPTIAN BROOCH

Here the design is formed by carefully shaped pieces of turquoise and lapis lazuli, each set in a little box of gold. This gem mosaic was the forerunner of jewel settings. (Specimen in the Museum of the New York Historical Society)

characters often deeply cut as though for use as seals. The larger and more elaborate forms have a broad, heart-shaped outline, and are representative of the later period. In these the lettering of the central panel is very slightly raised against a matte background composed of fine crossed lines, so that the inscription stands out on a polished surface against a dead one. The surrounding border is lettered with a longer text in smaller incised characters.

Nothing can be more appealing than the exquisite delicacy and detail of this engraving as revealed when the light strikes across the polished face of the lettering. The effect is much the same, and achieved in the same way, as that which one sees on an old engraved sword blade.

It is quite frequent among the engraved chalcedony amulets of both the oval and the heart-shaped types to find a short text, or sometimes only the name of the Prophet, occupying the center of the design, and a longer text wrought as a border or panel



A CYLINDER SEAL

Carved from rock crystal in Babylon about 2000 B.C. At the left is shown the impression made by rolling the cylinder over a piece of soft clay

around it. Also we meet with considerable repetition, a text of notable efficacy as a charm being used on many amulets. Here is one from one of the later seals, now a part of the Morgan Gem Collection.

CENTER: And the Thunder declares His Glory with His Praise, and the an-

gels also for awe of Him.

BORDER: In the name of Allah, the compassionate, the Merciful. Allah is He besides whom there is no god, the Everliving, the Self-subsisting by whom all subsist. Slumber does not overtake him nor sleep. Whatever is in the Heavens, and whatever is in the Earth is His. Who is he that can intercede with Him but by His permission? He knows what hath been before them, and what shall be after them, and they cannot comprehend anything out of His knowledge except what he pleases. His knowledge extends over the

Heavens and the Earth, and the upholding of them both burdens Him not. And He is the most high, the great.

A notable exception to the almost universal use of quartz for these Moslem seals, is an irregular slab of turquoise in the Morgan Gem Collection, five inches by three, engraved with about two thousand words.



A PERSIAN AMULET

Carved from chalcedony and engraved with texts from the Koran. The Arabic lettering has the effect of an intricate and beautiful decoration.



Photograph by John Ogilvie

Uvira, at the North End of Lake Tanganyika

COLLECTING BEES IN THE BELGIAN CONGO

An American Entomological Expedition in the Heart of Africa

By T. D. A. COCKERELL

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*The following article was written while Professor Cockerell was still in Elisabethville. On his return home he found that the expedition had obtained in all (including collections from Central and South Africa) more than 16,000 insects. Up to June 1 there have been described as new 116 bees, 1 grasshopper (*Acrida cockerelli* Uvarov, from Biano) and 1 caddis fly (*Leptocerina simulans moselyi*, from Elisabethville). Several new snails are being described by Pilsbrey and Cockerell.—THE EDITORS*

OUR party has been variously known as the Mission Cockerell, the Brigade Insecticide, or the Bilulists. It consists of five persons, Alice Mackie of London, John Ogilvie and his wife of Scotland and Demerara, and the Cockerells. Working together, we have obtained a very fine collection of bees and other insects, many no doubt rare or new. Ogilvie is the best collector of the group, working longer and covering more ground than any other.

We landed at Lobito Bay on the west coast, and crossed Angola on the second through train since the completion of the railway which connects the Katanga with an African port, and provides a new and shorter route for the exportation of copper.

The fauna of Angola is not well known, and we had intended to stop on the highlands and do a little collecting, but the Portuguese authorities proposed to tax us heavily if we did not go through on the first train, and we reluctantly abandoned this part of our project. Apparently the most interesting country on the route is the rising land east of the coast belt, where there are rocks and many flowers. The table land itself is comparatively barren, and at the time of our crossing (the second half of July) was extremely cold at night. Any future expedition should doubtless be provided with special letters from the government in Lisbon, as no concessions can be gained from the local authorities, and the arrangements

are more unfavorable for visitors than we found in any other country.

Thus it came about that our first stop was at Dilolo, just across the boundary from Angola, but in the Katanga Province of the Belgian Congo. Here we worked for some days, and were even able to cross the border and do some collecting on the Angola side. The country from Dilolo across the greater part of the Katanga, as far as Elisabethville, is very uniform. It consists of open scrub, with bushes and small trees, and larger trees along the water courses. Our visit being during the dry season, we found the whole country extremely arid, the surface recently burned over or in some cases still burning. In spite of the drought, trees were coming into leaf, and many of the new and tender leaves were brilliant red, appearing like flowers from a distance. The annual burning must be very destructive to the invertebrate

fauna, and no doubt accounts in part for the scarcity of land snails; we could find only a few dead shells of *Achatina* or related genera. The charred twigs and grass stems also cause annoyance by blackening one's clothes. In the midst of the burned areas, at frequent intervals, the most exquisite and brilliantly colored flowers may be seen, some purple, others bright red, yellow, or white.

Mr. C. Seydel called my attention to a very curious case of apparent protective resemblance,—a slender-bodied grasshopper, intensely black except the bright red concealed underwings, which sits on the charred stems and is there almost invisible. It appears to be a perfect case of adaptation, but certainly the grasshopper must have existed long before there were any charred stems for it to sit on!

The first outlook at Dilolo was very discouraging; it seemed that we could



Photograph by John Ogilvie

"CURATING" THE INSECTS AT TSHIBINDA

The pleasantest time of the day was when the expedition gathered about the table with their "captures," and Professor Cockerell examined them to see what new forms had been added to the collection.

The new bees were pinned and the other insects were put in papers ready to ship

get little at this season of the year. But soon we discovered a clear stream quite close to the town where the vegetation was green and luxurious, and there were many flowers. It really seemed that, just as a lone water hole in the desert will attract the animals from all around, so this limited area attracted all the insects of the vicinity. At any rate, they were there in abundance, and it was quite exciting to see the large carpenter bees (*Mesotrichia*) on the wing, visiting flowers of the mint family, the beautiful blue-marked parasitic bees of the genus *Crocisa*, the numerous species of leaf-cutting bees (*Megachile*), the swift-flying, hovering species of *Anthophora*, and many

others. Very soon we had a representative collection of the bees of the Katanga region, including many hitherto known from the collections of Dr. Michael Bequaert, of Elisabethville.

The bee fauna of the Katanga Province is more like that of Eastern Africa than that of the western side, in spite of the fact that the streams run into the Congo basin, and thus belong to the western slope. Indeed, much of the East African fauna penetrates into Angola. At the same time, so far as species are concerned, there is much endemism with the development of local forms. In the case of bees, the collecting so far done has not been sufficiently exhaustive to more than indicate some of the leading facts,

but our new materials when worked out will certainly contribute much to a better understanding.

I have in recent years studied many bees collected by Michael Bequaert in the region about Elisabethville. In the

case of the large carpenter bees, which are always brought home by expeditions, he did not find any novelties. The leaf-cutter bees (*Megachile*), excessively numerous in Africa, were represented in his collections by twenty-four forms, of which no less than seventeen were new. Of *Anthophora* he got nine, three being new. Of the Anthidiines, prettily marked with yellow, he got five kinds, all new but one. The types of



ON THE EDGE OF THE FOREST
Professor Cockerell collecting insects on the border of the great forest near Lake Kivu

these Bequaert bees are now in the great Congo Museum at Tervueren, Belgium, and much of our material will eventually go there.

Other collections in the Katanga country were made at Tenke, Biano, and Elisabethville. At Elisabethville we found the learned and enthusiastic entomologist Mr. Seydel, who assisted us in all sorts of ways. He has a laboratory with a good collection of insects and while he has no white assistant, he has trained a couple of negro boys to do excellent work. One in particular who has been with him seven years is fully competent to prepare insects for the cabinet, and knows a good deal of entomology. The library contains some good books

and a number of journals, including NATURAL HISTORY MAGAZINE. It is, however, far from complete, and I noted the absence of several important works on the African fauna which I have in my office in Colorado. Owing to the world-wide depression, especially acute in Katanga because of the fall in the price of copper, it is impossible to get sufficient funds to support adequately the entomological work, but nevertheless much progress is made, especially in relation to insect pests.

During our visit we accompanied Mr. Seydel to a place a few miles from Elisabethville to see a vast flight of locusts appearing like a cloud in the sky. (The species determined by Mr. Seydel as *Nomadaeris septemlineata*.) Fortunately they passed by, and did not enter Elisabethville. We had seen similar flights a few weeks before in the region of Lake Kivu, but the species concerned was different. Mr. Seydel said that this was the first great flight he had seen near Elisabethville, but it seems that this year the locusts are similarly migrating over a large part of Africa, even including the Mediterranean region, different species being simultaneously affected by the same impulse. We were surprised to find that in the Kivu region, and again near Elisabethville, the locusts appeared to be neither feeding nor laying eggs, so that in spite of the vast numbers, they passed by without destroying the vegetation. They all came originally, it seemed, from the British provinces to the east and northeast.

Near Bukama we collected two species of tsetse flies (*Glossina*), the first being taken from the rear platform of the car on the train. Mr. Seydel is visiting different points in this general region to ascertain the exact distribution of tsetse flies, which have recently been observed at much greater altitudes than had been supposed possible. We visited the great

Elakat cattle ranch near Bianco and saw the fine herds of cattle grazing on the upland plateau, at an altitude of nearly 5000 feet. These cattle have two great enemies,—the lions, of which thirty had been killed in the last three years, and the tsetse fly, generally absent from the region, but now appearing in certain valleys.

I was surprised to find that Mr. Seydel had given hardly any attention to the Coccidæ, or scale insects and mealy bugs, which are generally so destructive in tropical countries. In the parts of the Belgian Congo visited by us, they appear to be of little economic importance, though the green scale is sometimes found in abundance in the coffee near Lake Kivu. The first insect I collected on arriving at Lobito Bay, was the mealy bug *Pseudococcus virgatus*, which I described from Jamaica many years ago. It was on an umbrella tree (*Melia*), and was later found in other parts of the town, abundant and destructive. This same mealy bug was found by Miss Mackie in Elisabethville, but in small numbers and doing no damage. The altitude (about 3600 feet) is probably too great for it.

Mr. Seydel specializes in Lepidoptera, and is particularly interested in butterflies. One day when I was collecting with him by the Lubumbashi River a short distance from his laboratory, he suddenly became much excited at the sight of a large butterfly, which he was fortunately able to capture. It was the *Papilio mackinnoni*, of which he had seen only one other example in the vicinity in nine years. This rare swallowtail exists in two races, the original, more eastern, *P. mackinnoni*, and the more western race *benquellae* of Rothschild and Jordan. It is the latter which occurs near Elisabethville. Mr. Seydel had collected the true *mackinnoni* in a different locality, and gave me an entertaining account of the circumstances.

When he first saw them, they were flying too high to be reached by his net. He therefore got a bamboo pole to make the net handle longer, but still they flew too high. He spent a whole morning watching, but could not get one. The next day he did the same, with no better success, until about noon they came down to drink at a pool, and he captured them. He was thus able to present specimens to the Congo Museum in which the species had been lacking.

I had a quite different, personal, reason for being interested in this *Papilio*. When I was a very young man, living at Bedford Park, a suburb of London, the celebrated ornithologist Bowdler Sharpe was a near neighbor. Now Sharpe had a number of daughters, and one of them, Emily, got interested in butterflies. At this comparatively early date new butterflies were continually coming from Africa, and so it came about that Emily Sharpe had the pleasure of describing and naming *Papilio mackinnoni*, which I, her near neighbor, was destined to see alive at a much later date.

Another day, also by the Lubumbashi River, I was talking to Miss Mackie about some insect we had caught, when she looked down and noticed a fine butterfly with wings expanded, dead upon the ground. It was a large and handsome *Charaxes*, little damaged. We supposed, of course, that it must be well known to Mr. Seydel, but when I showed it to him he exclaimed that he did not possess it and had never seen it. On the way back to town we looked in at the laboratory, and from the literature easily made out that we had the eastern race of *Charaxes protoclea*, named *azota* by Hewitson. It has been known from Delagoa Bay to Nyassa Land and British East Africa.

No one can visit the Katanga Province without noticing many kinds of termite (white ant) nests. The largest and most conspicuous are the gigantic mounds made by *Macrotermes natalensis*. They must be of considerable antiquity; frequently trees or bushes are growing from them. The hard material from these nests is used in building, while the smaller nests of a different species, shaped like



Photograph by Alice Mackie

PROFESSOR COCKERELL AND CHIEF KASULO

Kasulo, the chief of the pygmies, who live in the forest near Tshibinda, gives an insect to the Professor



Photograph by John Ogilvie

FLIGHT OF LOCUSTS AT LAKE KIVU

The expedition saw similar flights of locusts not only near Lake Kivu but also near Elisabethville. In fact, the locusts were migrating over a large part of Africa, different species being simultaneously affected by the same impulse

the end of a finger, are broken up and mixed with sand to make a very durable plastering for the outside of houses. The curious mushroom-shaped nests of *Mirotermes* were occasionally seen.

Going by rail to Bukama, we took the stern-wheeled river boat down the Lualaba River to Kabalo, and traveling from Kabalo to Albertville by train, found ourselves on the shore of Lake Tanganyika. Livingstone knew the Lualaba well, but supposed it flowed into the Nile. It is in reality the Upper Congo, having its source in Katanga, or even to a slight degree in adjacent northern Rhodesia. The journey down the Lualaba took about three and a half days, through flat country and papyrus swamps, though fine mountains could be seen at no great distance. Native villages occur at intervals along the banks, and natives in dug-out canoes are frequently seen on the river. Fishing is the main occupation, and the fish are sufficiently abundant to be dried and exported from several localities. There is little opportunity for insect collecting, and owing to the

monotony of the vegetation, the actual fauna is doubtless comparatively small. We found few mosquitoes, but were careful to catch all that could be obtained, and were surprised that neither here nor elsewhere in the Belgian Congo did we find a single *Anopheles*. Presumably they abound in the wet season as people suffer greatly from malaria.

Leaving Albertville on the lake steamer, we had a night's run across Tanganyika to Kigoma, and another night to Uvira, at the north end of the lake. We had the whole day at Kigoma, and took the opportunity to go to Ujiji to see the monument on the spot where Stanley met Livingstone, November 10, 1871. The mango tree which formerly stood there no longer exists. Some interesting bees were obtained at Ujiji and Kigoma, representing the fauna of Tanganyika Territory, now in British hands.

We were especially interested to see Lake Tanganyika, because in 1927 we had visited Lake Baikal in Siberia, the other long, deep lake with a remarkable endemic fauna. Tanganyika is much

larger and really has the aspect of the ocean. Both lakes have been supposed by some visitors to have been formerly connected with the sea, but the evidence for this, derived from the fauna, will in neither case bear critical examination. On the beach at Albertville I picked up specimens of the shell *Edgaria nassa* which has such an extraordinary resemblance to certain marine forms, but is not really related to them. It was first found by Burton and Spake in 1858, when they discovered Lake Tanganyika.

The level of Lake Tanganyika is over 2000 feet, but that of Lake Kivu, a short distance to the north, nearly twice as much. From Lake Kivu a river now runs into Tanganyika, but geologists tell us that once the drainage was the other way. The fauna of Lake Kivu appears to be poor, with no particular resemblance to that of Tanganyika. The fish *Tilapia nilotica*, characteristic of the Nile Basin, but absent from Tanganyika and

the Congo, occurs in Lake Kivu.

There is now an excellent road over the mountains from Uvira to Bukavu (recently absurdly renamed Costermansville), at the south end of Lake Kivu. Bukavu has an excellent hotel, but is utterly disappointing from the standpoint of the entomologist. The soil is poor, and the native vegetation has nearly all been cleared off. Eucalyptus trees, and some casuarinas, have been planted all around, so that the aspect is Australian rather than African. We were surprised to see a very large Lasiocampid caterpillar feeding on the eucalyptus.

Our next objective was the Parc Albert, north of Lake Kivu. A small steamer to ply on Lake Kivu is being constructed and is nearly ready, but in the meantime the means of transport on the lake are irregular and uncertain. We also found that when we arrived at the north end motor transportation to and across the Parc would cost an exorbitant



TERMITE NESTS

The material from these nests, when broken up and mixed with sand, makes a useful plastering for the outside of houses



Photograph by John Ogilvie

A
LITTLE HOUSE
ON A TERMITE
NEST

Mr. Seydel thought that some of these nests must be as old as a thousand years. They are all inhabited, sometimes by more than one species

amount,—more than we could afford to pay. No doubt the time will come in the not distant future, when it will be much easier to go to the Parc Albert, and probably the authorities will become interested in facilitating the work of scientific people in that area. At the present time, however, at least from the Bukavu end, there is only the prospect of very heavy expense, much delay, and uncertain results.

Fortunately, we had little reason to regret this failure of our plans. Through the kindness of Colonel Jadot of the Kivu Committee, we were given the use of a bamboo house on the border of the great forest at Tshibinda, at an altitude of about 6000 feet, west of Lake Kivu. Camp beds and a cooking outfit were also lent to us from the stores of the Committee. Thus we were able to spend a number of days in an ideal locality, where the fauna and flora are rich, and the undisturbed forest is only a short distance away. This stay in Tshibinda was really the high point in our work in the Congo, in every sense of the word. The bees and other insects obtained were very numerous, each day affording many additions to our collection. The dense forest is not nearly so rich in bees as is the open country, but it has its special forms

of various insects, and no doubt its riches are practically inexhaustible though requiring patient collecting. We received much assistance from the young Belgian entomologist, Mr. van Roechoudt, stationed at Mulungu, some distance down the valley. Since we left he has moved up to Tshibinda. Several years ago the Belgian government authorities undertook to establish a great agricultural experiment station and botanic garden, to take in a strip extending from the edge of the forest at Tshibinda right down to the lake. Land was cleared, all sorts of things were planted, and buildings were erected to house the workers. Our house at Tshibinda was one of these. The meteorologist and entomologist are still employed, but otherwise the whole project has been abandoned, in spite of the great amount of money invested. Thus one may find coffee trees and various garden flowers growing in the bush. In front of our house a garden with white iris and other flowers was still in good order. In the present state of the country it is easy to understand why this extensive project could not be kept going, but it is lamentable to see the loss of the results of so much effort. The upper (Tshibinda) end is much the best, and it would be an ideal place for a scientific

laboratory and botanic garden. Perhaps, some day it will be developed with some form of international support, like the Naples Zoological Station.

I was particularly pleased to find a rich fauna of land shells in the forest at Tshibinda. I collected many species, some large, others minute. The smallest were picked out by my wife from a few handfuls of mold I put in a handkerchief.

In the forest near Tshibinda live the pygmies and gorillas. The particular form of gorilla occurring there has been separated from the typical *G. beringeri* as a race called *rex-pygmaeorum*, "king of the pygmies." According to the latest investigations the supposed races of the eastern or Kivu gorilla have little tangible basis, and probably cannot be maintained.

The pygmies, headed by their chief, Kasulo, came out of the forest and danced for us while Miss Mackie took a moving picture of the performance. They were rewarded with a bag of salt and various small gifts. Miss Mackie found a little looking glass which was presented to Kasulo, and caused quite a sensation in pygmydom.

The day after the dance Kasulo and several of the pygmies guided Miss Mackie, Mr. and Mrs. Ogilvie, and Mr. van Roechoudt up into the forest heights to look for the gorillas. My wife and I were left at the house, being hardly competent to make the ascent and push through the dense bush. The pygmies

hunt the gorilla, and are said to be fond of its flesh, though it is now illegal to kill the animals without a special permit. One pygmy exhibited a dried gorilla's thumb which he kept as a sort of talisman. The journey up the hill proved extremely arduous, but the gorillas were found, or rather heard. Owing to the extremely dense vegetation, it was impossible to see more than a few yards, but the gorillas roared very close at hand, and the movement of the bush could be seen. Although ordinarily peaceful animals, they may attack when hard pressed or seriously alarmed, and under such circumstances are very dangerous. The most dramatic moment was that when what was supposed to be a large male gorilla was making loud noises apparently a few yards away, and according to Kasulo, might charge at any moment. Miss Mackie stood with her moving picture camera, the young entomologist with his gun on one side of her, the chief of the pygmies with his spear on the other. Just what they would all have done had the animal actually broken through, no one is prepared to state definitely. It is certainly fortunate that no harm befell either to the people or the gorillas, and those who were there agreed that they had had a remarkable experience.

On top of the hill, near the gorilla locality, two specimens of bees of the genus *Colletes*, characteristic of temperate regions were found.



THE FOREST AT TSHIBINDA

PHOTOGRAPH BY ALICE MACKIE



The Lower Reaches of the Suwannee

“WAY DOWN UPON THE SUWANEE RIVER”

A Canoe Trip Down a River That Is Famous in Legend
but Unfamiliar in Actuality

BY CHARLES NEWTON ELLIOTT

HISTORY tells us that Stephen Collins Foster, who wrote the song “Way Down Upon The Suwannee River,” had never seen the stream. After he wrote the music, the story goes, he chose a romantic name from the map and on this name he built his song. Whether or not he had ever visited this most picturesque of all southern waters, his pen has made it immortal.

Stephen Foster did not choose badly. Of all the rivers in the southland, this is perhaps the richest in plantation history, the most vital in its beauty, and the most unique in its geographical formation. Its charm is worthy of any poetry and it has a story worthy of any prose.

One often wonders why so little is said or written about so famous a stream. Few persons know anything about it . . . where it rises, what its sister streams are, what body of water receives its tribute. One wonders why the Suwannee does not have more personal, intimate friends.

Last fall, in late November, I made a canoe trip down the entire length of the Suwannee in company with James L. Stevens. In writing about my journey to a friend in Montana, I attempted to describe some of the unique and interesting characteristics of the river. His reply read in part as follows:

Those pictures proved very interesting to many of my friends. It seems that we all had the erroneous idea that the Suwannee River flowed through boggy or swampy country, but after seeing one of the pictures which showed solid rock banks on both sides of the stream we were convinced that we had entertained the wrong idea. I have known of the river since I was a small boy, as we used to sing the song “Way Down Upon De Suwannee Riber” but seeing it would undoubtedly be inspiring, and riding the crest of its waves, camping along its shores—well, it’s beyond my imagination.

It gave me the idea that the American public did not really know anything about the Suwannee. For, though I have made an exhaustive search for material about this stream, I have been able to find but

little concrete or definite information concerning it.

To me this lovable old river has a personality. It seems very ancient and yet dignified in its senility. It seems to like tranquility, for it avoids the raucous cities, sometimes bending far out of the way to slip through the quiet, peaceful wilderness. It moves slowly down the deep aisles of forest tracts bordering its edges, it ripples happily along in the open, sunlit stretches, it lashes itself into foam over the shoals in its path.

The Suwanee River rises in the Okefinokee Swamp, that six hundred thousand acres of wilderness lying in southern Georgia and northern Florida. It flows southward out of Billie's Lake and in its tortuous bed travels approximately five hundred miles to the Gulf of Mexico, mixing its black waters with the brine above Cedar Keys, Florida. It borders three sides of Suwanee County in Florida. It traverses one of the wildest regions in all the southland.

A great many abandoned homes and settlements lie along the banks of this quaint, picturesque river, although this was one of the sections of Florida that the recent "boom" did not reach. These spots that civilization once touched give the impression of utmost loneliness, of brooding solitude.

The growth of this remarkable river has always held a fascination for me. Where it pours out of Billie's Lake in the Okefinokee, one may almost step across it. Where it joins the deep it is a stately, enormous body of water. Yet only three overground streams, the Suwanoochee Creek, the Withlacoochee and Sante Fé rivers, none of which appreciably

increases its size, flow into it. Some maps show that the Alapaha River flows into it but this is not correct, since most of that stream flows into the ground near Jennings, on the Georgia-Florida line, and the remainder disappears between there and Suwanee Springs under normal conditions. The bulk of Suwanee's waters comes from underground rivers that sometimes rise in the forest several hundreds of feet from the shore and form clear, deep pools called "springs." Usually this subterranean water is thrown from the ground as if by some potent, invisible force. It boils out of the huge caves and the force of its current at the shore



A BIT OF SHORE LINE

Where one of the local "silver springs" joins the Suwanee River. Note the break of white water at the mouth of the spring where it flows over a ledge to join the main river



GRAY DRAPERIES

A moss-covered cypress along the shore of the Suwannee River

line drives back the black waters of the Suwanee.

On gliding quietly near in a canoe, one may surprise huge fish in the edges of the black water, or turtles that kick violently for the shelter of the rock ledges. The smaller fish are more or less inquisitive and will come near the surface to examine the boat.

All of these springs are interesting. They seem to be favorite camping grounds for fishermen or picnickers who dare invade the domain of this old river. Charred sticks, blackened coals, and rusty tin cans are in evidence. Many of the springs are the termination of dim roads or trails winding through the pine forests.

The limestone, so prevalent throughout that section of the country, is said to have been deposited by the ocean that once lay over this vast land. This hard substance, which forms a base for the soils, makes the underground rivers possible. In places the limestone is so conspicuous along the river banks, especially during low water, that the streams appear to flow through solid rock, where, as my friend wrote, one would expect "boggy and swampy country." This limestone also forms the base of many shoals found along the Suwannee River. The largest of these is above White Springs, Florida. It has a drop of some twelve feet in a few hundred yards of river length.

In this section of the southeast wild life is abundant. Of the larger game animals deer and bear are plentiful. Alligators may be startled from their sunny beds on the sand banks along the shores. Turkeys, rabbits, and any

A SELDOM EXPLORED LAND

As much of the land along the Suwannee River is included in hunting preserves and estates, its picturesque beauty is guarded from destruction



number of the smaller fur-bearing animals are numerous. Squirrels, which seem to be the most prolific, may be seen in untold numbers. Of the latter animal the fox squirrel, which has been protected for several years, is prominent. This species, king of all the squirrel family, is usually marked with black and yellow. Unlike their smaller cousins, the grays, which jumped to the side of a tree and scolded at the tops of their voices when we made our appearance, the fox squirrels hopped slowly to the tallest tree in the neighborhood and just as unhurriedly climbed to a safe distance above the ground, not attempting to conceal themselves.

One afternoon, just before dark, when we had pulled the canoe under a high bluff to look for a good camp site, we became attracted to a big yellow and black fox squirrel playing in the tall pine above us. We stopped to watch him. We were then on a section of the river where the wild pecan trees grew in profusion along the shores. The country around these trees was fairly alive with squirrels. We had seen them all day but I suppose we were attracted to this splendid fellow on account of his beautiful markings.

He climbed slowly to the top of the



SILVER SPRINGS

The bulk of the Suwanee River's waters comes from underground rivers

tree and out on the end of a limb, where he flattened himself close to the bark and looked at us as if to say, "Well?"

"Wish I had that big fellow for supper," commented Stevens.

I was about to reply when a small Cooper hawk, hardly larger than the squirrel itself, suddenly darted in toward the tree. The squirrel saw him and with



A CAMP ALONG THE SHORE

Often the voyagers slept out under the stars, with no covering but the canopies of tree leaves. The "tarp" was spread when the nights were rainy



CONFLUENCE OF THE SUWANEE AND SANTE FÉ RIVERS

Where the clear water of the Sante Fé, which flows from Olustee and the Sante Fé Lake, joins the black water of the Suwannee River, several miles below Branford, Florida



AT THE END OF THE VOYAGE

Mr. Elliott and James L. Stevens, who is connected with the United States Department of Agriculture, at the Coastal Plain Experiment Station in Tifton, Georgia, discussing things as "they might have been"



THE SHOALS ABOVE WHITE SPRINGS, FLORIDA

These are the largest shoals on the Suwanee River, full of sharp, jagged rocks and deep holes in the limestone,—the only spot on the Suwanee where one finds it necessary to portage

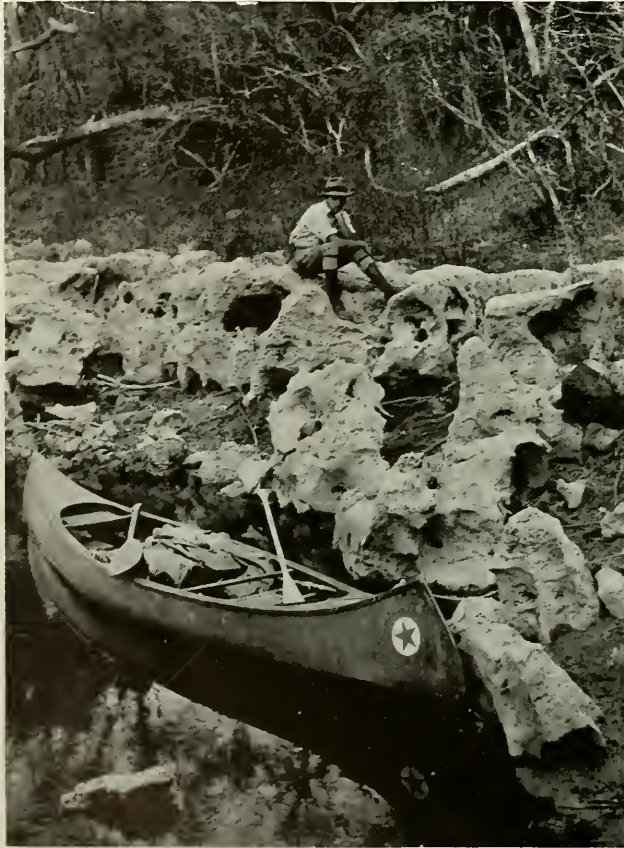


COOKING BREAKFAST ALONG THE SUWANEE RIVER

Often the voyagers rose just before the "dawn hour" and drifted down stream, making observations on the abundant wild life. Around seven or eight o'clock they stopped on some sandy beach to prepare breakfast

a chatter of alarm, bounded back toward the main trunk of the tree. He did not reach it. The hawk struck in mid air and, screaming, they crashed into the heavy blanket of moss close to the trunk.

Before I could move, Stevens quickly put a bullet through the moss. The hawk bounced away from the trunk and on observing us, flew across the river. I moved to the other side of the tree and found the squirrel clinging to the bark under one of the large limbs. I have often wondered what would have happened if we had left the two fighters to finish their battle, one for his dinner and the other for his life.



ANCHORED BY A LEDGE

Jagged formation of limestone, which is often said to be the base of Florida. This type of rock is found especially around the silver springs, through which they pour. Note how porous the ledge is

On landing at our camp grounds one afternoon, after the rain had poured in torrents all day, I put up the tarpaulin as a protection against the rain, while Stevens went about preparing supper. He was only half through when a heavy downpour drenched the camp fire. After much coaxing we finally persuaded the wet wood to burn again and finished making coffee. While we were voraciously consuming our half-cooked meal, an unearthly squeal suddenly rang through all the rain-drenched forest.

Stevens forgot his beans and soggy bacon. Snatching up his rifle, he bounded across the narrow mouth of the

bayou near camp and ran into the woods. In a few moments he returned and told grimly that he had found a crippled pig on the river bank. Bear tracks were all around it. The bear had run away at his approach. We put the pig out of its pain and left it, thinking the bear would return to it at night, but he did not, evidently on account of the proximity of our camp.

We saw a large number of alligators and one day added a six-foot specimen to our load by a lively few minutes of collecting. We were drifting along in the canoe and saw him slide from the river bank into the water and submerge. A few seconds later his head appeared close to shore and Stevens shot him. He went down as they do, dead or alive. We paddled to where he had disappeared and began prodding in the water, which was some three feet deep close to shore. Suddenly the sharp end of

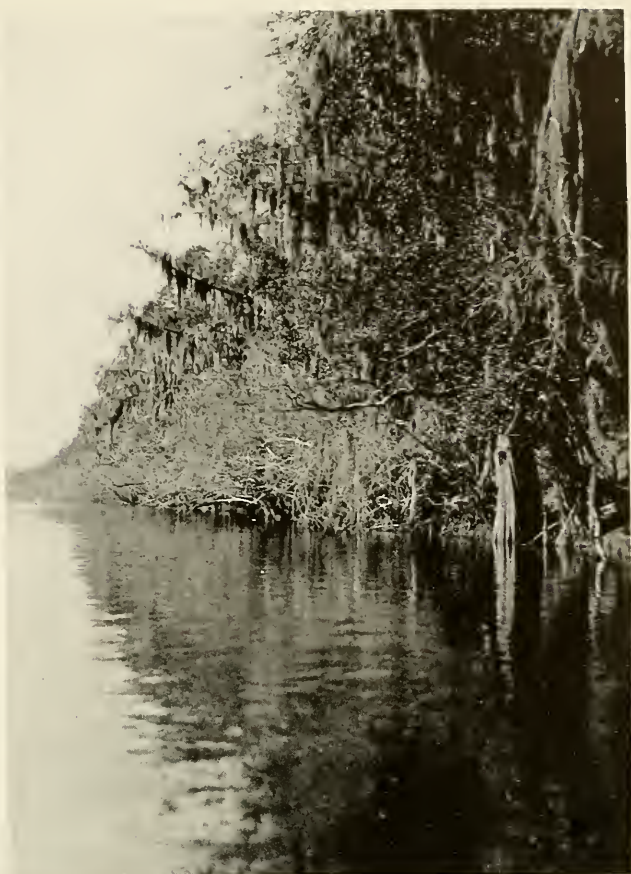
the boat hook touched him and he came up. The boat recoiled from the force of the explosion on the water and before we could recover from our surprise and swing the canoe around, the alligator was ashore. Stevens jumped out, caught him by the tail and wrestled him to a sand bank while I hovered close, pistol in hand, trying to end the struggle.

"Don't shoot him," Stevens panted, "hold him and I'll get the ax and break his neck. No use to ruin a good hide by filling it with holes."

I caught and held his tail while Stevens went to the canoe for the ax. The big saurian turned to look at me with his savage, basilisk eyes. I thought that I would hate to have my hands on this six-foot mass of leather and muscle and bone were he fully alive and in good health. I might not be able to turn him loose as quickly as I had caught him. Stevens came back and after much

aiming, hit him a light blow on the back of his head, calculating to break the neck without injuring the hide. But the blow was too light, and we finally had to shoot another leaden bullet into his skull.

It seems that an old alligator lying on the bank in the sun would be an easy target, but he is far harder to kill than one imagines. In the first place he never climbs more than ten feet from the water, unless he is crossing the country from one swamp to another, and in the second place he can run like his tiny cousin, the fence lizard. Then, too, he has extremely sharp ears and eyes and the slightest unnatural movement or



ALONG THE RIVER SHORE

Sometimes the water was still and deep. The shores were choked with trees and undergrowth, on which hung long, gray draperies of Spanish moss. Varied and interesting were the bearded trees and shrubs

sound will send him scurrying for the water. Alligator hunters who kill these reptiles for the hide market usually hunt them at night with a light. Then they are not at all shy. One is able, after he spots the bright red eyes by light, to approach within two or three feet of them. The hunter shoots and then gigs the alligator. Sometimes, too, the hunter uses a large hook attached to a rope, but this is not common practice. The hook is baited with beef or beef liver.

Though we passed several ferries on our trip down the river, not until the last day did we get a chance to stop and talk with one of the ferrymen. He was a

grizzled old chap, lean of figure but with muscled lines about his weather-beaten face and deep-set, bright blue eyes. The stories he told, in his native Suwannee dialect, were interesting and numerous.

Wider grew the river. We passed towns along the shore and drifted under bridges and trestles. One afternoon while I was casting under the willows for fish, Stevens stood erect in the boat, almost upsetting it.

"Look!" he exclaimed, "Look!"

A broad expanse of water greeted our view. The water was brackish. We had come out with the tide and now stood at the gateway to the Gulf of Mexico. That

night we camped where the salty breeze fanned us, and where the smell of brine was in our nostrils.

Much of the land along the Suwannee River has been placed in hunting preserves and estates. Its beauty, which is being preserved by this movement, seems to accumulate with the years. Time has hallowed the song of the Suwannee River and time itself will make sacred the far-flung solitudes with its pines and cypress and their gray draperies of Spanish moss. May it always be, as it is today, worthy of acquaintance, this most widely sung and most picturesque river in all the world.



LIMESTONE LEDGES LINING THE RIVER

© Photograph by
Henry Knutson



"KRA"

MONKEYS' TRUCE

A Study in Animal Behavior

BY WILLIAM H. CARR

Assistant Curator, Department of Education, American Museum

THIS is a story of retribution, of the triumph of the weak over the strong; there is no question about it! The place was the Kanowauke Lakes Nature Museum, the year 1925, and the actors two temperamental East Indian monkeys that were forever engaged in dispute. Perhaps if they had been left in their native lands, in Borneo or Java, the argument would never have arisen, or could have been settled without violence. But the East Indies were a far cry from New York's Highlands of the Hudson.

All summer long Kra, the female, and Mac, the male, spent restless days in a comfortable, wire-fronted cage. Visitors invariably examined the monkeys first and other exhibits afterward—such is the drawing power of the monkey! At the rear of the cage a little gallery led through a wall partition and into my office where an adequate retiring box,

also wire-covered, gave the pair a place of sanctuary when small boys became too intimate.

The couple lived together, it is true, but never amicably. When not resting, or engaged in routine pursuits, the two bickered constantly and loudly, nor were their discussions always merely verbal. The affair often developed into actual physical conflict, though never of a very serious nature. In these preliminary skirmishes, Mac, the macaque, was ever the victor. One blow from his small but accurate palm, followed by a threatening show of sharp little teeth, was usually enough to send Kra chattering to her corner, where she would sit trembling with anger, but beaten nevertheless. I often took the pugnacious Mac to task after one of these unpleasant encounters, but my scolding was of no avail. He was a smug, incorrigible, arrogant bully. When I held him and tried to convince



© Photograph by John Rothwell

WELL IN HAND

Kra and Mac were content to be held, and would relax gratefully whenever human fingers were gently clasped about their diminutive, warm, furry bodies. Kra seems to be considering the distance between the ground and her perch, nevertheless

him of the evil of his ways, he would look at me impudently and then hang his head as though to say, "All right, I might as well agree with you now, but wait awhile!"

When he reentered the cage, the ceaseless quarrel would be renewed and Kra continued to be the protesting but helpless victim.

Needless to say, Mac secured the lion's portion of all food unless, as was usually the case, we fed the cage-mates separately. At meal time, when the animals were together, Mac would present himself at the front and confidently await the arrival of bananas, rice, or any other

staples of diet. Kra, on the contrary, would hover timidly in the background, and as the food arrived and several yellow bananas were thrown, one to Mac and one to her, she would make an attempt to snatch her share and retreat to the horizontal bar above, but eight times out of ten, Mac would immediately grasp both bananas and greedily squeeze them to his selfish little body. If there were anything left and if Kra's courage were sufficiently aroused, she would get a share; if not, we simply had to toss in more fruit! When Mac's surprisingly capacious stomach was distended seemingly to the bursting point, he would fill his cheek pouches until he appeared to have been suddenly afflicted with a severe attack of the

mumps. He was not one to leave a task half finished.

Kra would eat in a more leisurely and thoughtful manner. She would select morsels carefully and convey them to her mouth daintily with her small fingers. Her worried, sad little face and her solemn-brown eyes would show keen concentration and she would frequently murmur in a low, throaty, satisfied manner, as the meal progressed. If Mac approached, she would raise her voice to a scream and apparently call him every name in her expressive and extensive vocabulary. It was pitiful to witness her real distress and agitation lest her food be stolen.

Small wonder that we would drive Mac into the retiring box so that his pestered mate could dine undisturbed and at her leisure.

Once each day there was real excitement in the monkey establishment—this was at bathing time. And here, once more, Mac would give an exhibition of his overbearing ways. If there had been an ocean instead of a large dish pan, I believe that even then Mac would have tried his best to prevent Kra from approaching the water until he had played in it to his heart's content. As it was, when the pan, brimming full of water, was placed in the cage, Mac would jump up and down and shriek with joyous anticipation of the good time ahead. Kra, back stage as usual, would also show her pleasure, but in a lesser degree, because she had to wait until the selfish one was willing to permit her to come forward.

The arrival of the water was indeed the signal for Mac to abandon himself to an absolutely spontaneous, reckless, and ecstatic period of sport. He would first drink, with frequent pauses to give mouse-like squeaks of glee. Then he would scoop up some water and watch it trickle through his fingers, executing all the while a happy dance which consisted of weaving back and forth with many interruptions for head jerking. Now both hands and arms would be thrust into the pan and splashed up and down.

The monkey would pursue invisible "fish" about the bottom as he leaned over farther and farther. A wet, dripping palm would next be rubbed and patted over his side and then, as though he could wait not a moment longer, Mac would leap straight into the water, alighting rigidly upon all fours. The imaginary fish would be sought with increased vigor as the brown hands traveled and chased and scurried here and there. Every minute or so he would duck his head beneath the surface and bob it from side to side in spasmodic fashion.

All of this would be a mere introduction. When Mac had become thoroughly



© Photograph by Henry Knutson

FILLED TO REPLETION

Mac's appetite was always excellent, and his capacious cheek pouches were frequently distended at feeding time. Observe his pointed ears and tuft of hair; they suggest an important personage in the nether regions

soaked, he would begin to shriek in an ear-piercing, high pitched *eeeeee!* and would suddenly spring stiff-legged, with taut muscles, to the cage floor, and jump about as though propelled by steel coils, turning and twisting, usually in anti-clockwise direction, until it seemed that he must drop of exhaustion.

As his wild play grew in intensity, he would plunge, head first, straight over the rim and down to the bottom of the pan. Often his "unbreakable" skull would strike the metal surface with a resounding bang! This collision would deter him not at all! Sometimes his momentum was so great that he would rebound in and out of the water and be sent sprawling upon his back, rolling over and over, finally to sit up with a slightly bewildered air, but with spirits in no wise reduced. He would turn somersaults, (not handsprings) into the water and alight with a vigorous thump. When pausing to get a second wind, his ever active hands would deliberately splash water, never *into* the cage, but out through the wires on to the exhibition hall floor below.

During all of this performance, Kra would wait and wait for her turn. Our usual procedure was to remove Mac and refill the pan for her benefit. Kra never showed equal enthusiasm for the water. It may have been that the enforced delay dampened her initial zest. She would bathe quietly and drink for sometime, calling to herself with extended lips, a contented *ou ou ou*, in a plaintive minor key, again and again.

In the evening we would open the small rear cage door in the office and allow the pair to explore the room. Mac, for once, seemed to desire Kra's company on these excursions for, if she showed any hesitation about leaving the cage, he would grasp her firmly by the tail and pull her out! Mac would show little fear while climbing about and examining books or

any other mysterious objects. Kra, on the other hand, with characteristic nervousness, would fly to Mac's side in a panic if any strange sound or movement were made by the human occupants of the room.

She learned to sit upon my shoulder as I wrote and would follow the pencil with her eyes until, no longer able to resist the temptation, her slender, inquisitive hand would reach slowly out and grasp it. She would look at it for awhile and test its hardness with her teeth. If an eraser happened to be attached, she would quickly pull it from the metal tube and discard the pencil in favor of the more interesting and chewable object. Ever so often she would look at Mac and call to him, *eee mooo eee mooeeee mooo!*

If I changed my position in the chair, she would clutch me tightly. She made short advances on to the desk to peer, in a stooping, near-sighted way, at the ink well or ruler, but if I so much as turned my head, she would bound back upon my shoulder and hold on to my hair as though fearful of being left alone there. If any other person in the room moved, she would scold him with a hoarse, guttural *krra, krra, krra!*

One evening a young man, with whom the monkeys had become acquainted, took both in his arms and they promptly went to sleep. However, whenever my friend or I talked, Kra stirred uneasily, opened her eyes, and made faint sounds that rose and fell in volume or intensity as our voices did. After a time she grew tired of this conversational effort and went sound asleep.

I believe that the pair of monkeys preferred human arms as resting places, to any other type of support. We issued a weekly magazine in the museum and, more than once, worked for a full twenty-four hours on the day before "publication" in order that the paper might be ready on scheduled time. Strong cups of

coffee, however, did not always keep us awake for the entire period as we turned the handle of an antiquated, much abused mimeograph machine that served as the "press." It was of common occurrence for several of our workers, when being "spelled," to visit the monkeys, take them from the cage, sit down in a chair, and doze with them until awakened by a new-comer. Despite the fact that the animals' slumbers were thus broken they seemed in no way to resent it and slept deeply.

When returned to the cage, especially on cool nights, Mac and Kra would embrace each other closely and sleep together in this position all night long. Usually Mac contrived to be against a corner and Kra's back consequently was exposed to the chill.

Even in sleep, Mac was the overlord!

But this state of things was not to go on for all time. Indeed, as August days waned, we noted a change, subtle though it was, in the monkey's cage. True, Mac still insisted on Kra's obedience. He maintained his superior station by force as usual and continued to monopolize the bath and to secure more than his due of the food. Nevertheless, Kra gradually showed an inclination to be a bit more stubborn in resistance—to contest affairs with more resolve. Her retreats to the rear of the cage, after physical encounters, were of shorter duration and she no longer



© Photograph by Henry Knutson

A STUDY IN EXPRESSION

If facial expressions shown upon monkey countenances provide a clue to the animals' disposition, then one may easily judge Kra and Mac. Kra's wistful and peace-loving nature is certainly indicated, while Mac, even in repose, has a slightly belligerent, devil-may-care air

sought the furthestmost point of escape. Once she had the temerity to dart to the cage front, take a proffered banana, and hold it regardless of Mac's threatening gestures. His own food, firmly clutched in one hand, doubtless prevented more effective attack but, be that as it may, Kra held her ground, a fact so unusual that we who observed, commented upon it.

Was Mac losing his power after months of undisputed reign? We all frequently hoped for the best but it was hardly to be credited that so pathetic and mild a figure as Kra could ever change her disposition sufficiently to alter her meek place in life.

Several weeks passed speedily as our season of museum effort drew to a close. Many details occupied me and I delegated care of the monkeys to a co-worker. When about to leave my office, one morning, I heard a sudden commotion in the cage. There had been many disturbances from the same source but, from the outset, this one was of a different nature. As I rushed to the door, a wailing, unfamiliar cry, came from the monkeys. It did not originate with Kra.

Outside there was pandemonium. Boys and men ran shouting toward the monkey cage, drawn irresistibly by the promise of battle. So noisy was the ensuing conflict that the entire office staff left their desks and speedily joined the throng.

Mac and Kra were locked in what appeared to be a struggle to the death. Their shouts fell to grunts as the fight progressed. They thrashed about in the straw, clawing, biting, and scratching. Blood flowed freely from Mac's torn ear.

Not pausing to get keys to the cage lock, I tore off the front panel with a lusty pull and thrust head and shoulders into the compartment. It was increasingly evident that Mac, the larger of the two, the bully and the vainglorious, was slowly but surely giving ground. His eyes turned from side to side as though seeking escape. The transformed Kra would have none of it. Her attack was relentless and purposeful. Her tail had been pulled once too often and nothing short of absolute victory was to be considered.

In a flash I had the pair in my hands and pulled, yes, literally yanked them apart. The female carried on the offensive until the end. She had become an avenging terror and Mac was by now only too glad to declare armistice. For months his cage-mate had endured the abuses and insults heaped upon her. She had been pummeled and browbeaten too long. As I held them there, one in each hand, she tried, repeatedly to reach

the male and continue the fray, all the while upbraiding him at the top of her voice as he gazed shamefacedly in another direction.

Mac was placed in the now mended cage and at once sought the resting shelf, where he lay and regarded the crowd. For more than half an hour I tried to soothe the small, long-tailed monkey as her pounding heart grew calm. After a time she quieted down and uttered only the caressing sounds she ordinarily made when tired. Gently I opened the cage door and led Kra inside. Instantly she spied Mac and, without any preliminaries, she sprang at him and this time, before I could separate them, he suffered an open cut upon the forehead. Mac now definitely showed fear and, as I once more held the two apart, he was entirely subdued and exhibited not the remotest inclination to resume hostilities. He was a vanquished creature, and he knew it!

That settled it. We placed the animals in different ends of the cage and made the trap door fast between them.

In the evening, just before dark, we decided to try once more to reunite the couple. We were motivated, not by mere curiosity but by the friendliest of feelings and simply wanted to see the trouble at an end. In the ordinary course of events it is not wise for an outsider to meddle with the domestic affairs of others but, in this case, "who would if we didn't!"

Kra was in the front cage at the time and when we pulled up the dividing door, she turned about and regarded the opening. Presently, entirely chastened, eminently peaceful, and somewhat alarmed, Mac appeared. Kra at once emitted a tirade of uncomplimentary adjectives and drove him to a shelf near the cage roof, where he cowered and remained. Then she went to the front and scolded the audience, by way of variety.

Mac, the tamed, finally became weary of his dark corner and ventured cau-

tiously, inch by inch, down to a position slightly above his mate. She paid not the least bit of attention to him. Eventually he gained sufficient courage to lightly touch her upon the head, whereupon he was once more forced to retire in no uncertain manner. This advance and retreat were repeated several times until Kra ignored his presence entirely.

Darkness came, and still the pair were apart. After a long hesitation, Mac threw caution to the winds, approached Kra and affectionately placed his head on her shoulder, for all the world like the return of the prodigal imp that he was, come to beg forgiveness of his offended companion. Almost at once they locked arms and were friends again. They "talked" together for some five minutes with lips working energetically, and then the worn and tired Mac dropped his head

and fell asleep. The feud was over and peace had at last descended. During the remainder of the time that we kept the monkeys, Mac never regained his supremacy nor did he seem to resent his altered rank. He had more "sense" than we had credited him with!

When food appeared, there were no squabbles—it was share and share alike. Of course Mac would fly into a tantrum now and then but his temper was much improved. Kra had only to threaten and all was well. We marveled at the change, and thought that it was too good to last—but last it did. When fall came, we presented the pair, the new regime unchanged, to a large zoölogical park, and said good bye to them. Our acquaintance with these two distinctive animal personalities—never to be forgotten, was at an end.



© Photograph by Julius Kirschner

SOUND ASLEEP

This was a typical sleeping position, strained though it may seem. Mac, as usual, was the more comfortable of the two



Landing from the Whaleboat on the Martin Vas Rocks

SOUTHWARD THROUGH THE DOLDRUMS

The Schooner "Blossom" Continues Her Quest for Oceanic Birds in the South Atlantic

By ROBERT H. ROCKWELL

Taxidermist, Department of Preparation, American Museum

PHOTOGRAPHS BY THE AUTHOR, EXCEPT WHERE OTHERWISE NOTED

This article brings to a close Mr. Rockwell's series of stories of the adventures on the schooner "Blossom," on her deep-sea cruise for oceanic birds for the Cleveland Museum of Natural History. The first in the series of these, "Under Sail to the Cape Verdes," was published in the November-December, 1931, number of NATURAL HISTORY, and the second, "Sailing to Senegambia," appeared in the March-April, 1932, issue.

—THE EDITORS.

FIVE months' shore leave in Africa had been more than enough, our bird and mammal collections had increased by several thousand specimens, and all of these had been packed and sent back by steamer to the Cleveland Museum.

At Dakar we made a fresh start. The "Blossom" had been reconditioned, her decks cleared and calked, and an ample supply of clean, fresh water stored in her tanks. Much of our canned food had spoiled in the heat of the tropics but a fresh supply, more adapted to our needs, was stowed away amidships.

Before we started there were innumerable things to be done, for most of our equipment seemed to be breaking down. Our wireless was repaired time and again, but it never did function properly. Our motor boat engine failed, even under the skillful hands of two local mechanics, so we left it behind. Our windlass engine balked and bent her shaft at a critical moment, so after this mishap the anchor was always hoisted by man power, which proved to be a back-breaking job. However, from all this and a lot more, that might be dreary reading, we learned a few

things about sea-going expeditions and windjammers in general. Sometimes I find myself speaking of the "Blossom" as an "old tub," then again, pleasant memories of the expedition come to mind—certain happy moments that recall a kind of dream ship, or a sunset that reminded me of a canvas by Turner. Looking back at it now from the proper perspective, it looms up into a glorious adventure that will be cherished with an increasing fondness as the years go by. With all her faults as an expedition ship there was a captivating element of romance about the "Blossom." To see her riding the crests of a white-capped sea or quietly rolling at anchor in a snug harbor at sunset was an experience never to be forgotten.

It was late in the afternoon when we cast off our lines and were towed by a government tug out of the port of Dakar. The tug captain had been paid for this

service, but without warning he unceremoniously cast us adrift, with the result that we came within an ace of going aground as we drifted dangerously near the beach into shallow water. We had been up all night trying vainly to get clear of the coast, but even with all canvas set, every puff of wind seemed to drive us nearer the beach, until at four A.M. the mate made a sounding which indicated about one fathom under our keel, so the order was given to let go the anchor. As usual, the cable fouled, and we continued to drift dangerously near the breakers while Da Lomba and I tried to release the tangled mass of the huge chain in the hawse pipe. At last, much to our relief, the chain began to rattle as the anchor dropped down to the shallow bottom, and the tension on our nerves slackened as we saw the cable tighten and hold us from what would have been the last chapter in the expedition.



THE "BLOSSOM'S" WHALEBOAT ON THE OCEAN

Kenneth W. Cuyler with his men and Long John DaLomba at the tiller of the whaleboat which was used for scouting for specimens. With this craft many landings were made on uncharted shores



THE SOUTHWEST SHORE OF SOUTH TRINIDAD

The cone on the extreme left is known as "The Ninepin," and at the extreme right hand of the island are two large rocks known as "The Sugar Loaf" and "Noah's Arc." The expedition landed at the center of the island

We had a series of events like this, but, after all, they seemed to put zest into the expedition. We soon forgot this incident and, after bending over that faulty windlass for two hours, we finally got under way and went down to breakfast with a wholesome appetite. Our first objective was to return to the Cape Verdes and Saint Vincent, where we hoped to obtain a second navigator. From here we were to continue to South Georgia and visit such islands as St. Paul Rocks, Fernando Noronha, South Trinidad, and then into the Antarctic.

In mileage our progress was the opposite of rapid. The winds were light and we tacked back and forth within sight of Dakar for more than two days. At this rate of speed it was reasonable to expect that we might spend the rest of our lives completing our itinerary, but just in the midst of a calm the horizon began to darken; the stillness was broken only by the clatter of our gear as the sails flapped

loosely back and forth, causing the boom to creak and groan in idle protest. A storm was approaching, topsails were taken in, and we stood by, waiting for the wind to strike. Suddenly, out of the mist on the horizon, the freshening breeze became stronger and stronger until it struck us full on the quarter and fairly shrieked through the rigging. It was a joyous feeling to watch the ship respond as she heeled over and tore through the foaming seas. During one of these squalls Da Lomba let me have the wheel. It was a great sensation to get the feel of the ship when the lee rail sometimes plowed under a huge comber.

Still unfavorable weather conditions held us back. It was fourteen days before we reached Saint Vincent again (some 350 miles), but many more days passed before we found a navigator and left these islands for good and headed south, bound for St. Paul Rocks. Our last sight of land was Brava. There was a

favorable wind and we now averaged a hundred miles a day.

Our new crew of black sailors behaved fairly well at the start, but they needed watching. Our shifts were four hours on and four off. At times it did not seem so good to be dragged out of bed at four in the morning, but our cook was always there with hot coffee and a snack. The sunrises were often beautiful and full of color. While the weather was warm, we slept on mattresses right on deck, clear of malaria mosquitoes. There was little to disturb us now except during sudden showers when everyone would take up his bed and walk or scramble madly down into the stuffy cabin.

We lived simply and we dressed simply. We were not over-dressed explorers, and I am afraid our pictures, if shown in the movies, would hardly measure up to the Hollywood type. A hat, shirt, and trousers were all that we required. Later we

became so rude as to go barefooted. It is surprising how few clothes one needs when each one does his own washing and there is a scarcity of water with which to wash.

An average day on board ran something like this. At eight bells (4 A.M.), which is early to be even half awake, I was aroused by a man from the previous watch. This was always an unhappy moment, but once on deck I took my trick at the wheel. It was still dark and the only light visible was the indirect glow from the box that housed the compass. The air, while chilly at first, always felt warmer after a little exertion on the wheel. The sails were full, although only a light breeze blew over a calm, rolling sea. The only thing that seemed alive and moving was the ship. I was not alone, however. At my left sat that fine old veteran of ancient whaling ships, Long John DaLomba, sprawled out in a low, easy, deck chair, but wide awake as an owl at dawn, and



THE RUGGED CRAGS OF SOUTH TRINIDAD ISLAND

The conical peak near the center is the Sugar Loaf. Its summit seemed inaccessible and thousands of sea birds circled around its oval crest



A FAIRY TERN AND HER YOUNG

These birds feed their young on a fish the size of a small sardine. They are exceedingly tame, and this bird permitted the photographer to approach within eight feet without becoming alarmed

ever on the alert for sudden squalls. At this early hour there was little said except a remark on the weather or a casual comment on the course. Dawn had not yet appeared, but bright stars here and there in the misty heavens cast their glimmer over a ruffled sea.

The lap-lap of broken waves on the hull was the only outward noise of the hour. All was quiet on board except the creaking of the ship's timbers as she lifted or fell on the slope of a wave. Three dark figures on the deck house in front of me slept soundly and sometimes snored. The lookout at the bow was usually awake but on this occasion we found him dead to the world and the dangers of the sea. However, two gallons of cold sea water dashed over him made him wake up with a sudden cry and an outburst of Portuguese profanity.

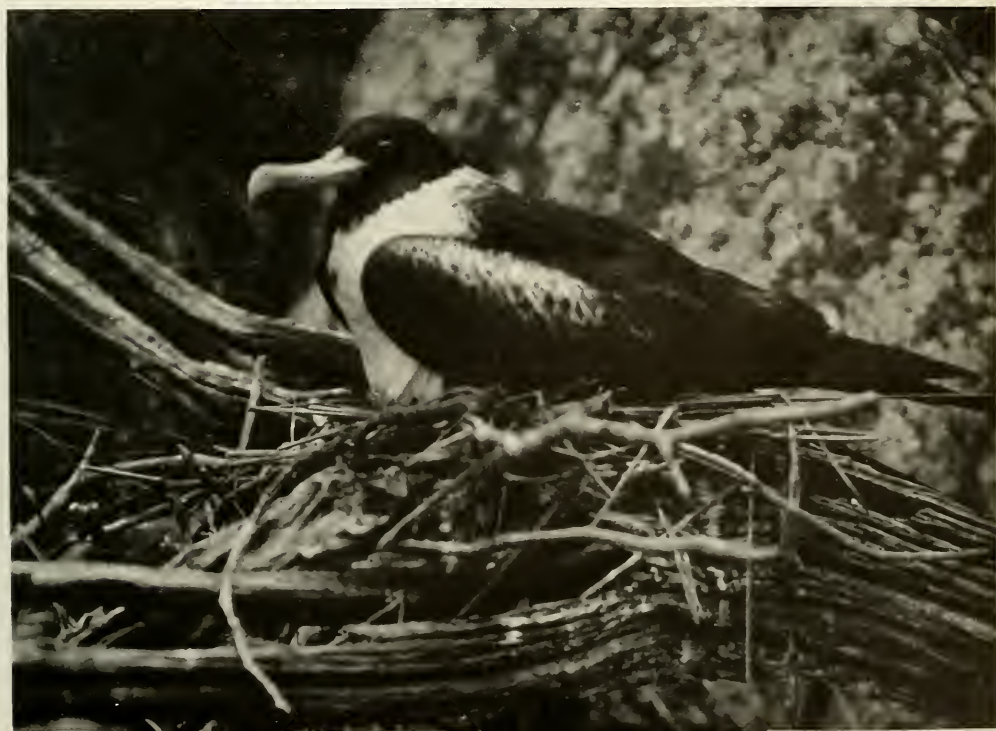
At eight o'clock we had breakfast. It consisted of canned sausage, potatoes, coffee, and bread. Our flour, cereal, and crackers were infested with weevils, so the bread was not so good. However, at sea one must eat what one can get and be contented. The morning was spent in doing whatever odd jobs happened to be on hand. The crew tended to the sails and gear, but I was often called on for special work. I remember one occasion when the iron grate from the stove burnt out completely and we had no spare grate. This was a serious loss—no grate, no fire, and consequently no cooked food. Our cook just sat down, and almost wept. After spending some time trying to remove a piece of iron from the ship's hull, I finally discovered a crowbar. This I sawed into equal lengths and then fitted them into the galley stove.

MAN-OF-WAR BIRD AND YOUNG

Two kinds of man-of-war birds were found on South Trinidad. These photographs show the larger variety. Unlike most of the other birds on the island, they were not common, and the nesting colony was restricted to a single small area on the northeast side of the island

THE NEST OF A MAN-OF-WAR BIRD

The nests were found in a rocky ravine, and usually on the fallen branches of dead trees. A notable peculiarity about these trees was that they were scattered helter-skelter among the rocks, and no living representatives of this type of flora survived





MOTIONLESS BUT WATCHFUL

Two fledgling man-of-war birds and a young booby, hungry, but silently waiting for the fish their parents are catching for them at sea

In the afternoon the days seemed to drag. Each of us had our favorite place of retirement during these hours of enforced idleness. After a year aboard ship the tropics were claiming us and now we were all ardent devotees of the *siesta*. At three in the afternoon recumbent figures sprawled snoozing in every corner on deck. DaLomba usually slept high up in the whaleboat, while Captain Simmons, Vanzetti, and I lay in our low-slung chairs in the cool, breezy shadow of the great mainsail. The sea often was very calm and in the afternoon it took on a deep, gorgeous blue. This coloring was a constant source of wonder to us. If we had not seen so much of it we should have doubted that real water ever could look like that. Observed at very close range, it actually seemed as though someone had carelessly dropped a package of bluing on deck and it had become mixed with the sea water that flowed in and out through the scuppers.

Reading was a pleasant pastime, but I

remember a few startling interruptions,—in fact one or two events happened every day. Once on a sweltering afternoon the cry went up of “Shark, shark, great big shark on port side!” Casually someone had looked over the rail, and there in the clear, glassy water, accompanied by three pilot fish, was a shark about twelve feet long. There was a lot of confusion for the moment; everyone was yelling loudly for the harpoon and no one seemed able to find it, but the shark stayed with us and almost rubbed its sides against the vessel.

After what seemed like an endless hunt, I found the keen-edged harpoon in the bottom of the whaleboat and passed it over to DaLomba. With a cry of exultation and an unerring aim he thrust the sharp, barbed iron deep into the shark’s back. Then the struggle was on. While a dozen husky hands held the rope, this demon of the depths made the crimson water boil in his frantic efforts to break away. Although we nearly got dragged



AN ADULT RED-FOOTED BOOBY

As members of the expedition approached these birds, they expressed their disapproval by snapping at them and squawking loudly as they struck at the intruder’s with their sharp beaks

overboard, the iron held him fast and, when he finally calmed down, a noose was slipped over his forked tail. Then with block and tackle we hoisted him on deck amidst loud acclaim. This was an eventful day but still there was more to come.

Late in the afternoon we were almost becalmed. Our position was Latitude 19:38 S., Longitude 29:37 W. Birds began to appear at frequent intervals. There were white terns and white boobies, the latter with blue bills and red feet. As a tern flew over the masthead I shot, and it came down with a long, gliding swoop and fell far astern. We lowered the dory and alone I made for the location as fast as I could pull. It was no easy matter to locate the specimen where it floated some four hundred yards away, in the trough of the waves. Still, I hunted about some time and, at last, getting a line on its location by signals from the ship, I discovered the prize, retrieved it on the end of the oar, and headed back to the vessel. By this time the sun had almost



SHIELDING THEIR EGGS FROM THE SUN

The noddy was common around the shoreline, but the sooty tern's breeding ground seemed to be restricted to one large outlying rock



A PARENT BOOBY GUARDING HER YOUNG

The juvenile birds were covered with immaculate white down. Aside from the boobies that were nesting, 200 or 300 non-breeding adult birds roosted on low bushes farther up the mountain

set, the waves began to curl and break unpleasantly from a freshening breeze as I looked longingly toward the ship. She seemed like a speck, far off on the ocean. I was aware that I needed all the strength and courage I could muster to get back to her. Perhaps there was no danger but, with the rising breeze, the old ship's sails that had been dangling loose filled out and she gradually kept creeping away from me.

The sea was roughening up and now the vessel was almost a mile away. For the moment I was most unhappy, but I had learned at a very tender age how to row and I bent on those oars with all my might and main. After a long pull the distance slowly became less. At one hundred yards a quarter-inch shark line trailed astern of the schooner, so I grabbed this with a couple of turns around my hand to keep from slipping into the huge hook that hung on the end. The pull of the vessel on the rope began before I could get to the bow of the dory with the result

that I nearly capsized as the dory shot forward, first to the right and then to the left. Presently, just as I was making the rope fast, it broke, and the dory slipped back almost as far astern as it had been before. After another hard pull I came alongside once more and then aboard, a little ruffled, but with our specimen, while our cook gave a boisterous guffaw and remarked "All that for one wet bird." However, it had been an enjoyable day. Supper was soon served, after which we listened to our victrola music and watched a golden streak of clouds at sunset change color, take on weird shapes, and then vanish into the western sky.

We were now passing through the doldrums. Before this experience, "doldrums" meant nothing to me. One must go through them in a sailing ship to fully appreciate their true significance. A description of the doldrums would not make cheerful reading. Actually they affect one physically as well as mentally. The last word in depression. Before the days of steamships, they had been the terror of sailors as their old-time ships beat around in one place for weeks at a time, becalmed as though on the waters of a small inland lake. These calm areas of the ocean shift about and are encountered at different parts of the Atlantic as the seasons change, but they are more prevalent near the equator. Occasionally

there is a light puff of wind but it blows hither and yon in the most baffling manner. The doldrums have been well charted by Maury and, even though we tried to avoid them, they trapped us close to where his charts indicated them in Lat-

titude 5:55 N., Longitude 26:30 W. That was on November 17, and we sloshed about here for ten long days within an area of thirty miles.

This was a most monotonous experience, but as in all such things, there were elements of compensation. There were heavy rains and dead calms; then it became almost as dark as night, with thunder and lightning such as I had never before heard or seen. The sea took on a weird, greenish cast, and



A GOOD SOURCE OF FOOD SUPPLY

The cabin boy takes a ride on a big green sea-turtle, which later provided fresh meat for the larder

we all stood by in silence. Now and then a squall struck us with such force that the spanker boom sometimes dipped over into the sea as the ship tore through the flying spray. While we hated the calms, these frequent squalls always put new life into us. To me they furnished a joyous contact with the sea that never can be quite forgotten.

As we edged our way south the winds began to freshen and our speed ranged from sixty to eighty miles a day. We were now approaching St. Paul Rocks. Captain Simmons ordered a landing so that we might collect specimens. It was here that Charles Darwin made some observations on his famous cruise aboard the

"Beagle." We wondered if anyone had ever been there since. On November 28, by dead reckoning, we were within eleven miles of the Rocks, but the visibility was poor and, as the rocks are only sixty-four feet above the sea, they never came within our view. After four days of vain effort trying to beat up to them, Captain Vanzetti's reckoning showed that we were fifty miles farther off than our nearest location on the twenty-eighth. In view of the adverse current and the fact that the "Blossom" would not beat to windward, we failed to make these rocks, but perhaps after all, it was just as well that we did not make a landing. There is no fresh water on the Rocks, and had the "Blossom" drifted out of sight, as she undoubtedly would have, a prolonged stay on these inhospitable shores might have proved very uncomfortable, if not actually hazardous. It was hard to give up this objective, but we headed south for the island of Fernando Noronha.

This high island was sighted December 7, but with the same result. The current was about two miles an hour and, with the wind also against us, we had to steer off and leave it behind, so we headed for the Island of South Trinidad, which lies 750 miles east of the coast of Brazil.

We had been forty-one days at sea when we came within sight of South Trinidad, but before reaching it we made a brief visit to the Martin Vas Rocks which lay thirty miles to the east. While the "Blossom" lay to twelve miles off shore, we lowered the whaleboat and sailed up to these strange shores where few if any people have ever landed. The main rock of the group rises abruptly from the sea, and towers up, bare and rugged, to at least six hundred feet, where a seemingly inaccessible, grass-covered plateau crowns its flat top.

As we rounded the north side of the island a grand vista of fantastic rocks came into view, some of which were arched



Photograph by Capt. Titti Vanzetti

REPLENISHING THE WATER SUPPLY

These large casks were filled at a brook on shore and then floated out to the "Blossom." It required considerable effort by DaLomba and his crew to get these barrels through the surf

and domed. One of cylindrical form rose straight from the sea like the spire of a vast cathedral. We made the landing without mishap, and on going ashore I placed beneath a huge natural arch near the shore, a square bronze plate which I had engraved to commemorate our arrival. This plate had been previously prepared on board the vessel.

Our stay here lasted only two hours, but we collected some noddy terns (*Anous stolidus*) and a few sooty terns, black-capped with white breasts. A member of the party collected a small tern in a colony that was breeding in nests plastered against an almost perpendicular cliff. Unfortunately this bird was lost when it fell overboard, and we did not get another one of this species during our entire trip.

We left these islands with a desire to stay longer and an urge to climb at least once to the dizzy heights of that green plateau, for who knows what rare winged waifs of the ocean may be harbored in this remote sanctuary of the sea.

Before night came on we reached Trinidad. The prospects of obtaining specimens here were promising. Even far off shore we could see a large variety of birds that kept flying continuously between the cliffs and their feeding grounds. As we sailed along the north shore, we saw a steamship anchored close to the beach. We learned afterward that this ship makes a visit here from Brazil twice a year to supply the simple wants of a few political prisoners. However, during our stay, these fellows never bothered us, although we had to be watchful lest they should attempt to gain possession of our ship or guns and make Robinson Crusoes of us. We anchored on the opposite side of the island, as we were not interested in the politics of Brazil, and I never even saw one of those unfortunate prisoners.

The island appeared to be two miles wide by about three long, and close to

2000 feet high. It is rough and rocky, and tree ferns, grass, and dense shrubs partly cover its sides and irregular crest. Within a hundred yards of the beach our anchor ran out into seventeen fathoms on a bottom full of rocks. We were all assured of this because we left that anchor there when our cable broke. Collecting began at once. All of us fished that night and many odd specimens came aboard, to be stored in our formalin tanks. I have never enjoyed such wonderful fishing elsewhere. We got all we needed for science, with a lot left over for the pot. The jack fish were especially fine eating. Then a huge, green turtle was harpooned, which proved to be the *pièce de résistance*. There was no "mock" about this turtle. He must have weighed four hundred pounds and from him we obtained the first fresh meat we had had in forty days. It was on the table at every meal for almost a week and was eaten with great gusto. The uncooked fat was as green as the patina of copper.

Our first landing on the island involved considerable risk. A huge swell was rolling up on the rocks but we put out a kedge anchor and eased up the bow of the whaleboat to the nearest ledge. Here the swell rose and fell on an average of six feet with each successive wave. One had to depend a lot on what the man at the stern might do, as it was his business to keep the boat from being smashed against the rocks. Then, at an opportune moment, when a wave carried the boat to its crest, one made a flying leap and grabbed the ledge. To jump too soon or too late meant disaster. It was most essential to do more than just look before we leaped. However, although we made many landings, we had only one accident, when a whaleboat capsized in the surf. Fortunately, however, no one was injured; a gun and a pair of field glasses went to the bottom and the leader of the expedition lost his pants.

The birds were remarkably tame, especially the noddies. In fact while we were going ashore, they came out to meet us, and one, a little bolder than the rest, alighted calmly on the head of the man at the helm, where it sat for several minutes. From rocks close to the beach a lone white tern flew up and looked in my face, so near that I reached out my hand and caught her in the air, but I let her go and she perched on a round rock near by. No attempt was made at nest building by any of these birds. Just a slight depression on the top of a round rock was enough. Some of the depressions contained a few pebbles, and I recall finding only one egg in each nest of the white terns. While the nests were often near the ground, they were always well out of reach of the carnivorous

land crabs that destroy the eggs and young.

Alan Moses and I left our companions on the ship and stayed ashore for almost a month. We had no tent but we found a nice little cavern on the hillside, facing the ocean. It was about twenty feet across, and perhaps the same depth, and we placed our cots near the entrance to catch the breeze. The only thing that bothered us at first was the large, aggressive land crabs that rumbled over the loose stone floor at night. Their shells were as broad as a man's hand. They glared at us with an evil aspect and were armed with hooked nippers which we were careful to avoid. We drove them all out of our cave, and those that tried to enter thereafter got a warm reception. Aside from the land crabs the cave was not a bad place to



A CAVE ON SOUTH TRINIDAD

Headquarters of Alan Moses and Mr. Rockwell where they worked and lived for a month. As a shelter this cave proved to be ideal. Indeed, it seems possible that one could subsist on this island for an indefinite period without outside aid. The abundance of food fishes along the shore and the teeming bird life that rears its young on these rocks guarantee an ample food supply

camp in and we were never troubled with mosquitoes or other insect pests.

The climate was delightfully pleasant and at night a clear moon illumined the cliffs. Mating sea birds called to one another all night long, and we always fell asleep to the tune of tumbling waves that crashed and pounded on this rocky shore.

We explored this island and found it to be a most interesting place. Besides the terns there were two varieties of man-of-war birds, Arminjon's petrel, and the white booby. Their tameness was almost shocking. We would start out in the morning, gather a bag of birds by hand, and then work until dark preparing them, repeating this day after day for almost a month. Altogether we made up about twenty bird skins of petrel a day, which may not be considered fast work by some, but we know in future years these specimens will stand inspection because they were properly prepared. Besides the birds we found numerous semi-wild goats and pigs on the higher, secluded sections. It was rumored that these (or rather their ancestors) were liberated by Captain Edmund Halley in 1700. As edible animals, the survivors have deteriorated, and while their horns and hides were good their flesh was very unsatisfactory. So, much as we longed for some fresh

meat, we had to throw it all overboard.

Our close proximity to these bird rookeries gave us a fine opportunity to study them and especially to see the man-of-war bird in action. As a glider and an acrobat this bird is supreme. His wing spread is nearly six feet—about the same as our bald eagle—but he is a weakling in comparison and lacks the powerful wing strokes displayed by other birds of prey. They usually appeared in the late afternoon and hovered like pirates above our ship. Like fighting aces they climbed high up into the air and then dived in a long swoop, attacking any booby that came within their area. Their victim always squawked a bit while being chased but soon he would disgorge his fish and fly on, while this acrobatic freebooter always dived and caught the fish before it struck the water.

When Commander Simmons completed his survey of the island, we headed southwest, and after eight uneventful days reached Rio de Janeiro. It was here that Alan Moses and I left the expedition and returned home. As there was no possibility of getting south for sea elephants now, the other members continued a while longer, visiting the islands of Ascension, St. Helena, and Fernando Noronha, before returning home.



THE HARBOR OF
RIO DE JANEIRO
AT SUNSET



At Mr. Eastman's home in 1928. Standing (left to right) are Adolph S. Ochs, Mrs. Charles Edison, Charles Edison, Henry Fairfield Osborn, Gen. James G. Harbord, Mrs. Madeline Edison Sloane, Owen D. Young, J. E. Sloane, and Ogden Reid. Seated (left to right) are Mrs. Ogden Reid, George Eastman, Thomas A. Edison, Mrs. Thomas A. Edison, and Gen. John Pershing

GEORGE EASTMAN

1854-1932

IN the City of New York the name of George Eastman will be rendered immortal through his munificent gift to the African Hall of the American Museum of four of its finest groups, namely: Buffalo Group from Kenya Colony; Klipspringer Group from Kenya Colony; Wild Dog and Roan Antelope Group of Tanganyika Territory; Water Hole Group of Kenya Colony. Intense personal interest enhanced Mr. Eastman's initial gift, for with Carl Akeley he visited Africa, at the age of seventy-two, and assisted in the actual collection of the specimens for the four habitat groups that are now forever connected with his name. It was this gift, inspired by the personal visit of Carl Akeley to Mr. Eastman's home in Rochester, which set the contagious example to other benefactors resulting in a succession of gifts of large habitat groups that now amount to fourteen.

Mr. Eastman's career was characteristically American. Born on July 12, 1854, at Waterville, Oneida County, New York, of a family of very limited means—

his father having been unsuccessful in an attempt to found a school—his school education in Rochester terminated at the age of fourteen, when he was turned upon his own resources. He worked as messenger, then as clerk, and finally obtained a position in a bank (where his highest rank would have been that of an unknown country banker). Meanwhile, having become interested in amateur photography, he set up a studio in the attic of his home, where, at the age of twenty-four, the young experimenter discovered a chemical coating which made dry plate photography possible. With this revolutionary discovery to encourage him and with \$5,000 he had been able to save, he took a partner—Col. Henry A. Strong—and began making dry plates in a small factory and experimenting with his first "foolproof" camera. This was in 1880, and from then until his death on March 14, 1932, the industry he founded grew until it penetrated to the remotest portions of the earth. His name is for all time inextricably bound up in the story

of the development of photography.

In a sense the climax of Mr. Eastman's photographic career came in the year 1928 with the completion of the kodacolor camera, after twelve years of research and experiment. The occasion was celebrated by a gathering at Mr. Eastman's beautiful and hospitable home of a group of men of national and international reputation. Centered around the venerable figure of Thomas Edison, representatives of this group are shown in the accompanying photograph: Invention, headed by Edison; Finance, headed by Owen D. Young; National Defense, headed by Generals Pershing and Harbord; the Press, headed by Adolph Ochs of the *New York Times* and Ogden Reid of the *New York Tribune*; Science, represented by myself.

The list of Mr. Eastman's philanthropies is one of the most imposing in American history; The University of Rochester, and the School of Music in the same city, the Massachusetts Institute of Technology, Hampton Institute, Tuskegee Institute, Oxford University, the dental clinics of London, Paris, Brussels, Stockholm, and Rome, and many other institutions received gifts which are variously estimated as totaling between \$75,000,000 and \$100,000,000. His philanthropic career is without parallel in America, because unlike his great predecessor Andrew Carnegie, Eastman was not only inventor and creator but was also a great administrator and most successful manufacturer and producer. His philosophy of giving may be summed up in his own words of several years ago: "Two courses are open to a man of wealth: he can hoard his money for his heirs to administer, or he can get into action and have his fun with it while he is alive." That he himself chose the latter course is plain to anyone who has followed the reports of his numerous benefactions.

In the field of business Mr. Eastman

occupied a unique place. Prof. Edwin R. H. Seligman of Columbia University has said that as far as is known Mr. Eastman was the first manufacturer in the United States to formulate and put into practice the modern policy of large-scale production at low cost for a world market, backed by scientific research and advertising. Furthermore, few businesses have utilized so thoroughly the research laboratory as an aid to business.

I well recall a tour I had the privilege of making with him through the exquisitely beautiful School of Music and the unrivaled Auditorium which he established in Rochester, in which every detail had been thought out with the vivid imagination of both the expressional and practical side of musical culture. At the close of this tour he remarked:

"You, Professor Osborn, are an educator and I appreciate your evaluation of the work I have tried to do here. I am an administrator, not an educator."

I replied, "No, Mr. Eastman, without any doubt you are an educator of the highest order; you prove it by the union of inspiration and the opportunity for profound musical research and ardent practice you have made possible here."

It was at this memorable meeting also that Thomas Edison said:

Osborn, I have been thinking a great deal of the difference between George Eastman, yourself and myself, and it comes to about this: You are always living in the past in billions of years. George Eastman is always living in the present in promoting the life and thought of the present generation by his great advances in photography. I am not dwelling on the past like yourself nor on the present like George Eastman, but I am always thinking of the future and of the still unknown advances which may be made by scientific discovery and invention.

In each of the fields of American civilization he entered George Eastman challenged comparison; and his charming, modest, self-effacing personality endeared him to all his host of friends.

Arthur Parkfield Osborn.

THE THIRD INTERNATIONAL CONGRESS OF EUGENICS

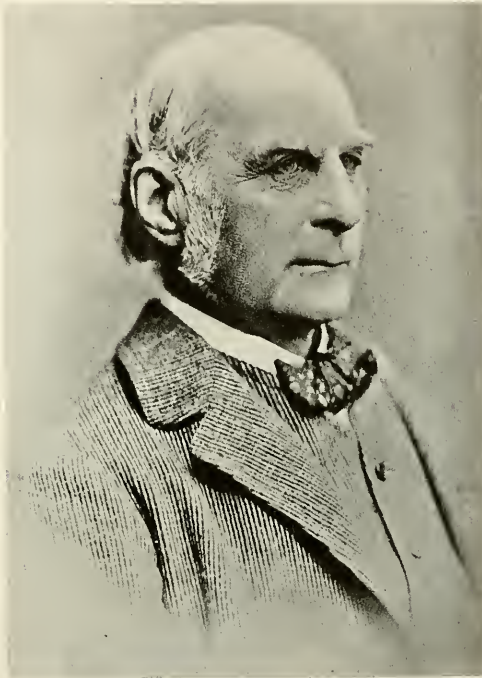
To Be Held at the American Museum of Natural History
August 21-23, 1932

EVERY schoolboy knows," or used to know, that the idea of trying to improve the quality of the breed of men was put forward by Plato and rigorously practised by the Spartans. But few schoolboys were told that Europe turned its back on Plato's plan and for more than two millenia devoted itself whole-heartedly and on a gigantic scale to dysgenics, pestilence and warfare.

The generation of Charles Darwin was the first to realize that the gloomy principle of Malthus was at work nearer home than in China; they heard directly from Darwin and Spencer of the reality and intensity of the struggle for existence and of its influence in perpetuating the most resistant strains; they saw for themselves the immense improvements, from the human viewpoint, that had been brought about by intelligent selection among the breeds of racehorses, dogs, pigs, cattle, and sheep.

Then arose Sir Francis Galton, founder of the Science of Eugenics, who defined National Eugenics as "the study of the agencies, under social control, that may

improve or impair the racial qualities of future generations either physically or mentally." This was the ideal that inspired the First International Congress



SIR FRANCIS GALTON

The founder of the Science of Eugenics, at the age of 73.
Photograph reproduced from *The Life of Francis Galton* by
Karl Pearson

of Eugenics in London in 1912, under the presidency of Major Leonard Darwin; it was transmitted to the Second International Congress in New York in 1921, under the presidency of Henry Fairfield Osborn; the Third International Congress in New York in August, 1932, under the presidency of Charles B. Davenport, sets for itself the guiding principle that "Eugenics Is the Self-Direction of Human Evolution." Consequently nothing that pertains to

the biological history of man or to the conditions of his racial progress or retrogression is foreign to the present Congress.

Like a tree Eugenics draws its materials from many sources and organizes them into an harmonious entity. From modern Genetics it has received the basal laws and formulæ for analysis of the phenomena of heredity in man; anthropology has supplied it with the technique of measuring and recording the physical

traits of human groups; from ethnology it may learn the scope and limitations of social tabus or mores upon the free mixture of different stocks; from vital statistics compiled by modern governmental and social agencies it draws the data for studies on the relative fertility of different strains in a community.

On the other hand, the youthful science has not lacked plenty of healthy opposition to its basic principles. "Eugenics for Cows, not for Humans" expresses the sentiment of more than one critic, while the free and unlimited coin-

age of defectives is regarded as an inalienable human right by others.

Doubtless the Third International Congress of Eugenics will not fail in its object "to clarify the principles and aims of eugenics, and to point out the most profitable lines of eugenical endeavor for the next decade."

Applications for memberships and inquiries concerning the Third International Congress of Eugenics may be addressed to Harry H. Laughlin, Secretary, Cold Spring Harbor, Long Island, N. Y.

—W. K. G.

THE NATURAL HISTORY OF MAN

FROM FISH TO MAN.—For the new Hall of the

Natural History of Man, at the American Museum, Mr. F. L. Jaques, of the department of preparation, has made a series of paintings that embody the writer's conception of some of the main stages in the ascent from fish to man. The first half of this hall, that dealing with comparative and human anatomy, will be opened to the public when the Third International Congress of Eugenics assembles at the Museum on August 22, 1932.

The first stage in the series represents *Cheirolepis*, an ancestral fish from the Old Red Sandstone (Middle Devonian) of Great Britain. The painting is based on a model of the skeleton by Christopher Marguglio, made from the very carefully studied drawing of the skeleton published by Sir Arthur Smith Woodward. This is an extremely primitive fish in which locomotion in the water was effected chiefly by undulation of the body, the fins being mostly folds of skin supported by cartilaginous rods and used mainly for steering and for balancing.

The second stage represents *Eusthenopteron*, a lobe-finned fish from the Upper Devonian of Canada, painted from a model by Mrs. Helen Ziska, which was based on fossil skeletons described by W. L. Bryant, L. Hussakof, and others. The pectoral and pelvic fins have become strong paddles. The construction of the skull, backbone, and bony parts of the paddles

foreshadows in many respects that of the earliest amphibians.

The third stage represents *Diplovertebron*, a primitive amphibian from the Lower Carboniferous of Bohemia. The painting is based on a model by Mrs. Helen Ziska, embodying Prof. D. M. S. Watson's observations on the most primitive fossil amphibians of Europe. At this stage five-toed hands and feet had already been evolved, presumably from an earlier paddle-like condition. Atmospheric air was breathed but the young were still developed in the water.

The fourth stage represents *Seymouria*, the most primitive known reptile, from the Permian-Carboniferous of Texas. This is based chiefly on a model made by Prof. Alfred S. Romer from the mounted skeleton in the Walker Museum of the University of Chicago. At this stage the skeleton retained many characteristics of the older amphibians, but adaptations for land living were progressing and very probably the eggs were laid on land, while the watery environment was retained only within the shell and within the body of the animal.

The fifth stage represents *Cynognathus*, a mammal-like reptile from the Triassic of South Africa, and is based on a model of the skeleton by Christopher Marguglio which embodies the studies of Seeley, Broom, Watson, and many others on the original fossils. At this stage a marked approach toward the mammalian grade



LEFT: An extremely primitive fish in which locomotion in the water was effected by undulation of the body. CENTER: A lobe-finned fish from the Upper Devonian of Canada. The pectoral and pelvic fins have become strong paddles. RIGHT: A primitive fossil amphibian. At this stage five-toed hands and feet had been evolved.



LEFT: In this most primitive known reptile the skeleton retained many characteristics of the older amphibians, but adaptations for land-living were progressing. CENTER: A mammal-like reptile. A marked approach toward the mammalian grade of organization is observed in the entire skeleton. RIGHT: The common opossum, one of our oldest "living fossils," illustrates an early stage of adaptation to arboreal life.



LEFT: An early stage in the evolution of the primates, with hands and feet thoroughly adapted for grasping the limbs of trees. CENTER: Although now somewhat overspecialized for arboreal life, these apes retain many characteristics which appear to be inherited from the remote ancestors of apes and men. RIGHT: An early species of man—the Neanderthal race. This ancient and extinct human species retained certain ape-like characters in the skull, braincase, and feet.



A MAMMAL-LIKE REPTILE FROM THE TRIASSIC OF SOUTH AFRICA.

This restoration of the skeleton of *Cynognathus* is based on studies by Seeley, Broom, Watson, and others on the original fossils. Similar original specimens were used as models for the other restorations of fossil animals of this series.

of organization is observed in the entire skeleton. These so-called reptiles were in fact near-mammals.

The sixth stage represents the common opossum, an archaic mammal, one of our oldest "living fossils," which has retained a grade of organization that was characteristic of the days of the latter part of the Age of Reptiles. During the enormously long period in which the higher mammals have been evolved, the opossum has remained almost unchanged—an extraordinary case of "arrested development." This animal illustrates an early stage of adaptation to arboreal life.

The seventh stage represents *Notharctus osborni*, a lemuroid primate from the Eocene of Wyoming. The painting is based on fossil skeletons described by the writer in 1920. *Notharctus* illustrates an early stage in the evolution of the primates, with hands and feet thoroughly adapted for grasping the limbs of trees.

The eighth stage represents a female anthropoid ape and infant characteristic of the latter part of the Age of Mammals. The existing anthropoids, especially the chimpanzee, are "living fossils" from the Miocene and Pliocene epochs. Although now somewhat overspecialized

for arboreal life, these apes retain many characteristics in the brain, skull, teeth, backbone, and limbs, which appear to be inherited from the remote common ancestors of apes and men.

The ninth stage represents an early species of man—the Neanderthal race. This ancient and extinct human species retained certain ape-like characters in the skull, braincase, and feet.

The label for this exhibit reads as follows:

STUDENTS IN NATURE'S TRAINING SCHOOL

In the present and past ages of the earth Nature has kept a physical and mental training-school of many grades. Her examinations have always been practical ones, the prize of survival being awarded to the fittest in each successive grade.

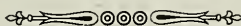
In the primary school the lower grades were passed through under water. Here one learned to swim and steer in the currents, to lurk quietly, to strike successfully. A few grades further on the pupils were equipped with air-sacs, so that they could wriggle out on the banks and use their fore and hind paddles as limbs.

After acquiring a physique to withstand hardships of heat and cold, some of the more advanced candidates were admitted to the school of the forests and to the higher curriculum of life in the trees; here also a practical course in the care and feeding of infants was required of all mothers.

At last the most intelligent pupils ventured out into the open and went into training both for short sprints and cross-country runs. In their manual training-school they learned the art of making flint implements and weapons; with these, when they retired to their dormitories at night, they secured for themselves their simple meal of bear's meat.

Thus they were prepared for the degree of H. S. (*Homo sapiens*), which was eventually won by their descendants.

—WILLIAM K. GREGORY.



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

EXPEDITIONS

THE AMERICAN MUSEUM EXPEDITION TO BOLIVIA.—A dispatch to the *New York Times* announces that the American Museum Expedition to Bolivia, in charge of Dr. Wendell C. Bennett, assisted by John G. Phillips, has returned to La Paz after a trip of exploration to the higher levels of the Bolivian Plateau in the vicinity of Lake Titicaca.

Doctor Bennett reports the results of the trip as highly satisfactory, having plotted and examined a number of large ruins, one of which is equal in size to the famous ruin of Tiahuanaco. The region traversed contains many round burial towers of excellent masonry, many of which have not been disturbed and so contain the original burials, with all the usual accompaniments.

The Bolivian Government has extended every courtesy possible, the Bolivian Air Force having furnished a plane for photographic work, with the result that to date many of the large ruins in the vicinity of Lake Titicaca have been completely photographed. Prof. Arthur Posnansky, the most distinguished Bolivian archaeologist, has extended many courtesies to the expedition, and in other ways greatly contributed to its success. In all, more than forty-three ancient ruins and settlement sites have been studied and reported, many of which were unknown to archaeologists. In some of these were found a large number of old Inca houses still intact. The best examples of these were near the town of Macalaya. Many of the houses in these sites were constructed entirely of stone, the roofs supported by crude arches.

The general plan of the expedition was to follow the former explorations of Dr. Adolph Bandelier, who was connected with the American Museum from 1895 to 1902, and to carry through to completion the plan originally developed by Doctor Bandelier, for an exhaustive investigation of the whole Bolivian Plateau.

THE ARMSTRONG SANTO DOMINGO EXPEDITION.—The members of the Armstrong Santo Domingo Expedition left New York on June 30

for the Dominican Republic to carry on zoölogical field work. Through the generosity of Mr. L. D. Armstrong, it is possible for Mr. William G. Hassler of the department of herpetology and experimental biology, as leader of the expedition, to continue his studies of the life histories and habits of the reptiles and amphibians of the island, this time at hitherto unvisited points along part of the southern coast. The other members of the party, Messrs. John Armstrong, Daniel Pease, and William Bush will specialize in the marine and insect life of the region.

THE LEGENDRE INDO-CHINA EXPEDITION.—On March 16 the Legendre Indo-China Expedition reached Saigon, thus completing its six months' collecting in that country. More than two thousand miles were covered by the expedition, the entire length of Indo-China was traversed, and the country crossed three times. Every province in Indo-China was visited and collections made in each. Altogether 384 mammals and 382 birds were collected. In the September-October number of *NATURAL HISTORY* there will be an article by Mr. Sidney Legendre telling about the experiences of the expedition while in the field.

NEW FAUNAL BIRD GROUP.—On May 17 and 18 Dr. Frank M. Chapman and Mr. Francis L. Jaques, under the guidance of Lord Grey, retraced the Grey-Roosevelt route of June 9, 1910, and selected on it a place in the New Forest, near Lyndhurst, as the site of a faunal bird group. Mr. and Mrs. Carl Tucker, the latter the donor of the group, were also members of the party.

Mr. Jaques remained to make the required field sketches and, thanks to the kindness of Sir Hugh Murray, in charge of the New Forest, a forester was detailed to assist him in collecting accessories.

The birds in this group will be mounted from sketches made for the purpose by George E. Lodge, noted English bird artist.

ARCHÆOLOGY OF MEXICO.—Dr. G. C. Vaillant returned from Mexico in the early part of May, after a successful season of stratigraphical work on the archæology of the Valley of Mexico. Not only were three periods discovered at the site of San Juan, Teotihuacan, but also a new culture, that of Mazupan, was defined and dated as post-Teotihuacan and pre-Aztec. Mrs. Vaillant working at Cuernavaca Morelos, made highly important finds, uncovering evidence of three periods, two related to the early cultures of Zacatenco and Ticoman, and a third that seems to be immediately prior to the Aztec conquest.

ASTRONOMY

THE forthcoming total eclipse of the sun on August 31, 1932, is attracting much attention among astronomers of the world. A committee has been appointed for the Amateur Astronomers Association for special study of the eclipse,—Chairman, Mr. Harry Lawton of New Orleans.

Dr. Clyde Fisher is planning to photograph the eclipse in Maine from an aeroplane. Also during the summer Doctor Fisher plans to visit Meteor Crater in Arizona, where he expects to make careful studies and photographs of this unusual phenomenon.

The Amateur Astronomers Association resumes its meetings on Wednesday, September 21, after which the meetings will be held as heretofore on the first and third Wednesdays of each month.

BIRDS

THE TRING COLLECTION.—At the end of January, 1932, Dr. Leonard C. Sanford, trustee of the American Museum, and Dr. Robert Cushman Murphy, curator of oceanic birds, went to England to arrange for the transfer to New York of the renowned collection of birds built up by Lord Rothschild in his Zoological Museum at Tring, Hertfordshire. After more than forty years of development, Lord Rothschild had found it necessary to offer for sale his ornithological treasures, the greater part of which was presented to the American Museum by a generous friend and patron.

No catalogue of the Tring birds had ever been prepared, but Doctor Murphy undertook to list the specimens in connection with the packing. The task occupied nearly four months, the typewritten catalogue running to seven volumes. One hundred and eighty-five wooden cases were required to contain the Rothschild birds, the last of these safely reaching the American Museum early in June.

The Tring Collection of Birds is one of the most comprehensive in the world. It has been studied more than any other, and it is filled with rarities and with specimens of historic and systematic importance. By its acquisition the American Museum receives nearly 280,000 specimens, approximately 3000 types, and probably more than that number of genera. The collection is particularly rich in its representation of Old World families—it includes, for example, all but four or five of the known species of birds of paradise. In a most remarkable manner it supplements the former collection of the American Museum, for Tring was as rich in birds from Europe, Asia, North Africa, South Africa, Australia, New Zealand, Malaya, and Papua, as the American Museum was in those of North and South America, the African Forest region, and Polynesia.

The Tring Collection will become available to students as soon as possible after the department of birds removes to its new home in the Whitney Memorial Wing.

In a later number of *NATURAL HISTORY* more will be said about the richness and significance of the Tring Collection.

CONSERVATION

THE JACK MINER BIRD SANCTUARY, which was originated in Kingsville, Ontario, in 1904, is now being made a part of the Jack Miner Migratory Bird Foundation, Incorporated. During the last thirty years Mr. Miner and his associates have carried on the work of providing a refuge for thousands of birds annually as they migrated from their breeding grounds at Hudson Bay to spend the winter along the southeast Atlantic coast and Mississippi Valley. Some of the first bird banding done on this continent was accomplished at this Sanctuary, and Mr. Miner's educational programs have aroused great interest in the care and perpetuation of wild birds. The Foundation is now working for an endowment which will insure the continuance of this worthy activity. Anyone interested in this project is requested to address Manly F. Miner, Kingsville, Ontario, Canada.

EDUCATION

NATIONAL EDUCATION ASSOCIATION.—Grace Fisher Ramsey, associate curator of the American Museum's department of public education, attended several sessions of the National Education Association held at Atlantic City June 24 to 30. As a member of the National Council of Education she was present at the Council meetings on June 24 and 25. On June 27 and 28 Mrs. Ramsey attended all meetings of the

Department of Visual Instruction of which she is a member of the Board of Directors.

In conjunction with the meetings of the department of science and nature study, the Museum and School Nature League cooperated in arranging a most attractive exhibit in the Hotel Chelsea. The exhibit included sample cases of the small habitat groups and other collections which the American Museum lends free of charge to the public schools of New York City. The School Nature League had an attractive section containing terraria of small plants and animals of the local region. Much interest in these exhibits was shown by many teachers attending the section meetings.

INSECT LIFE

CURATOR LUTZ of the department of insect life, American Museum, is taking a summer's vacation from entomology and is giving a course on "Visual Aids in Teaching" at the Cornell Graduate School of Education. As readers of his pamphlet *Nature Trails, an Experiment in Outdoor Education* know, this is not his first excursion into the pedagogical field. Assistant Curator Curran is giving instruction in entomology at the summer school of the Long Island Biological Laboratory.

SPIDERS are neither insects nor even very closely related to them; but it happens that the collection of spiders at the American Museum is in charge of the department of insect life. Until recently the Museum has had no specialist in this much neglected group of animals. Now, however, it is glad to announce that Mr. W. J. Gertsch has been appointed assistant curator for this purpose. Mr. Gertsch comes to the Museum from the University of Minnesota.

MEETINGS OF SOCIETIES

THE AMERICAN SOCIETY OF MAMMALOGISTS CONVENTION.—The fourteenth annual meeting of the American Society of Mammalogists was held in Washington, May 3 to 7. This was attended by Messrs. Anthony, Archbold, Gregory, Hatt, Simpson, Tate, and Miss Roigneau of the American Museum staff. Forty papers were presented on the program of the meeting, six of which were by the Museum delegation. Of the officers elected three were also from this institution: Mr. Anthony being elected first vice-president, Mr. Hatt corresponding secretary, and Professor Gregory a director.

The Society reaffirmed the stand taken at previous meetings and by resolution urged that the authorities give more adequate protection to the giant bears of Alaska and set aside Admiralty Island as a bear sanctuary.

The Society also reiterated its opposition to the present control methods practiced against predatory mammals and rodents and again requested the United States Biological Survey to cease its widespread use of poison.

GEORGE FREDERICK KUNZ

AS NATURAL HISTORY goes to press, word comes of the death on June 29 of Dr. George Frederick Kunz who for a number of years has been research associate in gems at the American Museum. An appreciation of his life and work will appear in the next issue.

MUSEUM ACCESSIONS

THE DEPARTMENT OF MINERALS AND GEMS of the American Museum has recently acquired through the gift of the late Miss Elisabeth Cockcroft Schettler a magnificent engraved emerald weighing more than 87 carats. This stone is rectangular in shape and is engraved on both sides with a conventional design of flowers and leaves. It is a Colombian emerald of fine quality, and the cutting is executed in the manner of the gem workers of India.

Sir Purden Clarke, late director of the Metropolitan Museum, in commenting on this stone said "this emerald should be placed in the period of the Mogul domination of India, the time of the Taj, viz, three hundred years ago. It was probably of Delhi cutting or that of Central Asia, and was used as a head ornament by some prince."

Included in the Schettler gift is a beautiful string of thirty-one beryl beads of light emerald color, native cut in the Indian manner and probably of considerable though indeterminate age.

MAMMALS

RICHARD ARCHBOLD, research associate in the department of mammals, American Museum, is spending the summer in Europe where he will visit leading museums to study mammal material from Madagascar and the Celebes. In Berlin he will work upon a collection of mammals from the Celebes in collaboration with Dr. Ernst Schwarz of the Berlin Museum.

HONORS

MIDDLEBURY COLLEGE, Middlebury, Vermont, conferred on June 13 last, the degree of Doctor of Science upon Curator Walter Granger, of the American Museum, in recognition of his valuable contributions in the field of paleontology to the knowledge and history of life upon the earth.

DISTINGUISHED VISITORS

DR. GUY E. PILGRIM, ex-officer in the Geological Survey of India, now retired, is spending two months at the American Museum studying

the bovid section of the Siwalik collection made by Barnum Brown in India.

THE LIBRARY

A RARE item among the recent accessions, in the American Museum Library is the *Centurie de Lépidoptères de l'île de Cuba*, Decade I-II, by Felipe Poey, 1732, long wanted and now a permanent accession, while three travel works by Linnæus have brought the Library nearer its goal of a complete collection of Linnæana.

New material is represented by the following:

Salamanders of Japan. By Katsuya Tago. 1931. A volume of inestimable value to the worker in that field but not widely known in America because it is in the Japanese language and not part of a scientific series.

Dictionary of Chinese Geographical Names. By Lin Chun-Jen.

A Comprehensive Chinese Gazetteer. By Tsang Li Huo and others. Two titles, issued in 1930 and 1931 respectively, which facilitate the locating of specimens from this vast but scientifically little-known country.

Wissenschaftliche Ergebnisse der Deutschen Atlantischen Expedition auf dem Forschungs- und Vermessungsschiff "Meteor". 1925-1927. Bd. X and XII. 1932.

Wissenschaftliche Ergebnisse der Dr. Trinkler'schen Zentral-asien Expedition. 2 volumes. 1932. These reports are important additions to the literature on scientific expeditions.

"Die Selk'nam." By Martin Gusinde. 1931. This forms Band I of *Die Feuerland Indianer*, a notable and comprehensive work on the inhabitants of the Tierra del Fuego.

LIBRARIES IN NATIONAL PARKS.—The American Library Association through its Committee on Libraries in National Parks is helping to build up the libraries in the various national parks of the country. Except in the case of four or five of the largest parks, most of these libraries are at present mere office collections, usually in the superintendent's or park naturalist's office. Not only are books about the national parks themselves needed, but all kinds of natural history books, both manuals and essays. There is not a single branch of natural history that is not of direct interest in some one of the national parks. Anyone interested in assisting this project is requested to write to the chairman of the committee, C. Edward Graves, Librarian, Humboldt State Teachers College, Arcata, California.

NEW PUBLICATIONS

Heredity and Variation: Continuity and Change in the Living World. By L. C. Dunn, D.Sc. University Society Incorporated. New York. 1932.

PROFESSOR DUNN'S book is a delightfully lucid and readable exposition of the problems studied, the methods employed, and the results so far attained in the science of genetics, with its scant, historical background and its present engrossing importance. By the use of descriptive charts and tables he shows typical inheritance of various characteristics, proceeding in regular ratio according to a seemingly fixed rule for all characters observed. As the same ratio is obtained

"wherever a cross involving two independent characters showing dominance is followed into the second generation, the conclusion is that the two pairs of genes involved are transmitted in inheritance in complete independence of each other." The author remarks: "The individual therefore seems to be a kind of mosaic, a temporary aggregation of units, assembled for his lifetime but shortly to be dissipated among his successors." He modifies this conclusion immediately because of the undeniable fact that, while all the various units of physical and mental traits seem to be independent units, inherited in chance combinations, yet they do produce a unity in the individual, acting together and moreover, acting only within the limits of the environment. In other words, what is really inherited is "the capacity to react in specific ways to specific environment."

In a chapter on the Mechanism of Heredity the author reviews the biological process taking place within the reproductive cell and the significance of the paired chromosomes. Knowledge of breeding processes and their results has been obtained chiefly from the study of the vinegar fly—*Drosophila melanogaster*—which because of its fertility, short breeding period (12-14 days) and the ease with which it may be kept in the laboratory, has been the form selected for most of the experiments. The results of these show that "all genes which determine the characters of the organism are located in the chromosomes; that each gene has a definite location in a specific chromosome and that the laws governing the distribution of the genes are actually the laws governing the distribution of the chromosomes and their parts to the germ cells." The establishment of the proof of this conception has been the work of Professor Morgan and his associates.

The discovery of the X, or sex, chromosome as an exception to the supposed rule of paired chromosomes, led to the discovery of other important exceptions. The "linkage" of certain genes in their original combinations when they pass to the offspring was first noted as an exception to Mendel's law of independent assortment and was followed by the discovery that such linked genes are carried in the same chromosome. Therefore Mendel's principle should apply only to genes from different chromosomes. Intensive study on this point resulted in identifying groups of linked genes with particular chromosomes, as well as the absence of certain groups of genes with the absence of certain chromosomes. Thus the actual factors of inheritance were found. The author quotes aptly a saying of William Bateson's: "Treasure your exceptions."

The value of this saying continued to be demonstrated, for in some cases the links between linked genes were broken and thus "cross-overs," their processes and results were made known and the further idea suggested that the frequency of these cross-overs, or breaks, depended upon how far apart the genes were. The mapped results of experimentation show the invisible, sub-microscopic genes in location, position, linkage, and character, so that the author is able to say for the genus *Drosophila* that "these animals may now be made up to order, somewhat as a prescription is filled." Similar maps are being made for other animals and for plants.

With regard to the origin of new hereditary characters, so long bound up with the influence of environment in the popular mind, it has been shown for all these variations that have been studied that the change is inside the organism, not outside. The gene itself seems to be the only agent for heredity. Many variations arising in the progeny are shown to be the result of new combinations of old genes, the appearance of old characters hitherto hidden but brought to light as "recessives" due to some new combination. "Mutations" or "sports," new hereditary characters which breed true from the start, seem to arise from such sudden and unexplained changes in the gene itself that De Vries believed them to be spontaneous, which, as Professor Dunn admits, is only to confess our ignorance of their cause. However, even this occult occurrence within an invisible part has been brought a little into the light and the appearance of a new gene is known to be heralded by a change of the chromosomes, most often a change in a single point on a chromosome.

Such studies of inheritance applied to man were initiated by Francis Galton as a science of eugenics, with the hope of making the same improvements in the human stock by eliminating the unfit, including the insane, criminal, and degenerate elements, and encouraging the production of healthy offspring,—surely a reasonable wish which, strangely, has aroused much opposition.

The author's statement with regard to heredity and environment is that these two influences can never be opposed but must continually coöperate throughout nature. Inheritance then consists in the following process: "*We receive from our parents two minute single cells containing an assortment of molecules of living substance—genes. Some of these specify the kinds of reaction which shall take place between our bodies and minds and our surroundings. The end result of our development depends on both factors.*"—W. K. G.

Les Oiseaux de l'Indochine Française. By J. Delacour and P. Jabouille. International Colonial Exposition, Paris, 1931. 4 Volumes, 4to, 1259 pages of text, 67 plates in color, 1 text-figure, 2 maps.

LONG neglected by ornithologists in the past, French Indo-China has been undergoing systematic exploration for birds since 1923 by Mr. Jean Delacour, ably seconded by Mr. P. Jabouille, recently governor of Annam. Their rich collections and many new discoveries have been the subjects of frequent communications in scientific periodicals, such as the *Ibis* and *l'Oiseau*, and of several special reports on Mr. Delacour's expeditions. In these undertakings he had the coöperation of the high officials of the French colony, many European residents, and the Kelley-Roosevelt Expedition of the Field Museum of Natural History.

These continued efforts were amply rewarded. The avifauna of Indo-China was found to be even richer than anticipated because of its diversified topography, with a long, broken chain of highlands extending down from the north and aiding the dispersal of groups of montane birds. The southeastern part of Asia is a section of the Oriental Region advantageously situated for its colonization by varied families and orders of birds, with climatic conditions most favorable.

The International Colonial Exposition of 1931 offered a fitting occasion to bring out this splendid report on the Birds of French Indo-China. Except for new forms still possibly to be discovered, a complete review of the avifauna is here presented. No less than 954 forms of birds, all occurring in the country, are described in the work, with notes on distribution and habits, and 118 distinct species, as well as a number of races, are beautifully illustrated in color.

One cannot escape the feeling that Indo-China possesses an unusually colorful bird fauna. This is especially true because of the many pheasants, fruit-pigeons, bee-eaters, pittas, sun-birds, and babblers, while even the woodpeckers, represented by many species, include a goodly number of bright hues.

In addition to coloration, the birds of Indo-China offer a "professional" attraction, in that so many are local forms found nowhere else. Such birds, thus far, are rarities to be seen in few museums, and Messrs. Delacour and Jabouille have done a noble service in figuring so many of them in full color.—J. P. C.

The Voyage of the Beagle. Adapted from the Narratives and Letters of Charles Darwin and Capt. Fitz-Roy by Amabel Williams-Ellis, Helped by Ann, Stephen, Susan, Charlotte, and Christopher Williams-Ellis. Illustrated by Kaj Klitgaard. J. B. Lippincott Company. 1931.

MRS. WILLIAMS-ELLIS' compilation is a singularly direct and forthright narrative

of the adventures of Charles Darwin and others on the "Beagle." One wonders whether the fact, announced on the title page, that the author was "helped by" her family, may be partly responsible for the clear simplicity of the story, for there is nothing that a child of almost any age could not understand and the episodes related are all such as might have been prompted by "Now put in this," and "Now tell about that." The stories selected of trees, insects, spiders, and animals might well be a child's first incentive to a friendly investigation of the world about him.

But the book is much more than a juvenile natural history. It takes on a few of the proportions and marks of the novel in its excellent characterizations and in the interplay of personalities. Darwin's own youthful individuality shines out in eagerness and modest self-appraisal. It is pleasant to read from the letters of the man who was to receive the highest awards from posterity these words: "I trust and believe that the time spent in this voyage will produce its full worth in Natural History; and it seems to me the doing what little we can to add to the general stock of knowledge is as good an object of life as most people have." His quick and eager enthusiasm was apparently equal at that time for all sides of natural history. He says of himself on one occasion that he "is red-hot with spiders," but his warmth is apparent to the reader in his descriptions of practically everything that he saw and

heard on his voyage and his trips overland. All these things may be found in much greater detail in the various sources from which the book has been compiled, but at the cost of much searching through the *Voyage*, the *Letters*, the *Autobiography* and the two-volume account of Captain Fitz-Roy. Mrs. Williams-Ellis has really made an abridged source-book for she has interpolated only the briefest notes in order to bring the parts of her narrative in sequence and has filled out the selected incidents from each of the sources mentioned. There is naturally nothing new in the subject-matter; but more than two thousand pages are here concentrated in 278 and the editor has lowered a barrier of several weighty volumes between the child and Darwin's stimulating companionship. The book will be enjoyed equally by adults who like to skim the cream from their intellectual nourishment.

It is a pity for young readers of the book that in some of the interpolated paragraphs (marked W-E) the English is not as accurate as the subject-matter; "different to" is going to be a handicap to the child that trusts the printed word. Unfortunately also the proof-reading has been so careless that in parts one is tempted to believe that the misspelling was planned in order to emphasize the juvenile style, especially as the errors occur most often in the "W-E" parts. But this theory lacks point and is inconsistent with the mature and illuminating comments of the author of these sections.—W. K. GREGORY.

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total membership, 11,532.

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THE AMERICAN MUSEUM OF NATURAL HISTORY

FOUNDED IN 1869

SIXTY-ONE 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 NEARLY 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. Nearly 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	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 of the class of \$10 annually or higher 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 have been constantly in the field for years, gathering information in many odd corners of the world. During 1931 twenty-three expeditions visited many distant portions of the globe. In 1932, however, owing to the limitations of funds, expeditions will necessarily have to be eliminated except as they are financed by gifts. In this work of exploration, consequently, the American Museum especially needs the generous help of its many friends in order to further the scientific work of the institution. Contributions to this phase of the work of the Museum are of more than usual value, and the Museum will be glad to discuss any angle of its delayed program of exploration with anyone interested in aiding this work financially.

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 108,000 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 coöperating 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 augment greatly the Museum's work, not only in New York City public schools, but also throughout the United States. More than 27,945,076 contacts were made with boys and girls in the schools of Greater New York alone, and educational institutions in more than thirty-three states took advantage of the Museum's free film service during 1931. 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

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A PAIR OF CANVASBACK DUCKS

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Associate Editor

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Wide World Photograph

A GENERAL VIEW OF MONTE ALBAN

The scene of the rich archaeological exploration in the winter of 1931-32 when Prof. Alfonso Caso discovered a royal tomb with all its treasures intact

(See "*Reading the Riddle of Ancient Jewels*," Page 464).

VOLUME
XXXII

NATURAL HISTORY

NUMBER
SIX

SEPTEMBER-OCTOBER



CANVASBACK DUCKS IN NORTHUMBERLAND

Observations on the Breeding and Behavior of an American Species of Wild
Fowl in Northern England

By VISCOUNT GREY OF FALLODON

WITH AN INTRODUCTORY NOTE AND PHOTOGRAPHS
By FRANK M. CHAPMAN CURATOR OF BIRDS, AMERICAN MUSEUM

I KNOW of no place where closer relations have been established between birds and man than at Fallodon. To observe how life there is enriched by this association is to see realized the potential value of birds to mankind. The luxuriance of the woods, the smooth greenness of the daisy-sprinkled lawns, the beauty of the gardens, the charm of the ponds, the appeal of walks through dense shrubbery are all enhanced by the birds that inhabit them. The air itself is musical with the songs of birds and animated by their passing forms.

The doorways at Fallodon afford close contact with their surroundings. They might in truth be called "out-of-doors" for one steps through them direct on to path or turf to find perhaps a moor hen (close ally of our Florida gallinule) at his feet, with a blackbird near by, while at a feeding-stand within arm's length titmice of several species, chaffinches, robins, and green finches rapidly succeed each other.

Before one has time for a second step a gaily attired mandarin drake asks for food in a manner that will not be denied. If his wants are not promptly supplied he may enter the open door behind you to forage for himself. Thus at once is demonstrated the confidence that prevails between birds and man at Fallodon. I think that St. Francis would have felt at home there.

It is the ducks that chiefly distinguish the bird-life of Fallodon. Ornithologically they are "wild ducks," but the term "wild" here acquires a new meaning for in truth the ducks of Fallodon are the tamest of birds. But they are "wild" in the sense that they are not of domesticated varieties and that (with few exceptions) they are in full possession of their powers of flight and free to come and go as they please. The population, therefore, varies with the season and, indeed, from day to day, but at times it may reach two hundred birds. In May last I counted twenty different species; two

years before, twenty-three. The birds live in and about two small, intimate ponds, which are more or less surrounded by dense undergrowth affording favorable nesting sites. Both are enclosed by a fox-proof fence which includes also the lawns and gardens. Duck enemies within this area, whether furred or feathered, are killed. This is primarily a sanctuary for ducks and if, as happened last spring, a jay destroys ducks' eggs, it receives the same treatment as its fellow criminals, rats and weasels.

The larger of the two ponds has an area of somewhat less than an acre. Here the ducks congregate during the day. A little bridge at one end, near the feeding-pens for young ducks, and a seat at one side are the morning feeding places, but at any spot along the shore one may be greeted by interested groups of birds that have learned that their appeal for food will always be honored.

The smaller pond is the scene of the "evening feed" and this is the climax of a Fallodon day. It occurs after dinner, at approximately half past nine by summer time. The birds have then assembled on the lawn beneath and near a giant larch bearing a seat from which they are fed. At our approach the ducks all start expectantly toward us; the lawn itself seems in motion. As we seat ourselves beneath the larch we are literally surrounded by ducks. They are at our feet, on the bench beside us, and even on our heads.

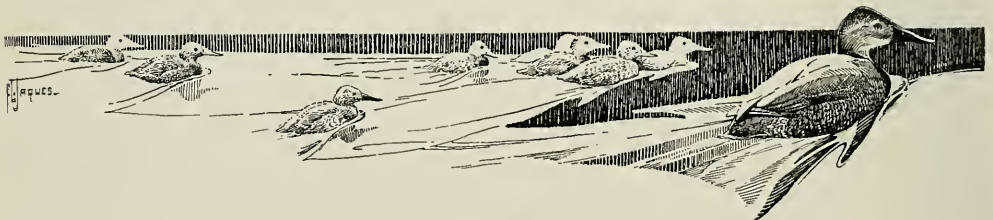
You fortunate ones who have had a chickadee alight on your hand, consider

the emotions aroused by a mandarin drake alighting on your cap!

An eider drake, twenty-one years old that has been at Fallodon for thirteen years, is served with a special fare; the others receive wheat, scattered on the ground, and bread which they take from the hand. Practically every bird in the kaleidoscopic throng is recognized. They are not merely pintails, or pochards, or teal, they are individuals, personalities, whose history and characteristics are minutely known. This is clearly shown in the account of the canvasbacks which, by request, Lord Grey has written for NATURAL HISTORY.

There is nothing in my more than half a century of bird study to compare with this experience—in its significance, as it illustrates adaptability; in its excitement, as the birds fearlessly cluster about and on us, rush through the near-by water, or come and go through the air overhead.

As I now recall this gathering of birds all eager to reach the hand that has won their trust, and hear again the high-pitched, ringing whistle of the wigeon in the dusk, I read in the daily press of a gathering of men in Washington all urging the Federal Government to double, and more, the period during which they may legally kill wild ducks. To these men it is the normal fate of a canvasback to be shot, but I'll wager that not one of them ever got the thrill from a "double" or a score of "doubles," that was Lord Grey's when after an absence of seventeen months one of his canvasbacks returned to Fallodon and the same day fed from his hand.—F. M. C.



CANVASBACKS OF NORTHUMBERLAND



FEEDING A CANVASBACK

A male canvasback has left the water to take bread from the author's hand

SOME years ago two very enterprising and successful breeders of water-fowl, Messrs. Maclean & Wormald, procured some eggs of canvasback ducks (*Nyroca valisineria*) from North America and eventually succeeded in establishing a stock. From this stock I obtained a pair of birds in the autumn of 1929. The duck was a bird of 1928 and the drake a young bird of 1929. They were pinioned birds and tame, so that they joined the other water-fowl at once in coming to the morning and evening feeds. The drake was the more enterprising and clever bird of the two. He discovered the way to the farther pond many days before the duck; he was also the first of the two that had the courage to take bread from a human hand.

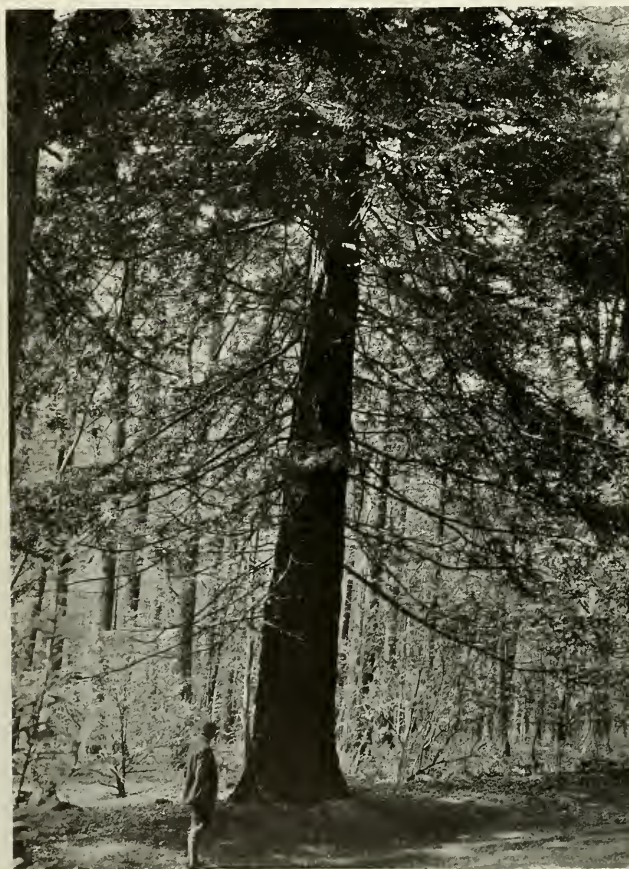
The birds showed no attachment to each other or inclination to keep together until the spring of 1930. On May 17, the duck had laid two eggs and appeared to be beginning to sit. On May 21 she was sitting steadily on five eggs. The nest was among rough herbage about two

feet from the edge of the bank, which was at that place about two feet above the level of the water. The nest was by the farther pond about 300 yards from the feeding place, which is at the nearer end of the nearer pond. Either because the duck was reluctant to make the journey to the feeding place or because she did not go there when the feeding was in progress, she developed a liking for bread. Whenever I took a seat on the side of the pond opposite to her nest, she would leave the nest, swim across the pond (some 30 yards), come out to me from the bank and feed readily from my hand. But she sat well, and on June 18 she brought five young birds on to the water. She soon lost one of these, but she was a good mother and reared the other four. The young birds were very shy. They discovered the soft food that is placed in specially adapted wire netting cages on the ponds for young ducks in the breeding season, but they would not enter and feed while any human being was near. It is a habit of the gardener



THE LARGER POND

The picture was made from the seat at which the author is feeding a male canvasback



A CALIFORNIA REDWOOD (*Sequoia sempervirens*)

AT FALLODON

The woods at Falloodon have been largely planted. For this reason there is a more intimate relation between tree and man than where the history of the trees is unknown. This redwood was planted about 1845

— SIERRA BIG TREE

(*Sequoia gigantea*)

Both of the California Sequoias thrive in England. This tree was planted about 1862



A FEMALE CANVASBACK FEEDS
FROM THE AUTHOR'S HAND

This is probably the bird that left
Fallodon in December, 1930, and
was absent until May, 1932



to put a supply of food in the cages four times a day. He often spends a quarter of an hour or more in giving the food, and in this way a large proportion of the young ducks are tamed and many will feed from the hand. But the young canvasbacks would not come to feed till the gardener went away. A friend who lives near also takes part in taming the young birds, and when I am at home I spend much time in the same way.

For five weeks the young canvasbacks were obstinate and impervious to all coaxing and no impression was made on them. The mother duck also ceased to feed from the hand, but she would come with her brood near enough to pick up food thrown to them on the water. They became very fond of bread and late on summer evenings when most of the ducks were at the regular feeding-place and I could get the canvasbacks by themselves,

I knelt, leaning over the edge of the bank, throwing small pieces of bread to the canvasbacks. In this way evening by evening I drew them nearer till at length in the dusk one evening a young canvasback snatched a piece of bread from my fingers. Then the frost of suspicion and fear began to thaw. I continued my coaxing and in a few days three of the four young canvasbacks would come to me for food and take it from the hand with confidence. The fourth young bird, though coming close with the others, could never be induced to feed from the hand.

They were seen to be on the wing on September 11, and the gardener, who saw one or other of them take a long flight round in the autumn, was astonished at the speed of their flight.

My fear was that they would leave me in October, but I preferred to run this



THE AUTHOR WITH TWO AMERICAN GUESTS

At any spot along the shore one may meet groups of interesting birds. Here are a male canvasback and a male American wood duck



SCENE OF THE EVENING FEED

Beneath this great larch, on the border of the smaller pond, the ducks gather to be fed in the evening

risk rather than to maim the birds by pinioning them or to frighten them by catching them and thus undo the tameness and destroy the confidence that it had needed so much time and trouble to inspire. However, October, when the pull of southern migration is so strong, passed safely, so too did November. In due course the birds achieved adult plumage; two were drakes and two were ducks. The three hand-tamed birds were a daily delight; they would come out anywhere on the bank to be fed and at the regular evening feed, though they ate wheat like the other water-fowl, they would stand close to me looking up to be fed by hand with bread. One of the drakes was particularly attractive. If I were kneeling or sitting on the ground he would pluck my sleeve or knickerbockers to call attention to his wish to be fed.

On December 8 there was enough frost

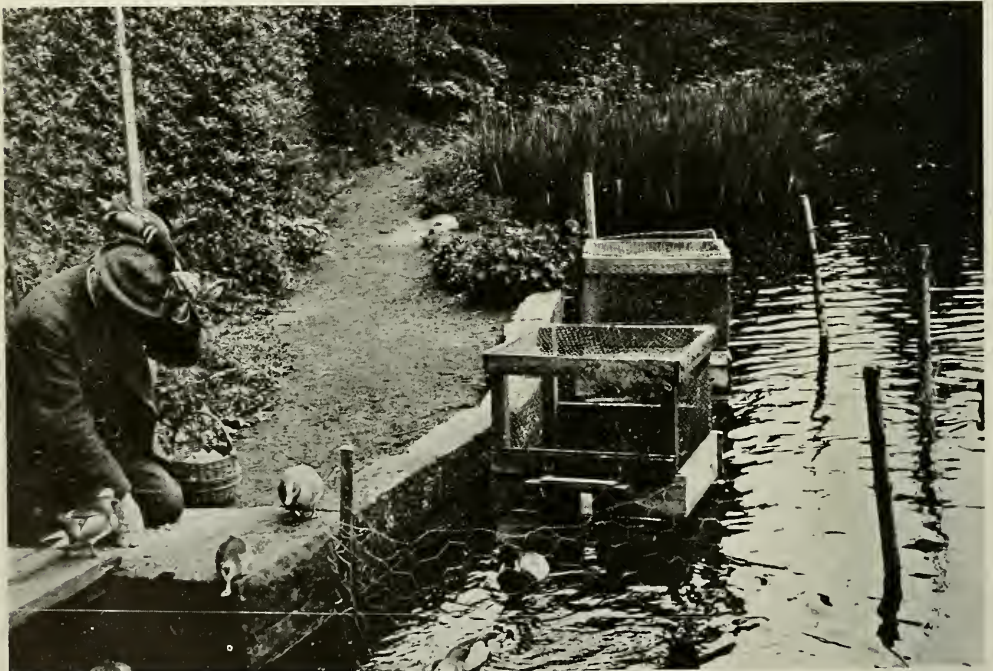
to make ice on the farther pond and the surface had all frozen except a small piece of water at the upper end. The nearer pond is very sheltered by trees and the water near the regular feeding place remained open. In this the water-fowl assembled, but the parent canvasbacks and the four young ones and three red-crested pochards (*Netta rufina*) allowed themselves to be marooned in the small piece of open water on the farther pond. They never came to the regular feed. I threw bread and corn on to the ice but the birds did not seem to understand the ice and would not come out on to it and I could not go to them because the ice would not bear me. On the morning of December 10 all the young canvasbacks were gone. Six days afterward one came back. It was the duck and the only one of the four that would not feed from the hand. It remained feeding regularly with

the other ducks till early in June, 1931, when it disappeared, having no doubt been prompted by a desire for change of place and perhaps of food. Had she wanted a mate she would presumably have left in search of one before June. But I should doubt if female canvasbacks breed before they are two years old.

In 1931 the pinioned canvasback duck nested again very near to the nesting place of 1930. She laid six eggs, began to sit on May 14, and hatched the eggs on June 12. But she mismanaged her affairs sadly. Three of the young birds that were the first to hatch left the nest. The duck did not go with them; they took to the water alone and perished. Eventually the duck came on to the water with one young bird. This she reared and at the date of writing (October 30, 1931) it is still on the pond. It was first seen to fly on August 22. It is a fine bird showing male plumage and comes

regularly to the sunset feed of wheat. It will also come on land for bread but has only just begun to take food from the hand, and this with great diffidence.

It is not right to found a general conclusion on the behavior of one pair of birds, but the slight experience that I have had suggests certain characteristics that may perhaps be confirmed by observations on a larger scale. My observation so far leads me to suppose that there is little attachment between the male and the female canvasback. They do not go in a pair or take notice of each other except in the breeding season. In this they resemble our common pochard (*Nyroca ferina*). The duck is a good mother showing sense and care when the young are hatched. The drake, as in the case of *Nyroca ferina*, takes no notice of the young. The young birds are by nature very shy but with care and patience they can be made very tame; the drakes be-



A MANDARIN DRAKE ON THE AUTHOR'S HEAD

The Chinese mandarin duck thrives at Fallodon. Possibly because it is a tree-nesting duck it commonly alights on one's head or shoulder when in search of food



A BUSY CORNER

During the day there are always numbers of ducks on the larger pond near the food-pens for ducklings. In addition to the Brazilian teal that the author is feeding there are seven species of ducks in this picture

come more tame than the ducks. Whether the young birds would stay or could be relied upon to return sufficiently to maintain the species full winged and yet tame, I cannot say from my own experience. The young birds are not in so great a hurry to go away as young *Nyroca ferina* are, but some individuals of the latter species always return and the species has been well maintained on my ponds for some years entirely by full winged free birds. My old duck canvasback often utters a small sound that makes her presence known, but the drake is silent except in the breeding season, and even then he is not noisy. Early in December, 1930, just before my young drakes went away, I heard them and their father uttering sounds that suggested rivalry; and it may be that if my adult drake had the company of others of his own sex he would be less silent. Neither

he nor the young drake of this year have been heard to utter a sound yet this autumn.

In the plumage of both sexes of the canvasback there is resemblance to our pochard (*Nyroca ferina*), but the male canvasback is the brighter bird. The canvasbacks are the larger and finer of the two species, more elongated in shape. On the other hand, the young canvasbacks, when first hatched, are more like the young redheads (*Nyroca americana*); but the latter are still more beautiful. Indeed very young redheads, when first hatched, are of a golden color and among the most beautiful of all ducklings known to me.

I fear that this fragmentary experience may have little that is new for American readers to whom canvasbacks are much better known than they are in England, but the recent introduction of this famous



A SITTING CANVASBACK

It was not desirable to remove the vegetation partly concealing the bird and she may, therefore, be seen only dimly in the foreground. For three successive years she has nested in this thicket

American species here may give some interest to an account of the ready breeding of a pair of pinioned birds left to hatch their own eggs and rear their own young, and to the behavior of the young birds when allowed to grow up unpinioned and free.

POSTSCRIPTS

MAY 25, 1932.—What preceded was written in October, 1931. Since then there have been further interesting experiences. The original pinioned canvasback has nested again in the same site as last year and is now nearly due to hatch. This confirms the impression that canvasbacks reared in captivity are very ready to nest.

The young drake reared in 1931 has never gone away though full-winged and free. On March 27, 1932, I was astonished, when sitting on the seat at the farther pond, to find myself in the presence of two female canvasbacks expecting bread. One of these, of course, was the old pinioned duck, the other was a bird that had been away and returned. She would not take bread from the hand but picked it up when thrown to her. At the evening feed she presented herself with the others and when my friend went to put soft food as usual in a trough level with the water, especially placed there for an eider drake, she followed him and went into the water to get some of the food. She then flew on to the bank and had a long feed of wheat close to my feet. Her actions proved beyond doubt that she was the bird of 1930 and had left me in June, 1931, and thus had been away for fully nine months. This bird is still here.

But a still more remarkable thing has happened. On May 17, 1932, the gardener, who takes great interest in the birds, said to me: "There is a mystery among the ducks; there is a third female canvasback."

This bird was not only tame but would take bread readily from the hand, and was evidently the female that had left me in December, 1930, and had not since been seen at Fallodon. It had therefore been absent for seventeen months. I have no means of knowing where these two returned birds had passed their months of absence, but they had somehow escaped the perils of life in a wild state and had thriven. Presumably, therefore, they have led the life of wild birds, but immediately on returning to

the home of their birth they behaved as if they had never been absent.

In March, when the first canvasback returned, I felt sure that the unmated drake of 1931, who was still with me, would mate with her, but he has shown no disposition to do so with either of the returned birds, and he and they remain unmated. On the other hand, a male pochard, who has also been away for several months and has recently returned, is paying assiduous court to one of the returned canvasbacks.

JUNE 16, 1932.—On May 28 the old canvasback brought a fine brood of eight young ones on to the water. The next day was cold, with so much rain that a heavy flood was caused. It was assumed that the newly hatched brood would not survive, but only one of them perished. The other seven have grown well, and are now thriving. They are,

as my previous young canvasbacks have been, independent and shy. If they happen to come within reach, they will take soft bread and dry meal thrown to them on the water, but they will not yet come near the hand, and do not connect the human presence with food, though the mother takes food readily from the hand on the water or on land.

The two canvasbacks that returned have again gone away, and also the young drake of 1931.

In so far as any general conclusion can be drawn from these experiences, it is that young canvasbacks, left free, will, unless unsettled by ice, remain where they have been reared till late in the following spring, but will then leave; that a canvasback is a very good mother; and that the young are very strong and healthy birds from the moment of hatching.



DOORSTEP MANDARINS

The male is feeding from the author's hand. The female is at the right. At times they enter the door opening into the library to forage for themselves



LITTLE MASK
OF THE GOD
XIPE-TOTEC

READING THE RIDDLE OF ANCIENT JEWELS

An Analysis of the Historical Significance of the Monte Alban Treasure—the
Ritualistic Meaning of the Ancient Mixtec Inscriptions

By ALFONSO CASO

Chief, Department of Archaeology, National Museum of Mexico

Translated from the Spanish by S. B. and G. C. Vaillant

WITH A FOREWORD BY G. C. VAILLANT, ASSOCIATE CURATOR
OF MEXICAN ARCHÆOLOGY, AMERICAN MUSEUM

PHOTOGRAPHS BY THE AUTHOR

FOREWORD

THERE arose great interest last winter when Professor Caso, excavating the ruins of Monte Alban, Oaxaca, Mexico, found a royal tomb with all its treasures intact. Since Professor Caso is the authority in the field of Oaxacan archæology, the historical and scientific data pertaining to the tomb were completely recovered. The rings and necklaces of gold, the cups of crystal, and the other jewels comprising this treasure have been made known through popular articles in the press and current periodicals, but little has appeared as yet to tell us who the makers of the treasure were and when they lived.

It is especially fortunate for the readers of NATURAL HISTORY that Professor Caso, the discoverer of the tomb and one of the

foremost authorities on Mexican pre-history, consented to give in these pages his first analysis of the significance of his finds. One of the greatest of Egyptologists said that "Museum collections are but a by-product of history," and in the following article the reader will see that archæology is not merely grubbing in the ground for curiosities, but is instead a method of historical research. Professor Caso uses his magnificent material to tell the story of these forgotten civilizations, not as collateral for personal aggrandizement or romantic interest.

Previous to Professor Caso's work at Monte Alban much digging but little historical research had been done in the State of Oaxaca. As a result considerable collections were amassed but very

little was known of them. The work of Professor Saville for the American Museum stood out from this welter of pot-hunting, and his Oaxacan collections now in this Museum are among the best documented in the world. Professor Caso, however, has succeeded in distinguishing the culture of the indigenous Zapoteco of the State of Oaxaca from the intrusive Mixtec civilization that was closely affiliated to the Aztec or "Mexican" civilization to the north. It is quite conceivable that in future research he may find even earlier civilizations than the Zapoteco and may possibly connect them with the Mayas to the south.

In this article he places great reliance on the native inscriptions inscribed on stone and written on leather or paper. Such writing has as yet been found only

among the Maya of Guatemala and Yucatan, among the Zapotecs of the Oaxaca region, and in the region occupied by the Mixtecs, the Aztecs, and other culturally affiliated Nahua tribes. Thus the connections and differences between these three styles of writing are of the same significance to a Mexicanist as the Egyptian, Greek, and Roman inscriptions are to a European scholar.

Not only is it a great privilege to welcome to these pages so distinguished a scholar as Professor Caso, but also it is peculiarly fitting to have an article which bears so pertinently upon one of the most important of the Mexican collections in the American Museum, and which gives so clear a picture of American intellectual attainment before Columbus.

—G. C. V.



IN a recent magazine article I gave a short preliminary explanation of the discoveries made at Monte Alban during the season of 1931-1932, under the patronage of the Ministry of Public

Education, the government of the State of Oaxaca, the Panamerican Institute of Geography and History, the National University, and the Messrs. Morrow, Del Valle, Melgar, and Velazquez Uriarte.



Wide World Photograph

THE ANCIENT RUINS OF MONTE ALBAN

Outside the City of Oaxaca, Mexico. The tombs uncovered here contained jewels and other relics of a civilization which flourished before the Spaniards came to America



Wide World Photograph

IN ONE OF THE NEWLY DISCOVERED TOMBS

Professor Caso (left) and Martin Bazan, his assistant, are taking the measure of a copper pot near Professor Caso's right hand. In the foreground at the left are the bones of Mixtec chieftains with pearls resting beside them

I wish, however, in this present article to discuss a specific point, but one very important to the find: To what indigenous civilization do the objects belong?

But before entering into this discussion, let me briefly relate how we found the tomb and made the excavation.

The mound of Tomb 7 at Monte Alban lies immediately next to the western edge of the road which goes from Oaxaca to the place where the ruins are situated. This mound is very little elevated in relation to the general level of the soil, but it is located at the foot of a small hillock which is some four meters high and represents undoubtedly the substructure of a temple. On the other side of the road and in front of the tomb and the temple are the tombs numbered 3, 8, and 9. Next to Tomb 7 is another little mound which shows a depression and doubtless contains another tomb which I could not explore in this season's work, but which I intend to uncover in the next.

We began the exploration of the mound over Tomb 7 by cleaning off the upper part, encountering what seemed to be the remains of the walls of some small

rooms located on top of the mound, the floors of which were covered by a thick coating of the stucco used in Monte Alban to surface walls, their sloping bases, stairways, and pavements.

One of the most important characteristics of Tomb 7 was a little ditch approximately 20 cm. wide by 6.85 meters long, situated exactly in the back part of the tomb, parallel to its transverse axis. (See plan on p. 468).

In opening up a vertical pit to find the tomb, we had to break through a second stucco floor, before we encountered the stones forming the vault. We removed two of these vault stones and were then able to descend into the tomb and to measure its interior length, with a view to finding the door. To do this, however, it was necessary to open another vertical pit before we reached a little antechamber, roofless and full of dirt, in which appeared, intentionally broken, three great Zapotec urns with their pedestals, shown restored in the figure on page 467. The central one of these very common urns represents an old god, probably the god of fire, whom the Mexicans call Huehueteotl, and who in their mythology was the lord of the central region of the universe. The urns at either side are representations of the Zapotec god called Cocijo, who, as I have demonstrated elsewhere, is equivalent to the rain god, called Tlaloc by the Mexicans. (*El Vaso de Jade de la Coleccion Plancarte*. *Revista Mexicana de Estudios Historicos*. Vol. I, p. 7).

After carefully removing the urns and

fragments, we were able to find the entrance to the tomb. It was closed by means of large stone slabs, and when we removed these we discovered that the door was almost completely blocked by a great heap of earth. Between the top of this earth and the lintel of the door there remained only a small opening, which we had to enlarge in order to penetrate to the interior.

None of the stones which sealed the entrance had inscriptions, but on the other hand, forming part of the vault of the antechamber and resting directly on the lintel, we found a stone with the inscription which appears on page 470, and which has about the same dimensions as the doorway, so that it is extremely probable that at first it occupied this position.

The inscription on this stone is indubitably Zapotec and I was able to read on it the year "serpent" and the day "flower," as well as the number 8, formed by a bar and three dots; but I could not say whether the sign ought to be attributed to the glyph "serpent" or to the glyph "flower," although the first seems to me more probable. Beneath the second of these signs there is a glyph which I do not know how to interpret, but it could be the number 4, united to the day sign.

As can be seen on the plan of the tomb, in the longitudinal cross section shown on page 469, there was a layer of earth inside which varied greatly in thickness. In the second room, next to the end of the tomb, it had a depth of merely 30 cm., while at the entrance it almost

hid the door, and we found in the projecting portions of the walls and the lintels, small heaps of dirt which indicated that the layer of earth originally reached that height and later owing to settling, subsided a little until it left, as I have said, a small opening between its upper level and the lintel of the tomb.

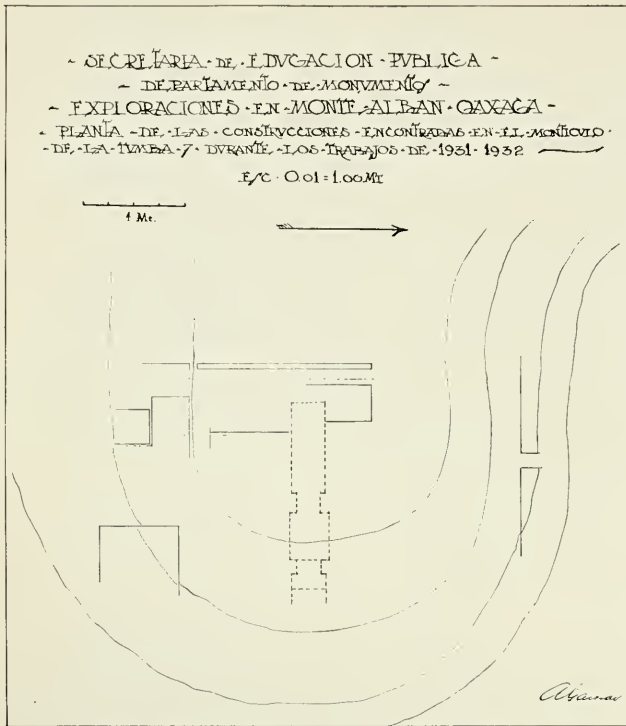
Furthermore, after cleaning away the earth which covered the tomb and taking out the objects from the principal burial, there appeared underneath, small clay vessels, a fragment of a Zapotec urn like those found in the antechamber, and a piece of a metate. The little pots are just like those which I found in Mound B during the excavations there, and are of the type which has always been considered Zapotec.

Therefore it seems to me unquestionable that Tomb 7 in Monte Alban was used twice. The first burial was made directly on the floor of the tomb and was accompanied by the vases, metates, etc. which I have just described, and by the Zapotec urns. The door was sealed, probably with the stone which is now in the vault of the first room and which



ZAPOTEC URNS FOUND IN THE ENTRANCE TO TOMB 7

These mortuary vessels represent Zapotec gods. The center one is the Old God while at either side are effigies of the Rain God Cocijo (See page 466)



PLAN OF THE MOUND COVERING TOMB 7

The dotted lines represent the plan of the tomb, while the solid straight lines show traces of walls. The irregular lines give the contours of the mound. (See page 466)

has the inscription of the year 8 "serpent" and the day 4 (?) "flower." Thus both the urns and the inscription show the first burial to have been Zapotec.

Furthermore, the very architecture of the tomb is Zapotec, like others which we found in Monte Alban and which Saville discovered in Xoxo and Cuilapan. (M. H. Saville, *Exploration of Zapotecan Tombs in Southern Mexico*. American Anthropologist, n.s., vol. 1, pp. 350-362). The chambers of the tomb are roofed by the two methods which the Zapotecs used and which we might call plane vaulting and angular vaulting. The first consists of great smooth stones placed horizontally and resting either on the walls of the tomb, or, as in the case of Tomb 7, on stones like brackets which are used to sustain the roof stones. The first chamber

was so roofed, as can be seen in the transverse and longitudinal cross sections on page 469.

The second chamber has an angular roof, formed by two inclined stones, as can be seen in cross section AB, on the diagram page 469. We find plane vaulting chiefly in cruciform tombs like those of Mitla and Tomb 3 of Monte Alban. Angular vaulting, on the other hand, is more characteristic of the tombs with niches, like all the others we discovered in Monte Alban in this first season of work.

It seems to me very probable that between the cruciform tomb and the tomb with niches there is a sequential relation. As a matter of fact the niches in the tombs are always three, and are placed one at the end of the chamber and two in the walls. It might follow that these niches

are survivals of the arms of the cross, or, if the tomb with niches is earlier, then they have become gradually more important, until they stand converted into the little rooms which form the head and the arms of the cruciform tombs. At the present stage of our knowledge, it is impossible to say if the first method of constructing the tombs was the cruciform type or that with niches, but the two methods of construction seem to me to have a definite relation.

Before entering into the discussion of the objects of the later burial, I wish to define what I mean *archæologically* by the term *Zapotec*. As I showed in my book *Las Estelas Zapotecas* (Zapotec Stelae), there is a great resemblance between the urns thus classified and the stones with inscriptions which have been

found at Monte Alban and other places,—
Etla, Zaachila, etc.

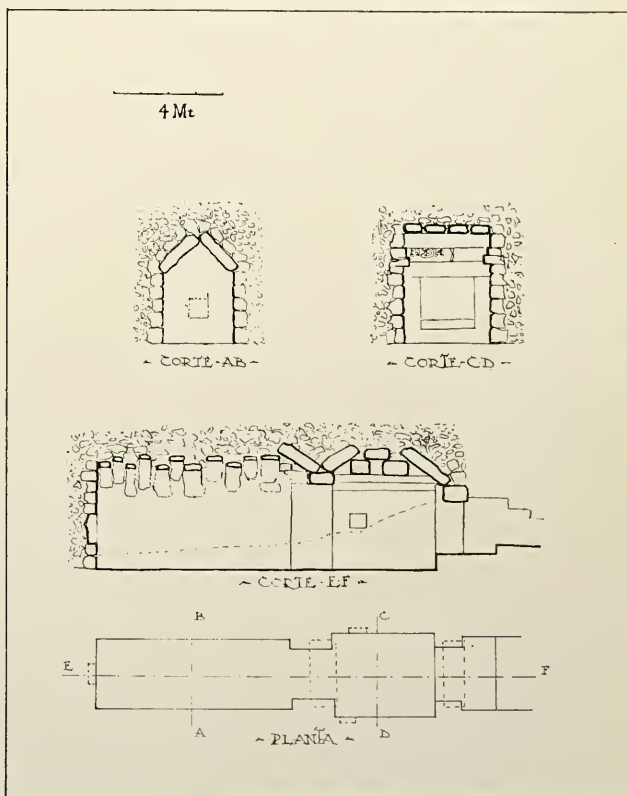
The urns which have in front a figure usually adorned with great panaches of plumes, have always been considered Zapotec, since they are found only within the territory which this nation used to inhabit. The stones or stelæ with inscriptions have a great resemblance to the urns, since, as I have shown, on both are represented the same gods and symbols. The hieroglyphs which are found on the urns and the stelæ are consequently Zapotec, and belong to a system of writing unquestionably related, in a general way, to that of the Mexicans and the Mayas, but in reality very distinct. For example, the signs of the days are very different in Zapotec writing, from the Mexican and Mixtec. Even though I cannot yet give the order of the Zapotec hieroglyphs, the day signs appear on page 470. On the other hand, if Mexican glyphs are compared with Mixtec, it will be seen that they are the same, if one excepts the stylistic variations which characterize glyphs as Mixtec without altering their essential form. (Page 470).

The year sign is different in all three: Mexican, Mixtec, and Zapotec writing, and probably also in Maya, but in this last case no year sign has yet been defined.

The Zapotec year sign is the face of the god Cocijo or Tlaloc, who has before his mouth a mask with serpentine attributes, in which the fundamental characteristic seems to be an ornament over the nose made by a disc and a trapezoid, which in the Mexican codices is the representa-

tion of the turquoise nose-plug. This adornment acquires greater importance as the glyph is simplified, so that I believe it must be the fundamental part of the sign. (Page 471).

In the Mixtec and Cuicatec codices and inscriptions, the sign of the year is a kind of interlaced A.O., although a trapezoid sometimes appears united to them (bottom, page 471). The A represents the solar ray such as we find in innumerable Mexican monuments, like the so-called Aztec calendar stone for example. The O, and the trapezoid which sometimes appears, represent the same symbol as is found in Zapotec writing, the turquoise in the nose of the god Cocijo. In some representations of this sign one or



PLAN AND CROSS SECTIONS OF TOMB 7

The dotted line EF marks the height of the earth in the tomb. On top of the earth were found the skeletons and jewels comprising the second (Mixtec) burial, and below, inside the earth, the objects of pottery and stone comprising the first (Zapotec) burial

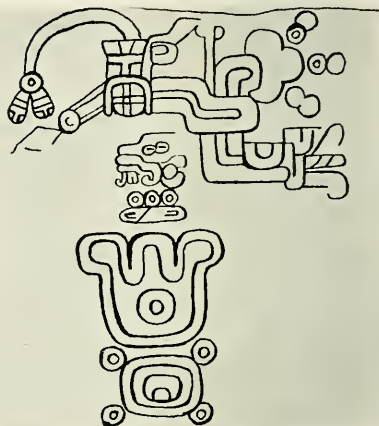


FIGURES ON THIS PAGE

Above. MIXTEC AND MEXICAN DAY SIGNS (CF., PP. 469 AND 474).

Right. INSCRIPTION ON THE STONE NOW IN THE ROOF OF Tomb 7, BUT WHICH ORIGINALLY MUST HAVE COVERED THE ENTRANCE (CF., PP. 467-468).

Bottom. ZAPOTEC DAY SIGNS (CF. P. 469).



FIGURES ON OPPOSITE PAGE

Uppermost Plate. MEXICAN YEAR SIGNS: (CF., P. 472). 1. TEOCALLI OF THE HOLY WAR. 2. BOURBON CODEX. 3. CLAVIERO. 4. AUBIN CODEX. 5. CODEX MATRITENSE DEL REAL PALACIO. 6. CODEX VATICANUS A. 7. MENDOZA CODEX.

Middle Left. NUMERALS, TOP ROW: MAYA NUMERALS (CF., P. 472). MIDDLE ROW: ZAPOTEC NUMERALS. BOTTOM ROW: GLYPHS ON A SHELL FROM TEOTIHUACAN.

Middle Right. ZAPOTEC YEAR SIGNS (CF. P. 469).

Lowermost Plate. MIXTEC YEAR SIGNS (CF., PP. 469-472) 1 AND 2. COLOMBINO CODEX. 3. NUTTALL CODEX. 4. BORGIA CODEX. 5. SELDEN CODEX. 6. BODLEY CODEX. 7. BODLEY CODEX. 8. VIENNA CODEX.



A



B



C



D



E



F



G



H



I



J



K



L



M



N



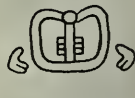
O



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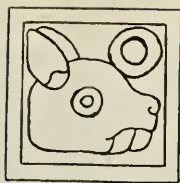
X



Y



Z



1



2



3



4



5



6



7



1



6



12



1



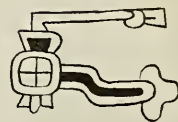
6



12



12



1



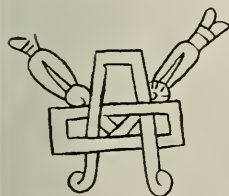
2



3



4



5



6



7



8



BONE, SHOWING YEAR SIGNS

Reading from right to left, the years 2 Flint, 3 House, 4 Rabbit, 5 Reed in rotation up to 13 (destroyed) Reed. Note the use of the dot system of enumeration and the day sign applied to that of the year (cf., p. 473)

both of the god's eyes are still retained.

Among the Mexicans the year sign is different, since they usually indicated it by the glyph of the first day in the year, enclosed in a square, or by the turquoise. The Mexicans designated with one term, *Xihuill*, both the year and the turquoise (top, page 471). The representation of numerals is also different, although we cannot here make as neat a distinction as in the preceding cases.

The Mayas, the Zapotecs, and the Teotihuacanos used dots to express numbers up to 5, and a bar or bars to

represent 5 or multiples of 5, combining bars and dots for other quantities. (Page 471). In no Aztec monument or codex do we find bars indicating 5, since they used dots to represent numbers as high as 13. On the other hand, in codices and monuments attributed to the Mixtecs we find both systems used; dots and bars combined in some, and in others only dots. Examples of the first are: the Laud, Cospi, and Fejervary-Mayer codices, and the stone of Cuilapan. As examples of the second we shall mention the Vindobonensis, the Nuttall, the Colombino, the Dehesa, etc., and several of the Borgia group as well. It should be noted that in the three codices where the dots and bars are combined,—Laud, Fejervary, and Cospi—the *system of enumeration by simple dots also occurs*. The last is used for the coefficients of the days in the ritual calendar, and, in general, for any calculation of days. With the system of combined dots and bars, other calculations are made which cannot yet be deciphered. The Laud and the Fejervary codices do not seem like the Cospi to have been altered subsequent to the original writing, a fact which demonstrates that both systems could be used at the same time and by men of the same culture, in spite of the proven fact that the Aztecs never used the combination of dots and bars. To summarize: The Zapotecs used the system of dots and bars, the Aztecs that of dots only, and the Mixtecs both.

We can say, therefore, that in hieroglyphic writing and in artistic style there exists a great difference between the



PECTORAL REPRESENTING A TIGER KNIGHT
Showing the years 10 Wind and 11 House and
the day 2 Flint. (cf., pp. 473-474)

HEADS OF QUETZALCOATL

The two heads on either side represent Quetzalcoatl. The one in the middle is Tonatiuh, god of the sun. His head protrudes from the open beak of an eagle which in turn projects from a solar disc. Another eagle hangs from the labret of the god. The head on the right dangles a butterfly in its mouth; that on the left a jade, from which hangs an eagle



material which has hitherto been called Zapotec and that designated as Mixtec. On the other hand this latter material is only distinguished from the Mexican or Aztec by the use of the year sign A.O., by the occasional utilization of the numerical system of dots and bars, and by less important stylistic variations.

On this basis, then, I am going to analyse some of the objects found in Tomb 7, which, having hieroglyphs, will permit us to study them. These objects are principally the carved bones and the jewels of gold and silver.

THE YEAR SIGN.—The year sign, indicated by an intertwined A.O., appears repeatedly on the carved bones and twice on the gold pectoral representing a tiger knight. It is certain that the first 13 years of the indigenous "century," a cycle of 52 years, are represented on the

bone (Page 472), and the signs united to the year glyph are *Acatl* (Reed), *Tecpatl* (Flint), *Calli* (House), and *Tochtli* (Rabbit), that is to say, precisely the signs used by the Mexicans and Mixtecs to name their years. The Zapotecs used *Ehecatl* (Wind), *Mazatl* (Deer), *Malinalli* (Herb), *Ollin* (Earthquake), signs which were characteristic also of the Cuicatecs. It should be noted that the numerical system of simple dots, rather than that of combined dots and bars, is used.

In the pectoral representing a tiger knight (Page 472) we have two dates. The sign A.O. tells us that we are dealing here with two years. In the square on the right the glyph inside the A is undoubtedly



BONES SHOWING DAY SIGNS

The upper bone gives from right to left between the two eagles the first thirteen days of the month, the lower from left to right the first twelve. (cf., pp. 474-475)

Calli, or "House," and outside we have eleven dots which gives us the reading "Year 11 House."

In the square on the left the sign inside the glyph A.O. is the head of the wind god Ehecattl; and ten dots surround the glyph, which gives us the reading "Year 10 Wind." Outside of the glyph also appears another small sign representing a flint knife (*Tecpatl*), and to this are attached two dots.

Now, in this case the two years marked on the two squares of the pectoral *cannot* belong to the same calendric system, since the days *Ehecattl* and *Calli* (Wind and House) are immediately next each other in the sequence of the signs (top page 470) and for two year signs to belong in the same system they must be five, ten, or fifteen days apart. The actual list of days follows:

- | | |
|-----------------------|---------------------------|
| 1. CIPACTLI—CROCODILE | 11. OZOMATLI—MONKEY |
| 2. EHECATL—WIND | 12. MALINALLI—HERB |
| 3. CALLI—HOUSE | 13. ACATL—REED |
| 4. CUETZPALLIN—LIZARD | 14. OCELOTL—TIGER |
| 5. COATL—SERPENT | 15. CUAUHTLI—EAGLE |
| 6. MIQUIZTLI—DEATH | 16. COZCACUAUHTLI—BUZZARD |
| 7. MAZATL—DEER | 17. OLLIN—EARTHQUAKE |
| 8. TOCHTLI—RABBIT | 18. TECPATL—FLINT |
| 9. ATL—WATER | 19. QUIAHUITL—RAIN |
| 10. ITZCINTLI—DOG | 20. XOCHITL—FLOWER |

Since each year begins with one of the above signs, and since the list is repeated in the same order indefinitely and without interruption, after 360 days each of the twenty signs will have been repeated eighteen times, and to complete the 365 days of the year we shall have to count five more days from our point of departure. Thus the first day of one year must necessarily be five days later than the first day

of the year before. For example, if a year begins with the day *Ehecattl*, the three-hundred-and-sixtieth day of that year will be *Cipactli*, and the last five days will be *Ehecattl*, *Calli*, *Cuetzpallin*, *Coatl*, and, finally, *Miquiztli*, which will be the last day of the year, causing the next year to begin with the day *Mazatl*. The following year will begin with *Malinalli*, the next with *Ollin*, and the one after that will begin with *Ehecattl* again. In the same way if the year has begun with *Calli*, the following years will begin with *Tochtli*, *Acatl*, and *Tecpatl*, but never in the same

calendric system can one year begin with *Ehecattl* and another with *Calli*, as do the years on the pectoral. On the other hand the 2 *Tecpatl* (2 Flint) which appears in the left hand square is undoubtedly a day sign, since it is not united to any other year sign.

We know that the Zapotecs, like the Mayas, named their years for the signs *Ehecattl*, *Mazatl*, *Malinalli*, and *Ollin*, while the Mixtecs and the Mexicans named them for the signs *Calli*, *Tochtli*, *Acatl* and *Tecpatl*. Moreover, on the calendar the day 11 *Calli* follows immediately after the day 10 *Ehecattl*, yet both these signs appear on the pectoral.

As a probable hypothesis I suggest that we have here an attempt to correlate the two calendars, the Mixtec and the Zapotec, and that both signs stand for one and the same year, called by the Zapotecs 10 *Ehecattl* and by the Mixtecs 11 *Calli*. The complete reading of the pectoral



GLYPHS ON THE BASE OF A CUP OF *tecali*
(ALABASTER)

would then be as follows: "The day 2 *Tecpatl* (Flint) of the year 10 *Ehecatl* (Wind) in the Zapotec calendar, which is equal to the year 11 *Calli* (House) in the Mixtec calendar."

The Zapotecs, like the Mayas, computed only elapsed time, so that it is quite probable that they should name the year which began with the day 11 *Calli* by the last day sign of the preceding year, that is to say, 10 *Ehecatl* whereas the Mixtecs and the Mexicans computed time while it was actually elapsing, so that they named the year which began with 11 *Calli* precisely by that day sign. (On page VI of the Vienna Codex we have also the Mixtec year sign joined to an owl head, which is also a Zapotec day sign. Cf. No. 8, bottom of page 471). The occurrence on the pectoral of the year sign A.O. similar in every respect to that which appears on the carved bones, proves the jewel to be Mixtec.

THE DAY SIGNS.—In addition to the three day signs which we have mentioned, among all the other signs that appear on the bones and on the alabaster cup (Page 474), *not one is Zapotec*, and furthermore they are in every respect similar to those which appear in the Mixtec and Mexican codices. Note for example the top bone in the illustration on the bottom of page 473, on which from right to left there is first an eagle head, then the first thirteen

days of the calendar, from 1 *Cipactli* to 13 *Acatl*, and finally another eagle head. The other bone in this same illustration, on which appear the day signs, must be read, on the contrary, from left to right. It also begins with *Cipactli*, though this figure is almost destroyed, but instead of having 13 days, it has only 12 and ends with *Malinalli*. The dots which occupy the separating brackets between the day signs on this bone have no numerical value. The third bone illustrated on page 472 is the one already discussed, which has the year glyphs, attached to each of which appears one of the four day signs, *Acatl*, *Tecpatl*, *Calli*, and *Tochtli*.

On other bones also there are day signs used either as the names of people or as dates. Thus I have found 4 *Tochtli*, 13 *Cozacauhtli*, 8 *Calli*, 8 *Ehecatl*, 7 *Acatl*, 5 *Quiahuiltl*, 7 *Ollin*, 4 *Xochitl*, 8 *Ocelotl*. There is not a single day sign which fails to appear somewhere, and there are moreover very important variants which I shall treat in detail in my monograph. Of all the bones and objects with hieroglyphs, *not one* bears a Zapotec sign, and it cannot be said that this is because the Zapotecs made no use of carved bone, since precisely at Monte Alban, from a place on the main highway, one of our guards recovered the three bones figured at the foot of this page, the designs of which are more clearly shown on page 476.

The upper one represents an owl and

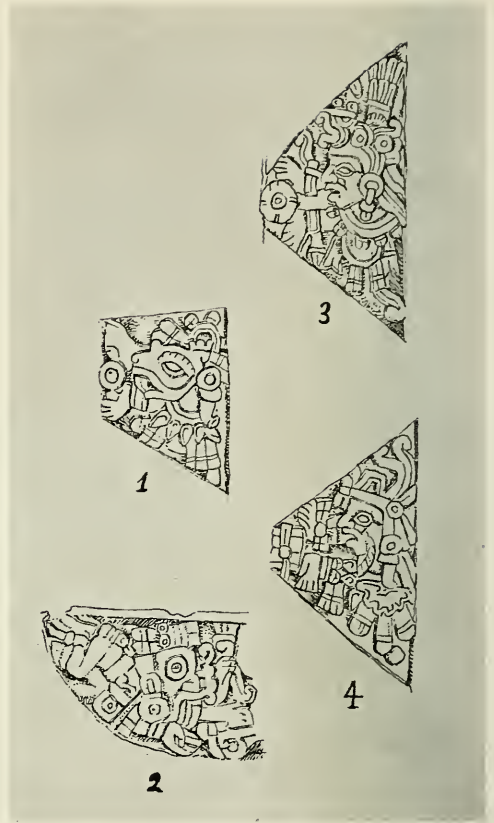


CARVED BONES SHOWING THE ZAPOTEC GLYPHS

another hieroglyph that I have not been able to decipher, although it seems to be a place name. The one at the left shows two claws of a bird of prey, perhaps an eagle, and facing them another hieroglyph which I would interpret as a bundle or a knot. The one at the right represents a conventionalized serpent with a great forked tongue and a graticulated body. The rattles of the serpent are carved in the space facing the head.

The three glyphs are of a style completely Zapotec. Note for example the glyphs M and F among the day signs of the Zapotec calendar shown on page 470, representing the serpent and owl heads, taken from Zapotec inscriptions. A mere superficial inspection is enough to convince one that these three carved bones are totally different from those found in Tomb 7.

THE GODS.—Representations of gods are also to be found among the objects of gold and the carved bones. In the former the two heads of *Quetzalcoatl* (page 473) are of particular interest. Each head projects from a solar disc, conceived in the Nahua or Mixtec manner, as we shall see hereafter, and wears over his mouth a sort of bird beak. But what definitely distinguishes these heads as those of *Quetzalcoatl* are the twisted ear plugs which in Mexican (Nahua) are called *epcololli* and which are always worn by the wind god and other associated deities, for example *Xolotl*. In the tomb we found several of

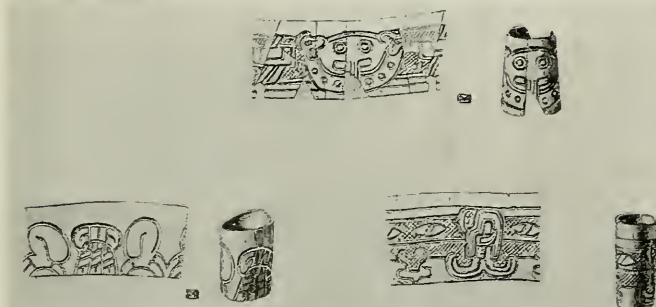


FIGURES OF GODS ON THE CARVED BONES

1. Xolotl, god of monsters. 2. Tlaloc, rain god.
3. Tonatiuh, sun god. 4. Quetzalcoatl, god of life, the wind, and the planet Venus

these ear plugs life-size, three of gold and the rest of shell. Never yet have I discovered a representation of *Quetzalcoatl* thus conceived, in a Zapotec urn or sculpture.

But without doubt the most beautiful image of any deity among all those we found in Tomb 7 is the already famous little mask of the god *Xipe-totec*, "our lord the flayed one," god of spring, of vegetation, and of jewelers (page 464). Although Sahagun tells



DRAWING OF ZAPOTEC GLYPHS ON BONES SHOWN ON PAGE 475

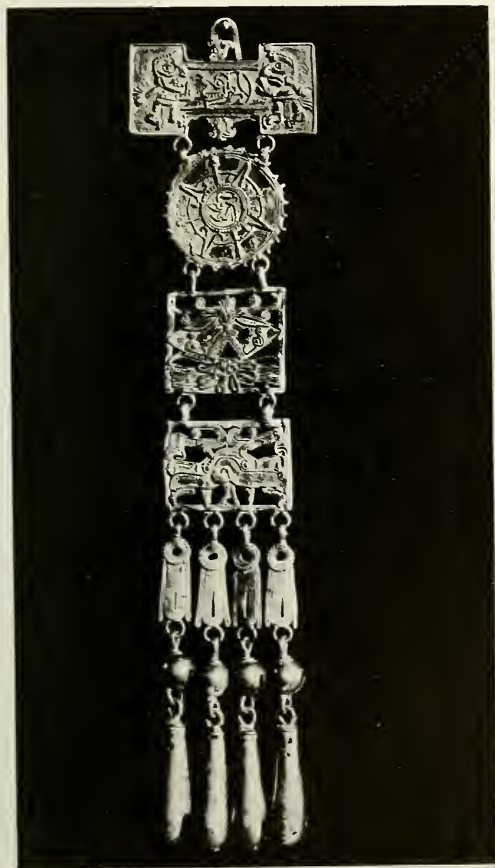
us that he was a Zapotec god, under his other name Yopi, he seems also to distinguish him as god of the *Yopi* or *Tlapaneca* tribe, who lived enslaved by Mixtec tribes in the region continuous to the present states of Guerrero and Oaxaca. (See page 427 in Seler's translation.)

As a matter of fact I never remember seeing any Zapotec funerary urn or stela in which *Xipe* appears with the attributes we are used to see in his attire, whereas in Mixtec codices his appearance coincides with that



MOON SYMBOLS

On the right and left are eagle heads projecting from solar discs and bearing in their beaks symbols of the moon. In the middle is another representation of the moon



GOLD PECTORAL OF MANY SECTIONS

Above, the *tlachtli* or ball game, representing the sky and the movement of the stars. Next the sun. Next a flint knife representing the moon. Last the toad, symbol of earth

of the little mask. The nose-plug with a cone in the middle and two lateral bands shaped like a swallow tail is found constantly in the representations of this deity.

On the bones we found portraits of *Tlaloc*, *Tonatiuh*, *Xochipilli*, *Xolotl*, *Huehucoyotl*, *Quetzalcoatl*, identical with these gods as they are represented in Mexican and Mixtec manuscripts, but we have had no such experience with the Zapotec urns and sculptures (see page 467). We could add the same of the animals, especially those which are day signs in the *Tonalamatl*, but for comparison one need only see those on the bones here published and to which I referred above.

THE SYMBOLS.—The symbols most common on the jewels of Monte Alban are the sun, the moon, the sky, the butterfly, as symbolic of fire, the *chalchihuite* (jade) the *tlachtli* (ball game), the earth monster, the falling eagle, the mountains, the representation of conquests, etc.

The sun is shown on several pieces of gold, but most significantly on the many-sectioned pectoral (at the left). Here, in the second section it is portrayed surrounded by a river of blood and with four rays and four jade pendants; at its center there is a circle with forty-nine dots and a skull. Probably the jeweler meant to



THE CELESTIAL BAND

As shown on the carved bones. The upper carving repeats the design of the sun god set in the celestial band. The lower shows the band extended with faces of divinities between the rays

make fifty-two dots, such as sometimes appear in representations of the solar disc. Again in a small gold disc and others like it from which project eagle heads, *Quetzalcoatl* heads, etc., the sun appears shown after the Mexican or Mixtec fashion.

The moon appears three times in these pendants: twice in the beaks of the eagles and a third time on a bangle. In all three it is shown as in the Mixtec codices (page 477). The celestial band in the Mixtec or Mexican style with the symbol of Venus alternating with flint knives or stellar eyes, also appears many times on the bones illustrated at the top of this page and once on a large shell bracelet shown at the right.

The butterfly as a symbol of fire, and also the jade, are found as pendants in the beaks of the eagles that decorate little plaques and rings of gold and silver (page 479). The *tlachtli* or ball game appears once on the first section of the multiple pectoral (page 477), and again as a place name on one of the bones. The monster of the earth, a toad with his mouth wide open, is also to be found on the last section of the multiple pectoral, and on several bones.

Conquered towns are indicated by the place glyph crossed out by an arrow, as is the rule in Mixtec codices, see for example the glyphs on one of the bones compared with the codices (top of page 480). On Zapotec stelae the place glyphs are shown (bottom of page 480) by a hill, with the name glyph inside it. The Mexicans use hills, too, but conventionalized after another fashion; and thus we find on one of the Monte Alban bones (top figure! at the right, page 480) a conventionalized hill exactly like those in the Mixtec codices.



THE CELESTIAL BAND
As shown on a shell bracelet

Lastly, the "falling eagle" or *Cuauhtemoc* is very common on the rings. This is symbolic of the setting sun as we have seen it in any number of Mixtec and Mexican codices, and as it appears also on a gold ring published by Saville (*The Goldsmith's Art in Ancient Mexico*. Plate III, c, d).

To summarize: The year sign, the day signs, the portrayals of gods, animals, and symbols as shown on the objects from Tomb 7 of Monte Alban are similar to those in the Mexican and Mixtec codices, and *totally different* from those which we find on Zapotec urns and stelae. On the

other hand, I have thought I perceived Zapotec style similar to that of the urns and stelae in certain of the gold objects already known; for example, that published by Saville, plate IV, of the above mentioned volume, and the ring (page 480). In these gold objects I seem to note a certain difference from the others already known. On the other hand, it must not be forgotten that the technique of working gold seems to have been the same all over pre-Colombian Mexico, so that it is probable that objects made of that metal, even when they come from places at great distances from each other, should have a similar appearance.

We can say that all the objects found in Tomb 7 show great



FALLING EAGLE
(*Cuauhtemoc*)

Symbol for the setting sun. In his beak he carries a butterfly

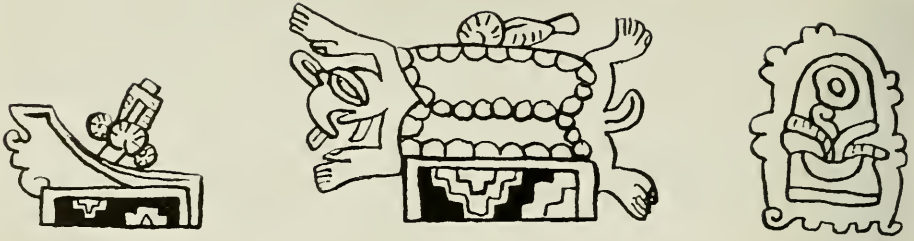
similarity with Mixtec objects and codices and no stylistic similarity to the style hitherto called Zapotec, that is, that of the urns and stelae. We are forced, then, to accept one of the two following hypotheses:

Either the objects of Tomb 7 are Mixtec, as contrasted with other objects found in Monte Alban and even those placed with the first burial in the tomb, which are Zapotec, or else what we call Zapotec is merely an older style which was replaced later by a new one which we call Mixtec, and as I have already pointed out in my book *The Zapotec Stelae*, this new style may be credited to the influence of tribes of the highlands (Olmecas, Mexicans) in Zapotec art and industry.



GOLD RINGS

The one in the middle is a falling eagle or *Cuauhtemoc*. He bears in his beak the glyph meaning jade



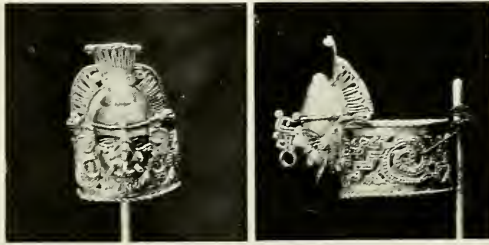
PLACE GLYPHS, AS SHOWN ON THE CARVED BONES FROM TOMB 7

The first and second glyphs indicate conquered towns, since each sign is transfixt by an arrow. The third glyph is a conventionalized hill. This place glyph is in the Mixtec style, but a similar formula is often used to denote towns in Mexican writing (Cf. p. 478)

But to decide in favor of one of these alternatives we need more excavation and above all stratigraphical excavation. There seems as yet no pressing reason, however, to abandon the first explanation and to assume that what we call Zapotec and Mixtec are two successive phases of one culture rather than coexistent manifestations of diverse cultures; and

Oaxaca, and that in the last centuries before the conquest Monte Alban was a frontier city between these irreconcilably hostile tribes. Thus my hypothesis that the upper or later burial in Tomb 7 must be attributed to the Mixtecs seems to me at present the most acceptable.

In the monograph on Tomb 7 of Monte Alban which I expect to publish at the end



ZAPOTEC (?) GOLD RING
Showing the head of the god Cocijó

as long as no new discoveries are made, I think it is meet to consider that the two styles, Zapotec and Mixtec, belong to distinct tribes who jointly occupied

of the year, all the jewels we found will appear in illustration, which will provide more data for comparison than are contained in the objects here discussed.



ZAPOTEC PLACE GLYPHS

These glyphs are drawn in a far more rigid style than are the Mixtec signs shown above, but they also represent place names. The designating signs are enclosed within another type of conventionalized hill, which defines these glyphs as locatives (Cf. p. 478)



On the Nam Hou River

ADVENTURES ON HUNTING TRAILS OF INDO-CHINA

The Experiences of the Members of the Legendre Indo-China Expedition
in Their Search for Museum Specimens

By SIDNEY J. LEGENDRE

PHOTOGRAPHS BY GERTRUDE LEGENDRE AND T. D. CARTER

THROUGH the bars of the ship rail we could see a long row of galvanized iron buildings sweltering under the first rays of the morning sun. Away in the distance the smoky gray summits of the mountains of Tonkin peered above mantles of mist, as if dreading to be dragged forth from their cool retreat into another day of torrid heat. On the dock below, half-naked Annamite coolies, their conical-shaped palm-leaved hats tilted back from their foreheads, their bare backs dripping with sweat, pushed iron trucks that clattered over rails already quivering under the relentless tropical sun. Beyond them a thin line of white helmets bobbed up and down above the pale faces of the ever present French customs officials, who had undoubtedly smelt our cargo of guns buried deep in the bowels of the ship.

"Well, here we are," Carter said.

Yes, here we were at Haiphong, the principal port of Tonkin, and the great northern gate to the federated states of Indo-China. Bounded on the north by China, on the northwest by Burma, on the central west by Siam, on the southwest by British Malay, and on the east by the Gulf of Tonkin and the China Sea, Indo-China forms a promontory dominating the sea routes that lead to the upper Pacific, and toward the passes of the Malay Straits. Politically Indo-China is a federation of five countries: Cochin Chine, a colony, Annam, Tonkin, Cambodia, and Laos protectorates. In reality they are all colonies, and are ruled by France with an iron hand.

It was in front of a French custom official that we now stood with the permit for the entry of the guns in our hands and the dull drone of his voice in our ears. The French customs have this peculiarity



ISLANDS OF THE BAY HA-LONG

The Bay Ha-Long with its hundreds of limestone islands is undoubtedly one of the picturesque spots of the world. In the foreground may be seen the Chinese junk on which three delightful days were spent

which should be remembered by everyone entering Indo-China. The higher the official, the politer he will be. A telephone will be in his hand instantly, and you will hear him utter quick, static commands to the effect that your baggage is to be passed "*Toute Suite.*" With a friendly smile he will rise, shake hands, and wish you a "*Bonne Chasse.*" You then return for the baggage and are told by a minor official that he is unable to give it to you until the signature of "*Monsieur Le Sous-Directeur*" is affixed to both the blue and pink papers which are attached to the twenty-four sheets that you are already holding. This may go on for weeks unless you do something desperate. We did. We sent a wire to Mr. Baudot of the bureau of *Tourisme* in

Hanoi, asking his help in the matter. I take this opportunity to say, that unless you have had special training as a detective and are an extraordinarily astute business man, and have nothing to lose, do not wire Mr. Baudot. With his assistance, and several additional papers from the government, we finally won the guns away from the little Frenchman with the red face and bulging eyes, and strapping them on to the back of the car, rode away in the direction of Hanoi, the capital of Tonkin.

Hanoi was first occupied by the French on November 19, 1873. Since then they have turned it into a modern town with street cars, waterworks, and all the other appendages that one hooks on to the word civilization. Nevertheless it still retains

SAILING IN THE BAY HA-LONG

From the village of Hongay the Bay Ha-Long was reached under sail. These sailboats, which were placed at the disposal of the party, added greatly to the romance of the region



part of its ancient charm. One has but to wander through the streets of the native quarter,—the street of brass, of furniture, of silk, etc., to see the life of a thousand years ago. Here merchants in their narrow

booths which open on to the street sit like fat spiders waiting to drag the unwary European into the depths of their dark lairs. Here they will fleece him nobly between deep bows and expressions of delight that such a highborn person should deign to enter their lowly store.

In the sunlit street native kitchens and traveling barber shops jostle their way through the surging throng, as they proclaim their wares in high, shrill voices. Annamite kitchens are always on the move. This relieves the owner of taxes, and also enables him to run his customers to earth rather than having to await their arrival.

Such a kitchen consists of a pole

balanced on the shoulders of the owner. From either end of this pole is suspended a five-gallon gasoline can. One smokes furiously, denoting that it is the stove, and the other, smelling to the heavens of old, decayed fish, and other delicacies dear to the native heart, is the larder. When a hungry client is eventually found, and the price of the meal is agreed upon (you must always discuss the price before you eat in the Orient), the cook places his kitchen on the ground, and with his customer squats beside it, oblivious to whirling rick-shaws and pushing crowds. When the hungry one has appeased his appetite and rises to go, he is confronted

with the barber who has stealthily crept up from the rear and placed his chair in position to await this opportunity. Should the prospective client be a man of means, he may step into the chair and have his head shaved,



THE RETURN FROM THE SEROW HUNT

The reason for the expedition's visit to the Bay Ha-Long was to obtain a specimen of the serow. Here is the hunting party, including the beaters, returning with their prize



SWINGING BRIDGE ACROSS THE NAM NA RIVER AT PHONG THO

Here the use of horses was dispensed with for a time and travel was continued down the Nam Na River in pirogues

and his nose and ears cleaned for two cents.

Hanoi offers no facilities for equipping an expedition. Unfortunately, I had wired Mr. Baudot from America asking if it was possible to buy everything that I would need there. He had replied in the affirmative, and as a result we left Hanoi for Laokay, the starting point of our trip, with the greatest heap of junk that I have ever had the misfortune to travel with. The tents had been made by a local saddler from automobile top material, the only waterproof cloth to be had in the city. The result was amazing, but scarcely what the French would call *une tente sérieuse*, due to the top being a light pearly gray in color, and the under side a vivid Scotch plaid. The tables of split bamboo, which rolled up beautifully in the shop, developed into hills and valleys when in actual use, leaving the butter on a

mountain-top, and the bread out of sight in the corresponding valley.

While the artisans of the city fashioned these masterpieces, we left for Hongay, the port of entry to the Bay Ha-Long. This body of water comprises one of the great scenic wonders of the world. Studded with islands which have been carved into fantastic shapes by the action of the sea, it is supposedly the home of a Chinese dragon who came down from heaven to direct the aquatic currents. According to the Chinese mythology, the "dragon" in question ascends to the celestial region at the spring equinox, and hides at the bottom of the waters during the autumn equinox. Whether it actually exists I leave to your own imagination, although three times, in 1897, 1898, and 1904, French naval officers vowed that they had seen this reptile looping across the bay.

Although the existence of the dragon is doubtful, pirates are a grim reality. The caves and inner lagoons of these islands have long been a favorite rendezvous and hiding place for their sampans. They traffic principally in the smuggling-in of Chinese opium, and the smuggling-out of Annamite girls.

Women in Annam have little value, due to the fact that only the men are permitted to worship their ancestors. As a result families practice the custom of selling their surplus daughters to the pirates, who in turn deliver them to the Chinese traders down from the north. The French have been trying to put an end to this horrible custom by patrolling the bay with gun boats, and forcing the sampans to report at regular intervals to have their papers of identification stamped. However, the task has proved very difficult, due to the enormous number of hiding places, and the fact that when the pirates are pressed too closely, they toss the girls overboard, after slitting open their stomachs to make them sink quickly. When the gun boat arrives, all traces of blood have disappeared, and the crew are fishing industriously over the sides of their boat. It was in this company that the "mouflon of the Bay of Ha-Long" lived.

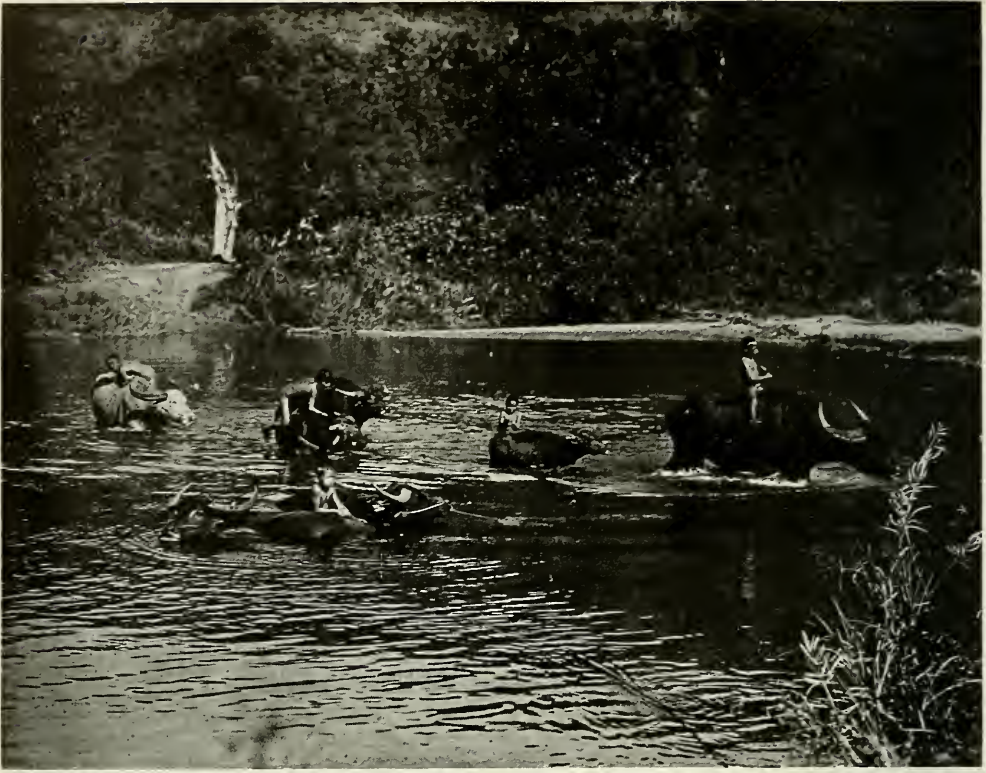
This so called "mouflon" of the French is not a mouflon, but a serow, a close relative of our Rocky Mountain goat. Living among the needle-like crags of these incredible islands, he can be shot only with the aid of beaters. No European either in or out of his right mind could possibly stalk him over those razor-edged rocks. Mr. Lapique, one of the old-timers of Indo-China, and one of the most delightful characters I have ever met, had arranged everything in connection with the hunt. We were to be his guests on board his yacht, a Chinese junk that had once been the flag-ship of a famous pirate fleet. From there we would

direct our activities. As we boarded the old schooner that was to take us out to our future home, the sails were hoisted, the mooring was cast off, and with the water rippling at our bows, we headed into the path of sunlight that lay across the bay like a bar of gold. Slowly the light withered in the western sky, leaving a maze of fading colors, a harmony of demi-tints. The mountains like great black giants reared their somber heads above the purple waters, and then, with the suddenness of the tropics, night fell, leaving us a black dot on black waters, with no sound but the sighing of the wind, and the murmur of the Annamites forward. As we slipped through the last tortuous passage, the lights of the "Princes," the junk, came into view. About her



MRS. LEGENDRE WITH A GIANT FLYING SQUIRREL

These large flying squirrels are nocturnal and seldom seen although they are often heard on moonlight nights



CHILDREN AT PLAY WITH WATER BUFFALO

Every evening after the day's work is done, the children of the village ride the buffalo into the river for their daily bath

high sides were clustered the sampans of our beaters, and in the offing a schooner rode silently at anchor. With a swishing sound a coil of wet rope fell on the deck, and by the warm glow of the light that flowed out from the cabin door, I could see a table set for four.

At dawn we left the junk and pointed the nose of the schooner toward an island whose rocky cliffs pitched down to the water below in a series of jutting balconies. A mouflon had been seen on the south end of the mountain the day before, and it was our plan to land the beaters there, and then take up a position on a narrow strip of land that served to connect the two halves of the island. The beaters were accordingly sent ashore in a sampan which was left in charge of one of their women, and we continued on to a

sandy beach which bordered on the isthmus.

Standing ankle-deep in the warm sand, I looked up at the steep slopes above me and said, "I will guard the beach."

"No," said Mr. Lapique, "you are the leader of the expedition and must have the best shot. You must go to the top."

"Yes," said Mrs. Legendre, "you will go to the top and I will guard the beach."

Reaching the summit I sank on a stone. Away below me lay the white beach rimmed by the turquoise blue of the bay. I could not see Mrs. Legendre, but I could see the child dressed in white who had followed her, and who jumped up and down with excitement when the mouflon came into view. So well did it do this that the animal was never seen again. The beaters stood on the top of a great

AMONG THE RAPIDS OF THE NAM HOU RIVER

The upper stretches of the river were filled with rapids and it was only the great skill of the boatmen in managing the pirogues that brought the entire fleet down without a mishap

cliff which frowned above the valley, and, throwing stones down the heavily wooded sides, called on the mouflon to come out and be killed. This having no effect, we returned to the sampan. The woman who had been left on board said that the mouflon had come down and looked at her. This was hard to believe, as with all Annamite women she was an inveterate betel-nut chewer, and had had her teeth enameled black besides, and a more hideous mouth it would be difficult to imagine.

In the afternoon a different island was chosen for the hunt, and a guide was given to me who led me far afield over knife-like rocks which cut my hands and feet, through what I considered impenetrable jungle, up vines using only my toes, and down precipices using the back of my trousers, until we finally arrived at a needle-like pinnacle with a point so



sharp that it could hardly be seen. Here I sat for an hour until I heard a shot. Then a battle commenced. For fifteen minutes there was bedlum. When I finally arrived on the scene, I asked if the mouflon had reached the sampan, but was told, no, that it was lying dead in the hills. Carter said that he had shot him, but, since they pulled him out of a precipice, I really think that he had fallen in and broken his neck while looking for the woman.

"There are two tigers terrorizing the village of Tuyen Quang. You must go and shoot them. I have notified Tabor-sky, an old soldier of the Foreign Legion, that you are coming, and he will act as your guide."

Baudot was speaking. We had just returned from the Bay of Ha-Long, and were looking for new worlds to conquer until the saddler had finished the tents. Within



CAMP AT NA HAI

Camp while on trek was not a pretentious affair, merely a fly or two for the protection of the drying skins. The cots were pitched under the stars with no other protection than the mosquito bars



RIVER SCENE IN LAOS

Most of the country of northern Indo-China is mountainous and travel can be carried on only with the aid of small mountain ponies

an hour we were rolling toward "Tiger Land" in Mr. Baudot's car, which he had rented to us at great profit to himself. At nine o'clock that evening we knocked on the portal of Taborsky's house. He was outlined for a moment in the light that streamed through the door. On his head he wore a great, wide hat to which a lantern was attached. His legs were incased in riding breeches and woolen stockings, and on his feet he wore rope-soled shoes, for, as he explained afterward, this was to enable him to walk silently, and prevent the tiger from hearing him. All that night we hunted tigers, and though our Foreign Legionaire swore that he had heard one grumbling in the brush and had dared it to come out, it had only gone on grumbling.

The following morning he took us to the

village of Chiem Hoa, ninety kilometers away. Here we stayed with an old mandarin chief of the tribe of Thai, and were given the *chambre de luxe*, although I shall always remember it as the drum hall.

It was square, and around the top of the wall ran a broad pink line, and around the bottom ran a broad blue one. In a corner stood the bed, four short posts supporting a series of planks at the head of which a block of wood lay in wait to receive our tired heads. No sooner had we lain down than there was a terrific Boom! Boom! and the windows rattled!

"What are they beating that drum for?" Mrs. Legendre said.

Not being a prophet, I remained silent. Sleep came. Boom! Boom! the drum roared. I roared also, but what was the use! Every fifteen minutes strong men

with big clubs belabored the hollow pig-skin-covered log. By this means they kept the sentinels, myself, and every one else within a radius of five miles awake, and ready for the bandits that never came. From sunset until dawn the north of Indo-China is a mass of tom-toms, bells, and whistles. The only quiet hours are those of the siesta from noon to three o'clock.

Our trip to Tuyen Quang having proved fruitless with the exception of a few birds and small mammals, we returned to Hanoi, gathered up our equipment, and on October 26 caught the train to Laokay. If you never look out of the window on this trip you will never regret it. The scenery is dull and monotonous. At Laokay we organized our caravan of thirty-two horses, which were tiny, being about eleven hands high, and headed northward in the direction of the military post of Baxat.

Baxat stands on a hill. The first view is of trees and straw-thatched roofs



LAOTIAN GIRLS AT LUANG PRABANG

The Laotian women are experts in weaving and are well known for their brightly colored scarfs, which they drape effectively over their shoulders



COLLECTORS FOR THE AMERICAN MUSEUM
While the expedition was stationed at the Plateau Bolovens, the native boys assisted greatly in procuring specimens

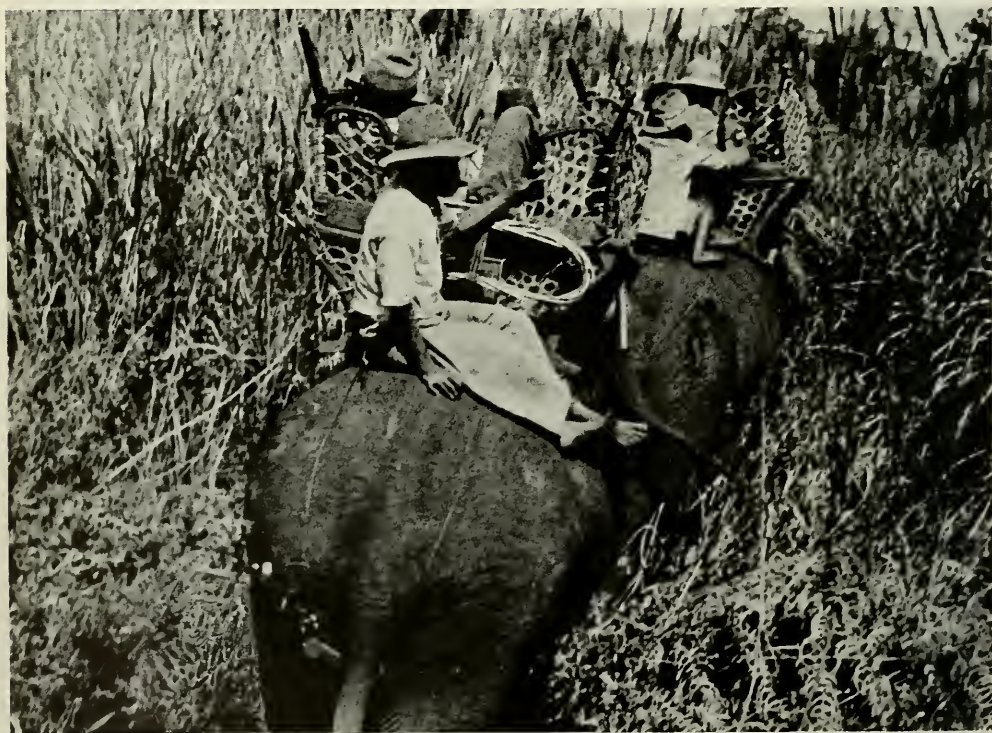
peering over a white wall. A winding path leads to barbed-wire entanglements in front of the massive spike-studded doors. As our caravan came to a halt, a tom-tom boomed forth three times, the signal of the arrival of a European, and the doors creaked back on their great hinges. Before us lay long, low, white-posted, straw-thatched buildings facing one another across a court of sun-baked red earth. To the right a curving path pierced a green hedge enclosing bushes covered with red and white flowers, and down this path came Monsieur Le Capitaine to greet us. He was shivering in spite of the heavy coat he wore, and his lined face indicated the fever ravaging his body. No host could have been more charming, and he entertained us during the three days that we remained there collecting specimens, as if it was the greatest pleasure in his life.

We left Baxat at daybreak. The leaves on the side of the trail were wet

and shiny, and they moved ever so slightly in the morning breeze. The air smelt of wet earth (so different from the smell of mud) and of the mountain that pitched down to the road, and of the long jungle grass that touched one's shoulders, leaving epaulettes of diamonds. Behind I could hear the faint thud of horses' hoofs, and the cries of the caravan men muffled in the fog, and ahead the trail turned and twisted, clawing its way into the flanks of the mountain. Slowly the gray mist became a luminous gold and drifted away in little whiffs. One's shadow with its extraordinary little pinpoint of a head stretching far out ahead became shorter, and little puffs of dust rose with each step. At two o'clock we arrived at Moung Hum, and here Mrs. Legendre made the mistake of telling the lieutenant in charge that we were weak and famished after our thirty-kilometer walk, due to the

fact that we had been served only coffee and toast for breakfast. When the morning of our departure arrived, I was amazed to see three bottles of wine on the table. However, my amazement quickly gave way to consternation when four orderlies entered the room. The first carried a bowl of soup, the second a fish, the third a roast duck, and the fourth a grilled steak. One bent down and whispered in the lieutenant's ear. "But certainly," he replied, "they are Americans," and a bottle of whiskey was added to the wines.

Moung Hum to Phong Tho is a three days' march, and it was at Phong Tho that we were to pick up the pirogues which were to carry us down the Nama River to Laichau. Pirogues are long, slender canoes hollowed out of great trees. With their arched sterns and bows they resemble the gondolas of Venice. The ones that we had were so small that



HUNTING ON ELEPHANT BACK

It was only with the aid of elephants that hunting could be done over country like this



ON THE PLATEAU BOLOVENS

This picture clearly shows the great height of the growth, for Mr. Legendre is seated on the back of an elephant, although the animal itself does not show in the picture

they were capable of carrying only two passengers and fifty pounds of baggage, and even then the waves of the rapids washed over the low sides into my lap. Twisting and turning, our boat danced down this swirling flood as far as Don Va. On either side the mountains stood out boldly against the sky, their slopes covered with a wild tangle of vines and trees. Suddenly the boat would round a bend, and there would be a clearing full of thatch-roofed huts and naked pot-bellied children looking at us with great, round, serious eyes. The dull roar that had filled my ears for the passed five minutes was finally explained. A rapid lay ahead of us. The boatmen shouted at one another as they strained their paddles. A thin mist hung above the yellow, curling waves. Black rocks bobbed up, disappeared, reappeared, only to be sucked under again by the flood. The paddles of the piroguiers splashed in the sunlight,

and then seemed to disappear in the smother of foam and spray. At length we emerged drenched to the skin, and I gave the order to make camp. With some misgiving we watched the men unroll the tent fly, for this was the first time that we had attempted to erect it. However, up it went on the rickety poles provided by the saddler. All ropes were fastened, and we stood off to admire its sway-backed shape. The tables and chairs were placed under its welcome shade, and Mrs. Legendre, seating herself, wrote massive sentences in her diary on the joys of camp life. Suddenly I heard a rip, waited for the crash, and was not deceived. Fly, poles, and all had completely collapsed on her, a little bump in the center showing her position.

Arriving the following day at Laichau, we found the village crowded with natives who had come in for the Armistice Day celebrations that were to take place in the



THE SLOW LORIS

These animals are arboreal and nocturnal, feeding chiefly on fruits, insects, and bird's eggs

Laotians in sampats. A sampat is a skirt, the back of which has been rolled and passed up between the legs to the front. This gives a marvelous rear view of the tatooing with which they cover themselves from the waist to the knees.

morning. There were Mayos, the hunters of Indo-China, dressed in blue jackets and trousers spun by themselves in their mountain homes. Around their necks they wore great silver collars the ends of which did not meet but were linked by a chain and padlock of the same metal. This unique decoration has probably descended from the time of Gengis Khan's subjugation and enslaving of the people of Southern China. Then there were tall, white Thai women, with long black skirts made by twisting a roll of cloth tightly about the hips, and permitting it to fall in straight folds to the ankles. Around their waists they wore gay-colored sashes, and, above, short tight-fitting bodices. On their heads were balanced immense round straw hats which always seemed to be on the verge of falling off. Intermingling with them were Annamites in long, shiny, black coats and white trousers, and

That evening the Commandant of the Post asked us to dinner. It was a banquet to which all the native chiefs and their wives had been invited, but of course the wives were not permitted to sit at the same table with the men. Mrs. Legendre was the only woman so honored, being the first white woman to have ever passed through this post. Now champagne and speeches always go together. As the corks popped, I stood up.

"Ladies and gentleman," I said, and went right through to "... and may the existing friendly relations between these great nations always remain."

A HELECTIS OR
FERRET BADGER

This proved to be one of the more common animals found on the Plateau Bolovens



A PANGOLIN OR SCALY ANTEATER

In many places throughout the journey, the holes of this strange animal were found

On the way home a sentinel challenged us with "Who goes there"?

"C'est Madame," I replied.

"Bon soir, Madame," he said.

Now that is how an army should be run!

Luang Prabang is the capital of Laos. It was here according to legend that Buddha stopped on one of his phenomenal long-distance tours, and looked about the country. Finding it beautiful, he desired to establish a city, but everywhere that he looked his eyes fell on herds of wild animals. Pondering a moment he hit upon the brilliant idea of stamping his foot and frightening them all away. So well did this scheme succeed, that I defy anyone today to make a collection in the vicinity of this town.

Leaving Luang Prabang, we mounted the Nam Khan River to Moun Yu. At Don Qua where we had stopped to collect, I witnessed a marvelous scene. Seated at breakfast on the porch of our

bamboo house, I was amazed to see Carter and Pough (his native assistant) creep by on their hands and knees. At the far end of the verandah they stopped. Pough knelt, and Carter standing on his back, thrust his gun through the thatch roof and fired. With a howl of delight they rushed out and returned with a thin bird with a long beak. It was a "sun bird."

Moung Yu is one of those peculiar places that we all know, —the faster one goes toward it, the farther it draws away. I was told when I left Luang that in five days I would arrive in Moung Yu, and the government accordingly wired ahead ordering a caravan of horses to await our arrival. After three days of traveling from dawn to dusk, we arrived at Passa only to find that we were five days from our goal. Pushing forward before the first rays of the sun had touched the mountain peaks, we arrived at dark, rejoicing mightily, for we were only four days away according to the chief of the

village at which we stopped. On the eleventh day I strode into Mounng Yu, the seven pirogues arriving two hours later.

Jogging along on the backs of tiny ponies at the rate of thirty-five kilometers a day for four days brought us to the village of Xeing Khoung in time to make our Christmas egg-nog in front of a roaring fire. The milk and cream that we used in this mixture is put up by a famous continental firm. It is absolutely fresh, and does not taste of any preservative. I

have never seen it any where except in the tropics, but there it is used a great deal. The following morning, in company with the resident's dog, we went quail shooting. Unfortunately, the animal was hungry, and swallowed the first three, but after that he permitted us to have a fair share of what we shot.

The road that runs from Xeing Khouang to Vinh crosses the ranges of the great Annamite Chain, and I have never seen a more dangerous trail. When our wild-eyed chauffeur finally deposited us at the Grand Hotel after a semi-aërial trip, I breathed a sigh of relief and immediately set about buying our own truck and car to avoid any such future experiences. We left Vinh on the sixth of January in the two dilapidated Fords that I finally acquired. Nape was our destination. Nape and Nakay, a village sixty kilometers farther south, offer splendid shooting. Gaur, banteng, tiger, and deer are to be found on the great plains, and in the surrounding forests. Here Carter shot a sambar so late in the evening that he did not have time to skin it out before night had fallen. Afraid that it would be eaten by some wild animal, he appealed to the guide. The latter nodded, and indicated that he would arrange everything. First he cut a bamboo and split it carefully with his "coup coup" until he had about twenty very narrow strips. These he plaited into an open-worked mat about a foot square. Taking another length of bamboo he split it at one end and inserted his work into it. The pole was then stuck into the ground at the sambar's head. Next he borrowed Carter's knife, and dipping the point into



A NATIVE MOI

The ax that this gentleman is carrying is with him constantly and is put to every conceivable use. Note also the large ivory discs in the ears



A GROUP OF MOI VISIT THE CAMP

The Moi live in long communal lodges, many families under one roof, but each family is partitioned off from its neighbor

the blood oozing from the wound, he drew a circle around the animal. Stakes were driven into the ground, forming a circle outside the one drawn. To these a vine was attached so that the deer was roped in like a plot of grass in New York. He then raised his arms until his hands were on either side of his chest, and half spoke, half chanted for a minute. Turning, he picked up his "coup coup," and pointed to the homeward trail. The deed was done, the taboo had been placed on the body, and neither man nor beast could touch it, and the extraordinary thing is that nothing did.

From Nakay our route ran down the valley of the Mekong through Thakek, Savannaket, Paxse, and up on to the plateau of Saravanne. We were now in the south where game was abundant, so different from the dense, impenetrable jungles of the north where every step had to be hacked out of the living wall of

green. All big game hunters entering Indo-China by Saigon, its southernmost port, find a country infested with professional white hunters who will guarantee you gaur, banteng and tiger within a month. In Djiring in Southern Annam, Mrs. Legendre and Carter each shot a tiger after five days' hunting.

Making our base camp in the village of Thateng on the Plateau of Saravanne, we remained there for three weeks, while natives poured in through the gates of the palisade, carrying beautiful woven baskets of bamboo which were filled with birds and small mammals. However, that was all they were bringing in. We needed the larger ones as well, banteng, tiger, wild boar, and gaur. They abounded in the country-side, but were difficult to hunt on foot due to the tall jungle grass that dwarfed one into obscurity. Elephants were the only solution, and on these we rocked across the country from dawn

until dark during the eighteen days of our sojourn.

From Thateng we descended on to the Plains of Cambodia, to hunt the giant ibis. This bird is the largest of the ibises, and has a long, curved beak, which it pokes into the ground in search of food. It is highly localized, and is considered very rare, there not being any specimens in America to my knowledge. We had been told that it might be found in the vicinity of Angkor, and accordingly the Ford was headed toward these world-famous ruins of the Khemer Empire.

Seventy-two kilometers from Angkor Carter shouted "Stop!" Stop! Ibis!

Ibis!" The Ford shuddered to a standstill, and the cloud of dust that had followed us all the way caught up and enveloped the car with its filth. Through this haze I saw Carter lift his rifle and, resting it against one of the arms supporting the roof, take careful aim and fire. We gave a whoop as the bird flopped about on the ground. Carefully wrapping it in paper to protect the feathers, we placed the package in the back seat and climbed in ourselves. Four hundred kilometers south of us lay Saigon, our port of departure, and supposedly the wickedest city in the world. I stepped on the self-starter with a bang.



MEMBERS OF THE MOI TRIBE IN SOUTHERN ANNAM

The passing of the caravan interrupted the work on a house that these Moïs were building. The workmen all came out to the side of the road to watch it pass



THE FIVE HAPPINESSES

JADE

The Mythology and Symbolism Expressed in the Carvings
of the Jewel of Heaven

By HERBERT P. WHITLOCK

Curator of Mineralogy, American Museum

NEARLY twenty-four hundred years ago Confucius, speaking of the "jewel of Heaven" said, "In Ancient times men found the likeness of all excellent qualities in jade."

Perhaps nothing can so vividly present to us the remote antiquity to which we must turn to find the beginnings of Chinese carved jade than the words "in ancient times" from the lips of this old sage. And it may not be amiss for us to enquire into the questions of how and why these orientals should regard this stone as the embodiment of all virtues.

Under the general

term "jade" are included massive varieties of at least two mineral species,—a massive pyroxene known as jadeite, having the composition of a soda alumina silicate, and a tough, compact amphibole, called nephrite, and corresponding in composition to a lime magnesia iron silicate. So closely do these mineral materials resemble each other in texture and outward characteristics that it is often difficult to distinguish them apart, especially when carved.

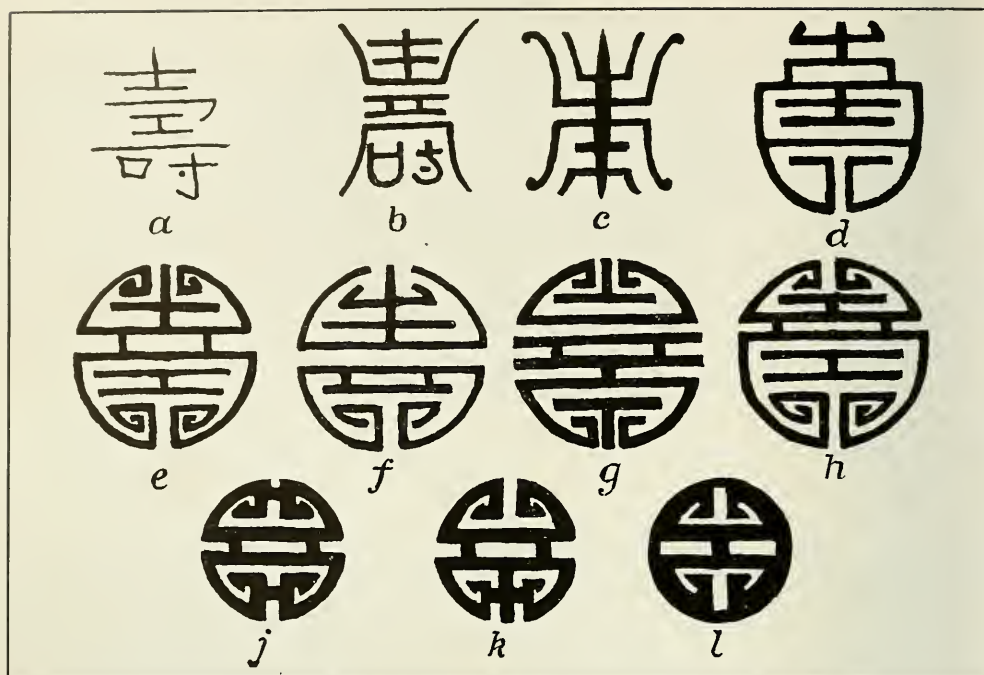


A FINGERING PIECE

Of white jade, in which a brown-colored area has been used for the ears and face of the "happiness" bat. The bulk of the piece represents a bag of grain (for prosperity). Below the bat may be seen the cords which tie the mouth of the bag. The whole carving is wonderfully smooth to the touch. Whitlock

Collection

Of the two, jadeite is slightly the harder, having a hardness of 7 in the Mohs scale as compared with about 6.5 for nephrite.



THE CHINESE CHARACTER MEANING IMMORTALITY

With some of the conventionalized variations (Shou marks). *a* Written character. *b* From an old embroidered silk. *c* From a suit of armor of the imperial guard. *d* From a jade wine pot (Tang dynasty). *e-h* Variations mostly in raised carvings on jade. *j, k* From jade pendants (K'ien Lung period). *l* Movable pivot from a jade prayer wheel

Also the specific gravity of jadeite is rather higher than that of nephrite; 3.34 as compared with about 2.95-3.00.

By reason of its toughness and relative hardness, jade was a favorite material for the fashioning of implements employed by primitive man. Wherever jade was obtainable, either from a native source or through trade, we find men of the cultural stage corresponding to the late Neolithic era employing nephrite, and occasionally jadeite, as materials for celts, axes, and other primitive tools and weapons, much as the natives of New Zealand at present make use of their local nephrite. But, although such jade implements of early man have been found in many places

throughout the world, there are but two regions where the use of this material has risen in cultural degree from the purely utilitarian to the decorative stage that places it among the ornamental stones.



WHITE JADE CARVING REPRESENTING THE IMMORTAL WARRIOR CHUN T'I RIDING ON THE ONE-EYED PEACOCK. WHITLOCK COLLECTION

In the portions of the tropical Americas comprising Southern Mexico, Yucatan, Guatemala, Costa Rica, Panama, Colombia, and possibly Ecuador and Peru, the pre-Columbian cultures furnished many carved jade objects of decoration well within the scope of ancient jewelry. There are now no known deposits of either jadeite or nephrite in these countries, and at the time of the conquest of

Mexico by Cortez, jade was so rare and so highly esteemed by the Aztecs that it

constituted their most precious possession, worth many times its weight in gold.

It is, however, among the Chinese that the high estimation of jade places it above all other gem stones. And it is in China that we find the use of jade not only extending back into vast antiquity, but furnishing us with a means of tracing through the countless examples of both ancient and modern carved objects the development of a highly interesting and attractive expression of the lapidary art.

As far back as the period of the Chow dynasty in the Eleventh Century B.C., we find nephrite used for carved designs, decorated chiefly with geometric motives.

Although jade of this early period was originally of some shade of green, corresponding to nephrite as we know it today, the green color has, in many instances been altered to some shade of brown, ocher, or dull red. This change is purely superficial, affecting only a very thin layer of the surface, and is due to the action of the weather during long periods of time, the iron oxides, which originally colored the stone green or grayish-green, having been replaced by higher oxides

of the ocher or umber shades. Since the oxidizing agencies producing this surface change of color are those that operate best in the upper layers of the soil, it follows that jade pieces which have been buried for long periods of time exhibit it in the highest degree.

Nephrite from local sources in Shensi and other Chinese provinces, or brought from Eastern Turkestan, or possibly from a deposit near Lake Baikal, furnished most of the jade of this period. In color the stone from these deposits varied from white and gray-green, through leaf-green to dark laurel-leaf-green, the depth of color increasing with the amount of iron contained in the nephrite. Some jadeite from Shensi and Yunnan provinces of China, and from Tibet was no doubt also used for Chow carvings, as for the worked jade of later periods. It is however, difficult to separate the jadeite of this culture from nephrite on a basis of color alone, particularly as many of the carvings in both materials have been altered in color through having been buried.

The tendency to supplant the geometric formality, characteristic of early jade carv-



A GIRDLE PENDANT CARVED FROM WHITE JADE SHOWING THE IMMORTAL CHANG-KUO, RIDING HIS MAGIC COLLAPSIBLE MULE. WHITLOCK COLLECTION



A FIGURINE REPRESENTING KWAN YIN, THE GODDESS OF MERCY, CARVED FROM DARK-GREEN YUNNAN JADE. AMERICAN MUSEUM GEM COLLECTION



THE FIVE POISONS

An amulet carved from white jade, representing a toad, a serpent, a spider, a lizard, and a centipede, the five venomous creatures whose images protect from evil. Whitlock Collection

eties through various shades of green, to deep "spinach"-green heavily mottled, and even to the black of *chloromelanite*.

Among the rarer colors may be ranked the light ocher yellow of some Burmese jadeite, a blood red, met with in patches in white jadeite, and a still rarer light violet or mauve. A beautiful jadeite from Yunnan province is colored a mottled, opaque, grass-green, very much

ing, with a freer and more graceful ornamentation culminated in the highly elaborate carving of the K'ien Lung period (1644-1912), with its undercut relief and open-work patterns. At this time also the beautiful green jadeite, from the Mogaung district in Upper Burmah, began to be imported into China, and much enriched the materials available for Chinese expression in carved jade. This choicest of the jade varieties is also the best known to the western world under the name of "imperial jade." It is never found in large masses, always in relatively small areas disseminated through white jadeite which fact accounts for the mottled and streaked distribution of color observed even in some of the finest and most highly prized pieces.

Aside from the semitransparent apple-green of the imperial jade, the colors that characterize this ornamental stone run the gamut of tints from the translucent white of "melting snow" or the more opaque "mutton fat" vari-

WHITE JADE DISK REPRESENTING THE MOON

The white rabbit, symbolizing the Yin principle, is compounding the pills of immortality in a mortar. Drummond Gift Collection





A DRAGON

A white jade figurine of a dragon with somewhat lion-like proportions. Whitlock Collection

like the color of malachite, but differing from the latter stone in texture.

With increased elaboration in the carving of jade by the Chinese lapidaries there grew up a symbolism involving the subjects depicted in this art. Just as among more primitive people we find glyptic artists depicting gods and heroes, sacred animals and supernatural attributes, so among the Chinese carvers of jade we find myth and legend, philosophic principle and ritualistic symbols used freely and developed with increasing conventionalization as the forms and patterns were



A HORNED AND WINGED DRAGON

Intricately carved belt ornament of white jade. Note the elaborate pierced carving in the background. Drummond Gift Collection

handed down through many generations of artists.

To those of us who have seen large assemblages of Chinese carved jade a very familiar figure is that of a tall, graceful woman, represented seated or standing, and holding either a vase or a lotus flower in her hand. She is Kwan Yin, the Goddess of Mercy, one who hears the cry or prayer of the world. According to the beautiful legend of the Chinese Buddhists,



DRAGON, HIGHLY CONVENTIONALIZED

Carved in old jade; of the period of the Chow dynasty. Note the archaic square turns of the body and the birdlike head substituted for a tail. Drummond Gift Collection

she was about to become an immortal, but turned back from the very gateway of the Western Paradise, when she heard a cry of anguish rising from earth. So by renunciation she achieved immortality in the hearts of the sorrowing throughout the centuries. Her shrine and her image is to be found in every Chinese temple, as

her prayer is always on the lips of countless mothers: "Great mercy, great pity, save from misery, save from evil, broad, great, efficacious, responsive Kwan Yin Buddha."

Whenever one finds six little men and two women carved in jade be sure that they are the famous Eight Immortals of Taoism. These legendary characters probably at one time actually lived, at least we have excellent reasons to regard some of them as historical personages. According to very old Taoist legends all of the Eight became immortal and each may be recognized by some article that he or she wears or carries, as the crutch and gourd full of magic medicines of Li T'ieh-Kuai, or the magic feather fan with which Chung-li Ch'uan fans the souls of those who are to be immortalized back into their bodies. Some of the Eight Immortals are depicted alone, as Chang-Kuo who is shown seated on his marvelous donkey, which folds up like a piece of paper when not in use, and his bundle of magic rods, with which he wrought all manner of necromancy.

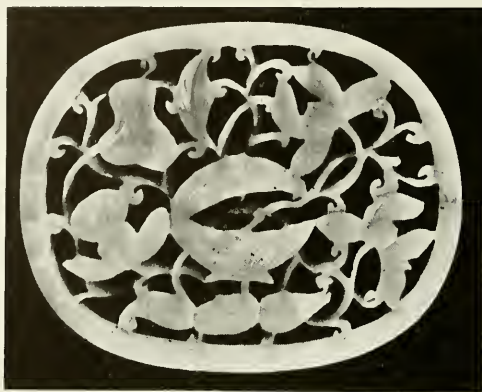
Chinese legend relates that long ago in

the nebulous period that preceded the Chow dynasty there occurred a tremendous battle of the Gods in which demigods, Buddhas, and Immortals, not to mention fire dragons and other wonderful creatures, participated. It was an

epic struggle, a sort of Chinese Siege of Troy or Mahabharata in the course of which Chun T'i, a Taoist warrior much gifted in magic, transformed his adversary into a red, one-eyed peacock upon whose back he rode through the sky to the Western Paradise. A little jade carving, no larger than a half dollar depicts this episode with detail and fidelity, even to the single eye of the peacock.

Disks of white jade sometimes show carved in relief a rabbit standing on its hind legs beside a conventionalized tree, engaged in pounding something in a mortar. The subject of this design emanates from the legend of Heng O, the wife of Shen I, the divine archer. She ate one of the pills of immortality and flew to the moon. Seized with a violent fit of cough-

ing, she presently coughed up the coating of the pill she had eaten, which immediately became a rabbit as white as purest



THE LOTUS

An open carving in white jade showing the lotus, one of the "eight auspicious signs," growing from a vase formed from one of its own pods. Whitlock Collection



WHITE JADE GIRDLE PENDANT

Representing a conventionalized dragon on the left, and a phoenix on the right. Both embody the *Yang* or male principle, and in this design support the disk of the sun. Whitlock Collection

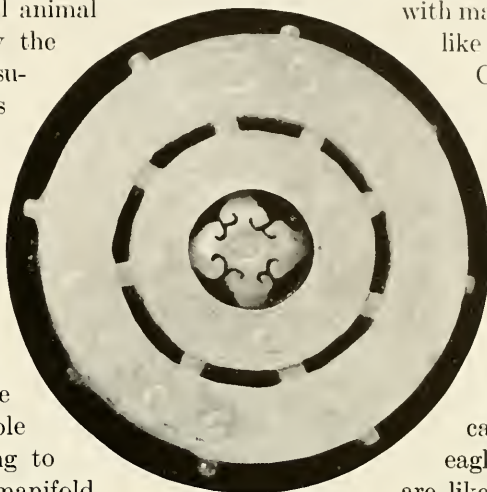
jade. Thus was created the ancestor of the *yin*, the negative or female principle of universal life, whose prototype is the moon.

The essence of the *Yang* or male principle resides in the person of the dragon, that mythical animal or being endowed by the Chinese mind with supernatural powers which are generally assumed to be exercised for good rather than evil, as when a dragon was invoked in times of drought to bring fertilizing rain. In this sense dragons were looked upon as veritable deities, and according to Berthold Laufer¹ the manifold types and variations of dragons met with in ancient Chinese art are representative of different forces of nature, that is, of different deities. In a measure this would explain why dragons are so univer-

sally represented in jade carvings, and why they vary so richly and amazingly. Some are full-bodied like lions, while some are attenuated, convoluted, and very reptilian indeed. Some have branching horns, and others are decorated with manes that are singularly like human hair. An old Chinese classic ascribes nine "resemblances" to the dragon; its horns are like those of a deer, its head that of a camel, its eyes are those of a devil, it has the neck of a snake, the abdomen of a cockle shell, the scales of a carp, the claws of an eagle, the soles of its feet are like those of a tiger, and

its ears like those of an ox. Even in the matter of claws this miraculous beast holds to no fixed rule for, although the imperial dragon has five to each of its four feet, ordinary dragons have but four.

Perhaps because of the fact that Chinese designs and decorative motives



A GROUP OF "WHEELS OF LIFE" CARVED IN WHITE JADE

Two have movable centers and can be rotated by holding the loose central piece between thumb and forefinger. The other one has a swastika for a center. Whitlock Collection

¹"Jade: A Study in Chinese Archaeology and Religion." Field Museum of Natural History Publication 154, 1912.

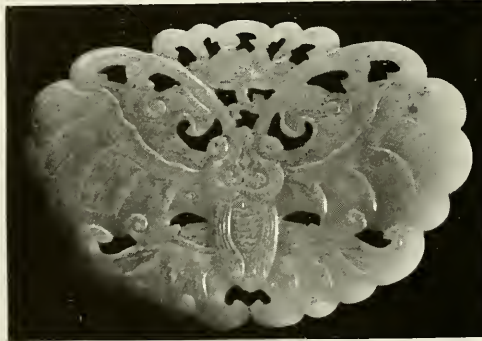
have been handed down from very ancient times, Chinese artists have learned to express these designs in highly conventionalized treatment. In no instance is this more obvious than in the treatment of the dragon in carved jade. His sinuous body has taken on angular bends or perhaps more frequently has divided and branched like a heraldic mantle. His feet have disappeared, or where present, the toes sometimes spread like the spokes of a wheel, the claws joining on to each other in a circle. Often a dragon holds or supports a round object like a pearl, which really represents the sun, phototype of the *Yang*.

Often associated with a dragon in designs of carved jade, is the phoenix, a highly conventionalized bird which ordinarily symbolizes prosperity. The phoenix, however, also stands for passionate love and is consequently an appropriate and symbolic love gift.

Much the same symbolism is attached



A SYMBOL OF IMMORTALITY
Highly conventionalized butterfly
carved from white jade



TWO AUSPICIOUS SYMBOLS
A peach blossom, also symbolic of immortality,
has been made a part of this butterfly design

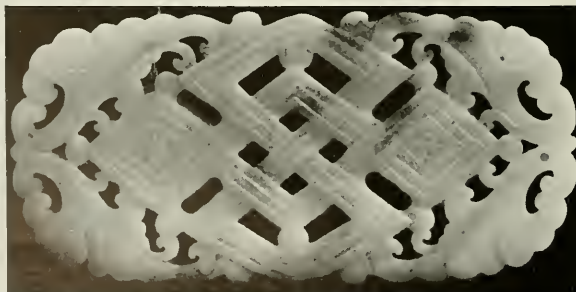
lizard, snake, spider, toad, and centipede. Sometimes these five are represented together in carved jade in an amulet known as the "Five Poisons."

When Buddhism was introduced into

China from India in the Han dynasty in the first century of our era, it brought with it a very interesting series of symbols, known as the "auspicious signs," most of which were said to have been stamped in the footprint of Buddha. These Buddhist symbols were favorite forms

among the lapidaries of the Kien Lung period, and are often met with carved in white jade of that epoch. One of the most characteristic of them is the Wheel of Life, a disk represented within a disk, often

THE MYSTIC KNOT



A very popular Buddhist symbol, carved as a buckle in white jade.

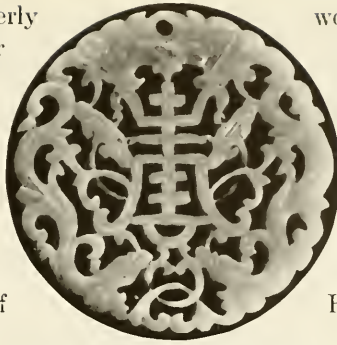
Note the swastika in the center of the closed loops. Whitlock Collection

wrought with a very cleverly executed movable center about which the whole device may be turned. In this way we have the so-called "prayer wheels" dear to the hearts of Tibetan Buddhists in whose reverend fingers they revolve, in a measure taking the place of the bead rosary. The "spokes" connecting the two disks may number six or eight and the design of the central movable disk may represent the swastika, or the immortality symbol, or even the mystic *yang yin*.

Another very popular auspicious sign is the lotus, either represented with its leaves, embellishing other designs, or growing from a jar or vase, the jar being yet another of the eight treasures of Buddha.

A symbol much in favor is that "mystic knot" which is represented as having no beginning and no end. Not only was this sign one of those found in Buddha's foot-print, but it is also said to have appeared on the breast of Vishnu. The Chinese, who love to ascribe auspicious meaning to their symbols, sometimes call it the "Knot of Everlasting Happiness."

Returning to the Taoist type of symbols,



THE HAPPINESS SYMBOLS
Note the "bat of happiness" above the "happiness" character



This girdle pendant illustrates another variation of the happiness character surmounted by the bat of happiness



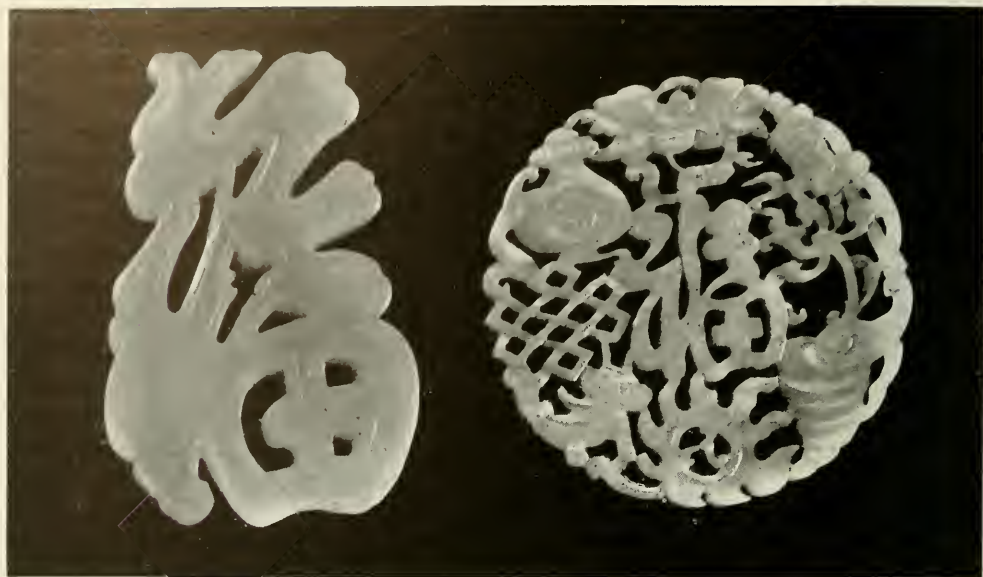
The simplest form of the happiness character

we have the magic gourd, sometimes depicted alone and sometimes accompanied by a monkey. In the legend of the monkey that became a god this famous gourd was the prized possession of the Demons who opposed Sun Hou-tzu, the Monkey Fairy, and his master, and was capable of containing a thousand people. Sun by a clever device exchanged it for a worthless gourd, which he made the Demons believe could contain the entire universe.

Because butterflies symbolize immortality in Chinese, as they do in Greek mythology, carvings of butterflies were buried with the dead, and no doubt the beautiful white jade butterflies of the K'ien Lung period are survivals of a symbol handed down from Han time. Like most of the other Chinese carved forms they have become highly conventional, often with peach blossoms and swastikas represented on the extended wings.

In the midst of the Western Paradise on the border of the Lake of Gems is the orchard of immortal peach trees whose fruit ripens every six thousand years. These celestial peaches have the mystic virtue

It is surmounted by the sun disk between dragons



WHITE JADE GIRDLE PENDANTS

Carved with the luck character. To the left is shown the character unembellished, on the right it occupies the center of the design surrounded by a gourd, a mystic knot, a sun disk, etc. Whitlock Collection

of conferring long life, and thus by eating them the Immortals renew their immortality. That is why the Peach of Immortality is so often carved in jade, and why the immortal peach blossom is such an auspicious symbol.

Almost equally auspicious as one of the magic emblems of Taoism, is the Fungus of Immortality which was supposed to grow only on the sacred mountain Hua Shan in the province of Shensi. The contorted and involved shape of this miraculous plant lends itself well to the designs of girdle pendants and it was often carved in the white jade of the K'ien Lung period.

Not only are the Chinese fond of auspicious symbols, but they love a rebus, or as we would say, a pun. The Chinese word for happiness is *fu*, and the same word pronounced a little differently means a bat. So a carved bat becomes a symbol of happiness, and is very generally used either alone or combined with other favorable symbolic designs. Should you meet a design involving *five* bats you are to read it as meaning the "Five Happinesses,"

that is to say "Old Age, wealth, health, love of virtue, and a natural death."

It would probably never occur to any one but a Chinaman to use the somewhat complex graphic symbols of the Chinese language in a decorative way. And yet treated conventionally, as the Chinese treat all of their designs, these characters are capable of developing into balanced and well proportioned decorative forms.

One of the oldest as well as one of the most decorative of these "Sho marks" is the character that stands for longevity, or to give it a more mystic significance, immortality. The figure on page 498 shows the modern Chinese character for longevity and a series of its conventionalized variants mostly derived from jade carvings. This seems to be a favorite symbol for use as the movable center of the "prayer wheels" mentioned a few pages back.

Another character very popular with the carvers of girdle pendants in white jade is that which signifies happiness. This is, of course, often combined with

the happiness bat, as well as with dragons and other auspicious symbols. An interesting variation is the "doubling" of the symbol by representing two happiness characters side by side, adjacent parts being connected.

The jade pieces carved with this "double happiness" are appropriate gifts for newly married couples, and convey a wish that their union may be a long and felicitous one.

A somewhat rare conventionalized character in carved jade, rare because it does not lend itself readily to symmetrical

design, is the one that signifies luck or good fortune. In the writer's experience it has been used either alone, without decorative embellishments, or in a somewhat haphazard assemblage of symbols.

Certain designs lend themselves specially to the smooth, rounded contours of fingering pieces, such as are dear to the hearts of contemplative Celestials, who love to sense their cool, delicious feeling through what is to an Occidental the least developed of the senses. Perhaps if we cultivated a love for jade fingering pieces we would think more. Who knows?



A LARGE BUTTON OR STUD CARVED FROM WHITE JADE WITH A HIGHLY CONVENTIONALIZED "SWIRLING" FLORAL FORM, IN THE CENTER OF WHICH IS THE FAMOUS "YIN YANG" MARK.
WHITLOCK COLLECTION



The Early Winter's Snows Had Completely Obliterated the Old Trails

A WINTER JOURNEY IN THE CANADIAN ROCKIES

The Lure of the Great Frozen Wilderness
That Lies "North of Fifty-four"

By MARY L. JOBE AKELEY

PHOTOGRAPHS BY THE AUTHOR EXCEPT WHERE OTHERWISE INDICATED

AFTER my first effort to scale Mt. Sir Alexander in northern British Columbia, I made another attempt on the mountain and a somewhat extensive reconnaissance about the lakes of Jarvis Pass the next summer. Although on this second climbing expedition, after several trials a point about two hundred feet from the summit had been reached by our party, the ultimate peak—a sheer, overhanging snow cornice in a state of avalanche—afforded neither hold for ice axes nor solid footing on what we believed to be the one feasible line of attack. We therefore decided that until conditions on the summit should change it was useless to try further.

A few years later H. F. Lambart, of the Canadian Geographical Survey, after a

careful reconnaissance of the peak by airplane, said:

"Mt. Sir Alexander will never be climbed. It is an absolute knife edge of snow, not even corniced along its full length."

That was how the great peak impressed him at an altitude of two thousand feet above its summit. However, this prediction did not prove true. In 1929, Dr. Andrew J. Gilmour, Newman D. Waffle, (who lost his life while attempting to climb Mt. Robson in 1931), and Helen I. Buck, all of New York, scaled the peak in their second attempt, following a route along the west face which differed almost entirely from our old line of attack. This first ascent required twelve hours of extremely arduous climbing along a most

hazardous route that led them below and beyond the great snow cornice, which to us had appeared as large ice grottoes, to the ultimate summit, where they found scant footing on the crest so narrow that, as Doctor Gilmour says, "with utmost care two persons can barely stand side by side." Thus was Mt. Sir Alexander finally conquered by three of the most skilful, experienced, and intrepid mountaineers in America. A complete account of this ascent was published in the *Canadian Alpine Journal*, 1929, Vol. XVIII.

Following my two expeditions and prior to the conquest above noted, my interest in this new and impressively beautiful country "north of Fifty-Four" did not wane. Like all who find their greatest joy in the wilderness, I determined to return at my first opportunity and visit the area between the headwaters of the Fraser and the Peace. I hoped, if possible, to view these great solitudes when enveloped by the silence and snows of winter. My chance came in an unexpected way. Suffering from the aftermath of the influenza scourge, which to my great and lasting sorrow had claimed my companion, Margaret Springate, as a victim, I was ordered to the mountains one early autumn to recuperate. Here at last was my desired opportunity to make a winter trip, and though far from fit, I determined to undertake it. I was fortunate in securing the services of the veteran guide, Donald Phillips, whose assistance had been so valuable on our previous expeditions. He was preparing to take in supplies for a scientific expedition to the Wapiti River under the auspices of the Smithsonian Institution and I joined their forces.

Our line of travel may be described as follows: starting at Robson Pass, our route lay north down the valley of the Big Smoky, across Jack Pine Pass to the West Jack Pine. Thereafter it led along the headwaters of the Fraser Smoky to Sheep Creek Pass and thence to the Porcupine. Approaching Mt. Sir Alexander from the northeast, we traveled north to the Porcupine and to the Wapiti. On our way north we crossed twelve high summits or passes, ranging in elevation from 5000 to 8100 feet. The distance we estimated at approximately four hundred miles.

This expedition enabled me to study and photograph the Northern Canadian



MT. ROBSON

A brilliant aurora illuminated the camp at the base of the highest peak in the Canadian Rockies



THE VIEW FROM JACK
PINE PASS

Great cumulus clouds lay in the dark valley of the Beaver. They lifted and fell in the wind as if moored by unseen cables to the tree tops

utterly and golden autumn was now in rapid flight. Nature, though quickly submitting to the heavy hand of the great Frost King, was still in violent and rebellious mood. All in an hour the world was sup-reddened, snow-drenched, and sleet-

smitten. Surely this season of caprice and startling change preceding the monotonous below-zero weather of winter was sounding a warning note to all sluggards to retreat to the southland, and at the same time with a compelling voice was calling forth the restless to adventure. It seemed too good to be true

Rockies in winter time and to extend somewhat our knowledge of the country north and east around the sources of the Porcupine and the Wapiti Rivers. The actual problem of accomplishing such a winter journey in the high mountains, and the unusual conditions which there confronted us among the valleys, alp-lands and peaks, during nearly four months in the wilderness are the chief subjects I wish to present here.

As we left Robson Station for Mt. Robson on the tenth of October all the Red Gods smiled upon us. No other time in the year could have been more alluring than this day in late fall in the Canadian Rockies when our little outfit of thirteen horses hit the trail leading among the yellow poplars on the flats and the flaming Arctic bear-berries on the lower mountain-sides. No longer were they mountains of green forest, gray rock, and white snow. They were literally ablaze with color, from the frost-touched lower reaches of vegetation across the variegated rocky cliffs up to the sun-kissed, rosy peaks. On the days immediately following, the whole world seemed everywhere rife with action and uncertainty. Dazzling sunsets, mysterious auroras, heavy thunderbolts, and dense snow-storms crowded upon each other. Summer had vanished



A FRESH SNOWFALL ON JACK PINE
Sunrise on the Jack Pine turned the snowy corrugated peaks to faintest rose

HEAD OF THE BEAVER
RIVER

Dark blue shadows lay thick in the snow-filled valley of the Beaver, which at most seasons was the abode of almost perpetual rain and snow

that I should be on the trail again, my face set toward the northern wilderness.

Beyond Mt. Robson and Mt. Bess, I considered Phillips' knowledge of the little known region absolutely essential to success and safety in travel. Here the trails, still few and dim and far between, were for the most part those which Phillips himself had made only a short time before. The pack trains of our previous expeditions had left so slight an impression as they had traveled for great distances along the dry and heather-grown Alpine sum-



mits, that even a skilled guide, unfamiliar with the topography of the country, would have found great difficulty in picking up our former routes. Furthermore, Phillips was a safe guide for the difficult winter travel we were sure to encounter.

The beautiful Indian summer sunshine of our first day on the trail and a night of brilliant aurora at Robson Pass quickly gave place to a cold, biting rain through which we traveled the next two days. It finally came down in such a deluge that we had to wait over a day in camp. But this "storm staid" camp had its compensations in the spectacular at least. After thirty-six hours of steady downpour the rain suddenly turned to snow in the early morning. I shall never forget my view of Mt. Bess in this tempest. The lofty white peak, seemingly but a few rods away from us, stood out vividly against the gray background of the sky, while the driving snowstorm, as heavy as an April downpour, with rain drops becoming snow drops and falling with a splash and thud, spread a thickly dotted veil between us and the impressive peak.

It was now evident that even this light snowfall of two hours' duration would impede our progress greatly. Phillips had expected to reach the Wapiti before the



STRENUOUS DAYS

Donald Phillips tearing out a frozen beaver dam in order to get the outfit across



A HAZARDOUS BUSINESS
The cayuses are crossing a half-frozen muskeg reinforced with spruce trees

miles—a maze of snow- and ice-covered ridges and rocks gleaming in the brilliant sunlight. But it was at the summit, as I waited for the pack train to overtake me, that the full beauty of the scene was revealed. Behind and below me lay the dark, wooded valley of the Beaver, at most seasons the abode of

first deep snow fall. With his intimate knowledge of winter conditions in the mountains, he well knew how much it would increase the difficulties of taking a heavily packed outfit more than one hundred miles into the interior and across many high passes and dangerous summits. He also realized that we might be snowed in. Until now we had been making long drives at good speed. But now our good going was obviously at an end.

At 10:30 as the storm ceased and the men began to pack the horses I started on ahead in order to secure some photographs from Jack Pine Pass. The wet snow encrusted everything profusely,—tree, bush, plant, and rock—from tree-line up to the pass itself. It was indeed fairyland through which I cautiously picked my way for more than two

almost perpetual rain and snow. Today it had drifted full of great cumulus clouds lifting and falling gently in the eddies of the wind as if moored by unseen cables to the tree tops. Among the mountains stretching to the northern horizon, the main Jack Pine River, black and serpentine, meandered through the winding, snow-filled valley. Directly along my path an enormous black wolf had traveled ahead of me only a little while before. His tracks were six inches across and had been frozen in the crust not more than an hour ago. Perhaps he was the solitary old fellow who on a previous trip had followed our outfit for several days

NORTH OF "FIFTY-FOUR"

Mt. Sir Alexander and the sea of unclimbed peaks from airplane. Mt. Mary Jobe (named by the Canadian Government for Mary L. Jobe Akeley) is in the right background



Royal Canadian Air Force Official Photograph

Courtesy Department of National Defence, Ottawa

PRECIPITOUS SLOPES

Showing the cliffs among which the party had climbed in darkness the night before

across these same mountains and had howled persistently about our camp in the night time.

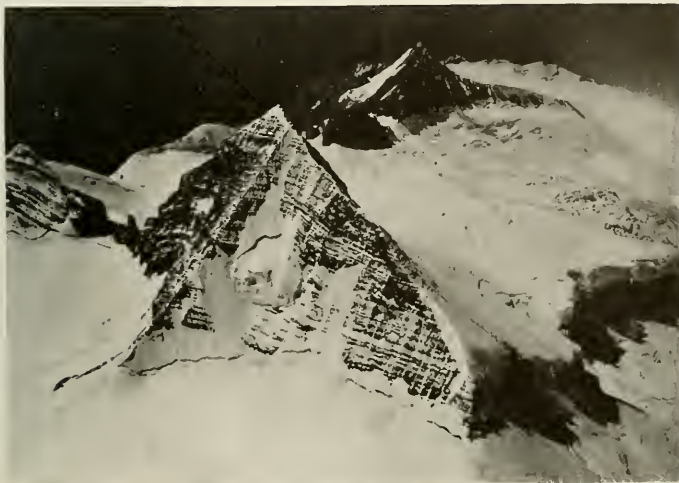
Of more immediate interest was the way our pack train crossed the pass. It was amazing to see the horses negotiate the abrupt two-thousand-foot descent into the valley. Often I found myself peering over the edge into space. It seemed almost improbable that the cayuses would venture down such an incline without the greatest urging. But they did it without a single shout from their master. After stopping a moment to look the route over carefully, these astonishing animals began the descent as cautiously as would a skilled and careful climber. In the worst places they seemed to enjoy the excitement of doing the thing deliberately without losing their heads. No one can travel in the hills by a pack train disciplined and proficient as this without feeling a debt of gratitude to the patience, intelligence, endurance, and skill of the mountain cayuse, as well



as to the man who has prepared them for the test. I have seen old "Wendy," the lead horse, climb in safety without shifting her load or loosening a cinch, where a man would hesitate to go without using his hands. My hat is off to this noble beast of burden who has made possible every one of my eleven journeys in the high mountains.

That afternoon another blizzard hit us; fortunately it had not overtaken us while we were crossing the Jack Pine Pass. Phillips' assistant, Jack Hargreaves, a good-natured and manly young fellow, displayed his unselfish character in every emergency. The moment we reached

camp he was hard at work, never stopping until the last chore was done. At first, making camp was a simple process. We had each appropriated



MT. SIR ALEXANDER

An airplane photograph of the mountain which Mrs. Akeley was the first to attempt to climb. The narrative of this exploration was told in the May-June number of *NATURAL HISTORY*

*Royal Canadian Air Force Official Photograph
Courtesy Department of National Defence, Ottawa*

a big spruce tree at night and had unrolled our sleeping bags on the thick mat of dry needles underneath. But after the first snowfall it was necessary to pitch an Indian tepee, which served as our common living quarters during the day and protected the grub panniers and sheltered the men at night. During bad weather when the storms drifted the snow deeply under all the spruce trees, my own sleeping shelter was a little silk *wickiup*, or lean-to, set up like a half-tepee. When pitched at the proper angle, it excluded most of the rain and snow, and on the stormiest evenings it was made cozy by a big fire in front. During nights when the mercury sometimes fell below zero, my Alaskan eiderdown bed, warmed earlier in the evening by heated stones, kept me as comfortable as I could wish. My little *wickiup* spoiled me completely for living in a tent. Affording all the protection of a tent, it offered the advantage of

allowing me each night to view an illimitable world of forest and mountain and sky. About my little camp the great, friendly trees stood guard; to the ancient mountains I "lifted up my eyes" and in their strength and majesty I caught the essence of peace and courage; while, as I sometimes lay for hours watching the stars in their round—the Great Bear in his gigantic stride about Polaris, Cygnus in swift flight across the heavens, the mysterious aurora fitfully search-lighting the blue vault, the completeness of the universal law impressed me anew:

The very law that moulds a tear and
bids it trickle from its source,
That law preserves the earth a sphere and
guides the planets in their course.

The following morning the landscape was everywhere white and beautiful. Dark blue shadows lay thick in the snow-filled valley and here and there stretched upward through emerald green forests to

a white and massive corrugated peak just turning to faintest rose in the early onrush of the sun. As we traveled well below tree-line I noticed protruding through the thin snow a few belated buttercups and painted cups—the pale afterglow of summer. All other flowers had vanished. Everywhere the slides—but lately covered with rank growing flowers—lupines, columbines, forget-me-nots, Silenes, Dryas, and a myriad others—were but a gray waste. Even the flaming scarlet Arctic bear-berries had turned to a dreary brown; while the willows, a week or



THE CALL OF THE HIGH MOUNTAINS

Mrs. Mary L. Jobe Akeley, who
is shown above, has made nine
expeditions to the Northern Canadian
Rockies



A FOOT OF SNOW IN ONE HOUR

Near Sheep Creek Pass the party experienced a snowstorm during which, by actual measurement, a foot of snow fell in one hour. The falling snow shows plainly against the tent and the figure of Mrs. Akeley in the foreground

so ago a mass of gold and bronze, now stood out dark and naked above the deepening snow.

We now faced strenuous days. Fording and re-fording the winding Jack Pine, crossing the Middle Fork in a high stage of water where Phillips delayed two hours to tear out a large frozen beaver dam in order to make our crossing possible, traveling thereafter through heavy drifts of snow across a high summit and down a precipitous descent to the West Branch of the Jack Pine, we at last struck out to the highest and most formidable summit of our entire journey—a summit 8100 feet in altitude which separates Big Smoky waters from the Fraser Smoky on the British Columbia side. To cross this summit on the Great Divide proved one of the most difficult and spectacular events on the trip. It was four in the afternoon when we reached the West Branch of the Jack Pine. Fearing another snow-storm might occur that night, easily making it impossible for us to cross this high summit,

we determined to attack it at once even though the hour was late. From our 5000-foot elevation at the river the route led up to a ridge 3000 feet above. Beyond that was a long descent to tree-line, before we could camp for the night. High up on the mountain it was still light and we climbed as fast as we could out of the shadows. After an hour and a half in snow which deepened at every step we had just struck very steep going above the last scrub, when "Blue," a pack horse that was out of condition, and that had been hanging behind on all the steep places, now suddenly refused to move. The men shifted "Blue's" load to Jack's saddle horse, but the exhausted horse still refused to get in line. He required the greatest urging.

Shortly after six o'clock, darkness and a violent snow squall swooped down upon us simultaneously. All about the snow was drifted terribly. At times I floundered through drifts quite to my waist. If the horses had not broken out the trail, I

could not have made a yard of headway. They were displaying the greatest effort, while I knew Phillips on foot at the head of the outfit must be having a serious time.

The darkness now became so intense as each moment the snow fell thicker and faster that I could not recognize the horse immediately ahead of me. Earlier I had tied up the halter shank on my saddle horse because he had plunged so violently through the drifts that I was afraid he would strike me. Now he was completely lost to sight in the storm. Occasionally I could hear Phillips shouting to give us our bearings, but his halloos sounded far away, subdued by the angry voice of the storm. As we fought our way upward through the ever thickening night, it grew bitterly cold. The wind struck us in a fury. Although I was warm from the exertion of climbing, my clothing was so saturated with snow that whenever the pack train halted my hands and feet became numb almost immediately. A few hundred feet below the crest of the ridge it became necessary for both Phillips and Jack to go to "Blue's" rescue. They tied him to the tail of Phillips' saddle horse and poor old "Roanoke" thereafter literally dragged the worn out cayuse up the mountain-side. While the disheartened horse was being rescued, I utilized the halt to search for my saddle horse, rub enough feeling into my fingers to untie my mackinaw coat from the saddle and pull it on over my frozen shirt. The raging storm now subsided for a moment and we had the cheering sight of a long, level summit just ahead. It was now 8:30—we had been fighting the storm for four and a half hours—and I was weak from hunger. All at once I began to think I could go no farther. But I did and finally reached the top. Once more the snow enveloped us. Suddenly I saw Phillips stop near by, then disappear

in his tracks. In a moment he reappeared plunging about violently. Afterward he told us he had stepped through a snow cornice and had immediately found himself dangling in space. He had been saved by old "Roanoke" who had braced himself against the shock and then had deliberately pulled back on his halter shank, hauling his master upward to secure footing. The danger of traveling in the dark along this narrow summit was all too obvious after this close call. We halted, waiting for a break in the clouds. It came finally but briefly, and Phillips realizing the peril of attempting to descend into the valley of the Fraser Smoky, cautiously led us down through a maze of cliffs and gullies toward tree-line again on the Jack Pine side. We had not made our pass after all! As we slowly climbed down, the clouds shut in on us. What looked like a straight stretch of snow ahead of us often proved to be a perpendicular drop. Time and again I missed my footing and fell headlong in the darkness.

Very much alive, we finally made camp that night at 10:30, just below tree-line on the steepest side-hill I had ever camped on. I kept a big fire of dry spruce boughs blazing while the men unpacked; and when I turned the horses loose, it was so cold that the halter snaps froze to my fingers and I had to shake them loose. No evening meal was prepared that night. Hot soup and a fairly level place on which to stretch out was all that any of us wanted. Phillips cut down half a dozen spruce trees, piled them up and thus leveled off two spaces. Sheltered by the dense, drooping branches of my tree, I soon crept into my sleeping bag and sank into broken sleep, glad to see the end of a day which had begun *eighteen hours before*.

The following morning was cloudless—as calm and beautiful as if no storm had ever raged in these snow-silenced hills.



ON THE GREAT DIVIDE

Crossing this 8100-foot summit in a heavy snow storm proved a serious undertaking

Again we climbed through the drifts 2000 feet back to the summit. With wholesome awe we looked upon the cliffs among which Phillips had led us in safety the night before. We found the summit a sheet of glare ice. It required the utmost care of both man and beast to keep a footing on the long and narrow descent.

As we reached tree-line we saw where the wild people of the hills had been taking their morning exercise. Here half a dozen black-tailed deer had bounded along at a wonderful gait across the open, side by side. A little farther on a big bull moose had joined them, shaking the heavy snow off the lower branches of the trees with his broad antlers as he ambled on. Near him had walked a cow and calf. Here a pair of foxes had trotted along behind the procession and a wolverene had emerged a little way from the timber into the open and then had backtracked on his trail; while all about in the thin snow under the trees many mice and Douglas squirrels had scampered to and fro. About noon we

came upon a herd of caribou on a wide plateau. Eighteen of these beautiful creatures—several of them carrying fine antlers—were digging through the snow in search of the still plentiful and slightly green forage of the high meadow. They gave little attention to us until we were close upon them and then they stampeded but slightly. In fact one large bull trotted ahead of us for nearly half an hour and finally climbed up to a ridge near by where he stood watching our entire outfit pass a few rods away.

For the next ten days we traveled north. For a week we climbed up and down across high snow passes—5000, 6000, 7500 feet in altitude they were—under conditions similar to those previously described. We had to shovel out snow for our camp ground at night. Each morning we broke ice on our canvas water pails and sometime during each day the snow continued to fall. The snow was now everywhere packed and deep and beginning to show blue-green in every crevasse



THE FALLS OF THE PORCUPINE

On the return journey the party was overtaken here by a chinook in which much of the snow quickly disappeared

and in the deep imprints left by our horses' feet on the upper levels. My clothing was always wet or frozen.

We now replaced our hob-nailed climbing boots with oil-tan shoe pacs, fitted with excellent brakes of trap-chain, in which we wore three pairs of ordinary wool stockings and a pair of lumberman's heavy socks. We were thus well equipped for ice and snow and to wade many a stream and to walk miles of muskeg.

There is space here to recall but a few high spots in the remainder of the journey. Beyond Sheep Creek Pass, by actual measurement, *we had a foot of snow-fall in one hour.* Across the three long miles of Surprise Pass, 7000 feet in altitude, the pass Phillips had dreaded most of all, we fought for every step we made.

The drifts were appalling; a biting north wind chilled us through and through, and, most serious of all, a blizzard overwhelmed us. How Phillips led us in safety is still a mystery to me. "I can go across Surprise Pass blindfolded," he had said, and I know it was actually true. This master of woodcraft with an amazing instinct in the wilds had learned the topography of the region just by crossing the pass once before. All along the long undulating pass to the Porcupine, the snow was deeply drifted. Phillips had not once sat in his saddle since leaving the Jack Pine. He had broken trail incessantly. I now begged to go ahead on my horse and break out the drifts, for I remembered this part of the country well and our route was easily followed. Old "Pet," my horse, now did valiant service. Rearing on his hind legs a little at each step, this noble animal broke out with his front feet drifts that were shoulder deep and thus for two hours relieved Phillips of his grilling task. There may be some people who do not love a horse, but it happens that I am not one of them.

At the end of October we reached Mariel Lake, ten miles from the base of Mt. Sir Alexander, and in range for our only possible view of this mountain. I waited our approach to this vantage point with the greatest eagerness. Any clear weather we had usually occurred between twelve and two o'clock. To my great delight, at about 1:30, as we reached a tiny lake north of the peak the massive snow peak was easily discernible. It was cloud-hung about its lower ram-parts as it usually is even in the most favorable weather, but its magnificent icy summit shone rosy pink above a dark-blue cloud-bank, as the long rays of the slowly retreating sun illuminated this Monarch of the North. Everywhere about us the winter's snow caught the reflected glory of the eternal snows on the great mountain itself. For a few brief moments

the earth was enveloped in a rosy mist and we gazed in awe and reverence upon this marvelous display of Nature's handiwork. In half an hour the sun had vanished. It had shone longer than at any other time since we had left the Smoky.

At length we reached the pass to the Wapiti, our last pass. Here one evening just at dusk a month before, Phillips had rescued one of his men from a pack of six black wolves. The man had been out in search of a lost horse and had been surrounded and cut off completely from camp and after he had fired his last cartridge. Near this pass a month later, when on our return trip we were traveling along one evening just at twilight on the frozen river. Ahead of me were Phillips and two pack horses while right behind was old "Blue," still weak and "going empty." I suddenly noticed half a dozen objects darting back and forth across the wide expanse of snow-covered river ice a hundred yards or more ahead. Then I heard Phillips fire his rifle. Immediately the dark objects ran back toward me and then into the heavy spruce forest along the river bank. They were six black wolves. There just in the edge of the cover I soon saw them sitting on their haunches intent upon our movements and whining and yelping in great excitement. Phillips shouted to Jack to drive up the outfit while he held his gun on the pack. Then we all went ahead as speedily as possible and in an hour were in camp. That night Phillips made a rope corral for his horses and he and Jack put their bed rolls near by. Every once in a while we heard the wolves as they made noisy bivouac, close at hand. Phillips cleaned and loaded my 30-30 and handed me an extra box of cartridges as I said good night. About midnight, I was awakened by hearing someone build up my fire. My *wickiup* had been pitched as usual a considerable distance away from the main camp in the edge of the forest and I had gone to sleep with a

big fire burning, as that night the mercury fell to forty below zero Fahrenheit. Now I saw Phillips stoking up the fire.

"The wolves seem to be pretty hungry. You better keep your fire going," Phillips said. And "I think they're after old Blue," he added as he floundered back through the snow to his outfit.

The wolves were near enough now. I could hear them whining and yapping just as they had done in the early evening. Both men now began a patrol of the camp, as the wolves became bolder. However, one doesn't borrow trouble in the wilderness. With two good hunters on guard, I soon fell asleep again, rousing but slightly as one of the guides came over now and then to build up my fire.

Finally, at the end of *our fourteenth day of storm*, and three weeks after leaving



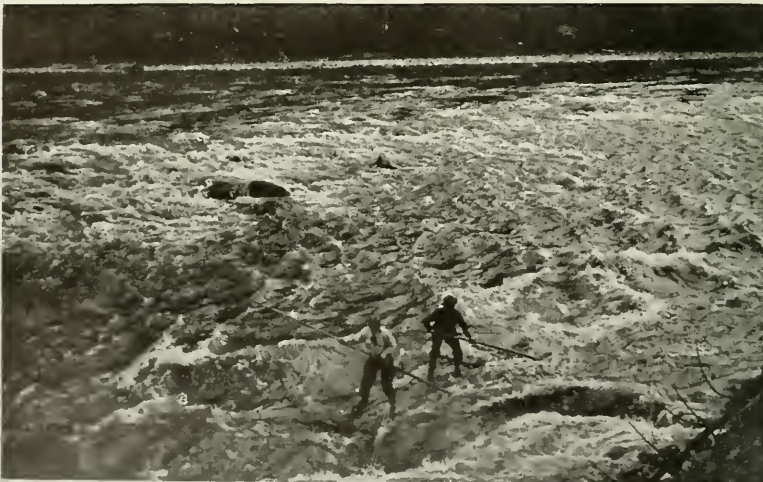
MRS. AKELEY'S SLEEPING SHELTER
Mrs. Akeley camped in this little *wickiup* at sixty degrees below zero

Mt. Robson, we reached our destination on the Wapiti. Though during our first week we had zero weather it was succeeded by a lovely chinook which made possible a considerable stay and the rather thorough investigation of the area drained by the streams of this watershed.

There is no space here to tell of our return journey by way of the Porcupine, Sheep Creek, and Grande Cache to Entrance and Jasper, through the lower foothills where our days of hardship and adventure were supplanted by the quietude of comparatively easy travel; of how we swam our outfit across the swift flood of the Big Smoky in the midst of slag ice to where a numerous band of Crees waited for us and gave us of their hospitality; nor how during the early December days the mercury continued dropping until at Christmas time it finally

reached sixty below zero Fahrenheit, and I had for the first time the experience of sleeping in the open in a really low temperature and of learning how easy it is to be comfortable in light woolens, smoke-tanned moccasins and buckskin.

Even in the face of three months of rather untoward events, I was able to add somewhat to my knowledge of the Northwest and I found again the health which I had gone so far to seek. And as I said farewell to my long-loved mountains and the peace and solitude that in them dwell and turned reluctantly, as usual, toward cities and the noisy throng, I found myself treasuring in my heart, just as I do today, the memory of a new act in Nature's great unfinished drama, which a winter in that fragment of the boundless frozen North had revealed to me.



PHILLIPS AND HARGREAVES SHOOTING THE RAPIDS OF THE BIG SMOKY IN ORDER TO OBTAIN A DUGOUT CANOE IN WHICH TO FERRY THE OUTFIT TO THE GRANDE CACHE SIDE



A Welcoming Group of Ongies on Little Andaman Island

NATIVES OF THE ANDAMAN ISLANDS

A Pygmy People Who Lead an Isolated and Idyllic Existence
in Their Island Homes in the Bay of Bengal

By C. SUYDAM CUTTING

Trustee of the American Museum

AGES ago, when the maritime people of India first came into contact with the Andaman Islands, they called the local aborigines by a Sanscrit name that meant "monkey people." From this name the present word Andaman was derived. So few are the early records of these islands that we can only suppose that this archipelago was rarely visited by seamen. For centuries, since prehistoric times, in fact, these islands have remained out of contact with the general march of South Asiatic civilization. So bitterly did their population resent the intrusion of foreigners that, today, they remain literally as primitive as they ever have been.

Racially, the Andamanese belong to the negroid race and can be classed as true pygmies. Formerly, anthropologists believed that all negroid races once upon a time migrated from Africa. Today, although this theory is not entirely disproved, it is believed there once existed a negroid people well distributed in south-eastern Asia and indigenous to the country. To this race, now nearly extinct, the Andamanese must have belonged. Probably they inhabited the southern

part of the great Indian peninsula in a pre-Druidian period. With the advent of the latter people they may have been largely exterminated, and some of their survivors found their way south by sea to their present isolated abode.

As pygmies, the Andamanese may be compared to very small similar peoples living in Malay, the Philippines, and the Belgian Congo. Since characteristics of all races are indubitably due to their environment and possibly food, one could ascribe these same elements as the cause of the very short statures of all pygmies. The Andamanese are living in an age previous to that of agriculture and metals. It is true that nowadays they have some metals, but these have filtered to them from the present colony formed by the British at Port Blair. Except for this source, they would have no metals at all. So primitive is the life of the Andamanese, so little have they of what we understand as worldly goods, that it is really surprising how well they get along. They are of two types—those living along the shore and truly amphibian, and those living in the midst of the dense tropical jungle of the interior.



PYGMIES OF LITTLE ANDAMAN

Mr. Glasson, the government forest officer standing with the group, is 5 feet 10 inches tall

The coastal people are, in part, fairly friendly to visitors, but those in the interior, the Jarawa tribes, are fiercely hostile. Early records all show that the enmity to strangers of all Andamanese was unsurpassed. This must have been due to the fact that natives from the mainland, while stopping at the islands, often carried off some of their numbers to be sold elsewhere as slaves. Up to the present all attempts to make friends with the interior tribes have failed. Frequently they made raids on the settlement with the primary object of collecting metal. Today, however, these raids are few, due to the efficient reprisals against them by Government punitive expeditions.

Let us consider the lives of those natives that make their home along the littoral of the North and Central Andamans. Their food supply, which is abundant, is composed of fish and roots, the latter dug up in the jungle, and the fruit of the screw palm. A small part of the jungle right beside the shore is cleared, and tiny thatched houses, hardly more

than lean-tos, are set up in a semicircle. These villages are only of a temporary nature as the natives are forever moving from one place to another. After one site has been inhabited for a certain length of time, the common village smell becomes so offensive that a general exodus takes place to another likely spot. As there is no overcrowding of population, there is ample room in the islands for everyone. Likely sites for villages are easily found, as practically all the littoral is bordered with a clean, sandy beach.

The clothes of the Andamanese are very meager and easy to make from the natural resources of the jungle. Any ornaments they may have, such as beads, have filtered like metal from the settlement at Port Blair. Domestic articles are few—merely wooden receptacles for holding water, and a species of basket work. Knives of all sorts are made from the fine hardwood trees in the jungle and can be used for everything from making their dugout canoes to shaving the hair in the



ANDAMAN HOMES

Tiny thatched houses, set up in a semicircle in a clearing beside the shore, form the shelters of these small peoples

center of their heads to form a broad part. The main efforts at industry are in the making of articles to obtain food.

As stated before, these people are quite amphibious. Travel by water is done entirely in small dugout canoes with a light outrigger. They are astonishingly expert in the handling of these boats and can paddle and maneuver them with ease at high speed. From these dugouts, hunting by spearing of turtle and dugong (a manatee running in length from eight to nine feet) is continually practised. The spear, about fifteen feet long, is tipped with a removable barbed point. This latter is attached to the end of a line. When the barb has entered the body of the quarry, the spear shaft comes loose and can be retrieved as it is floating on the water.

When hunting dugong, the spearman often has to hurl his spear a considerable distance. In such an instance he will himself leap out of the canoe as he makes his throw. From the moment he hits the water his movements must be fearfully rapid. At the sting of the sharp point which penetrates deep through the soft skin of the dugong, the latter starts off in the water at full speed. Carefully has the spearman seen to it that there is ample slack to his rope for, as this is rapidly being taken up, he must retrieve his spear-shaft from the water and climb back into the bow of the dugout. Hardly has he



MR. CUTTING WITH TWO ANDAMANESE NATIVES

The scant clothing of the Andamanese people is only such as can easily be made from the natural resources of the jungle

gotten back than off they all go, dragged by the dugong. The dugout's crew is comprised of two or three men, and wonderfully do they preserve the equilibrium of the frail craft during the dugong's rushes. The latter are strong, fast swimmers, and considerable time may elapse before the strain of the pull will wear them down. Like turtles, they are hunted in shallow water, about five or six feet deep, as they are both bottom feeders off the coral. Sometimes the dugong in his rush may make for the open sea and reach deep water. Should he



A SIMPLE FORM OF FISHING

The use of bow and arrow is popular for fishing, and boys are trained from an early age to shoot with diminutive forms of these weapons

then sound, the situation may become impossible and the rope must be cut.

As the most appropriate time for hunting is by moonlight, the dugong is not killed immediately after his capture. The animal is brought to the shore and there kept fast by ropes till the next morning when he is killed and eaten. From our standpoint of sport, this moonlight hunting in a dugout would certainly come into the classification of a major one.

A PRIZE CATCH

Dugong flesh provides a staple article of diet for the Andaman natives. The dugong is usually hunted by moonlight and dragged to the beach where, the following morning, it is killed and eaten

Turtle hunting, also best done by moonlight, is very much easier. To begin with, there are many more turtles and as they are usually speared at close range they do not necessitate a leap into the sea at the moment of spearing. It certainly does credit to these Andamanese that they can, with so little difficulty, penetrate the thick hard shell of a forty-to-fifty-pound turtle. After being speared, like the dugong, they will start right out pulling the dugout through the water, but they are very different animals, with much less speed and strength, and they soon tire. Two or three rushes are about their limit and then they are hauled up the side of the dugout by their forelegs and deposited in its bottom.

Light as the outriggers are, they add quite considerably to the stability of the boats and then, also, the balance of the natives seems perfect and they never upset. They did not much want a guest along when out hunting and they were hardly to be blamed as, one night when a long spear throw was made, we very nearly upset—a thing which would never have happened had they been alone.

Of course the aftermath of all this is a feast the next day. The dugong is just skinned out and the meat cut off, cooked, and eaten. As the animal is large, there is





A COMMUNAL HUT

This large, thatched dwelling, inhabited by the Ongies of Little Andaman Island, is set near the shore just within the edge of the jungle

apt to be a surplus of meat after the meal is over, but there is no saving made for the future. They have no salt to preserve the meat nor do they cut it into strips and sun-dry it. So easily is sea food procured that they do not consider any laying up for the morrow. When a man is hungry he goes out and catches the food for his immediate use and that is all. The meat of the turtle is cooked in its own shell and then eaten right out of it. In its case, however, differing from the dugong, the entrails are the choicest tidbits of the whole animal. Their preparation is elaborate, and they are most carefully cleaned and washed before being cooked. Maybe, after such a feast a dance takes place. It is a somewhat simple affair, the natives merely jumping up and down and swinging branches of evergreens in their hands.

The other and simpler form of fishing is with bow and arrows. When watching the accuracy of these bowmen, one would immediately assume they had reached the acme of perfection in this art. Boys are

trained from an early age to shoot with diminutive bows and arrows. First they practise on still targets and later on moving ones. Pieces of wood are rolled along the ground and they shoot at these while they are still in motion. The proper full-sized arrows are barbed, usually in two places, with the bones from pigeons' wings. These form a dreadful weapon against human beings and so great is their velocity at close ranges that they can be driven clean through the body. The proper place for shooting fish is along the edge of the reefs which can be reached by dugouts, or along the shore line where the water is shallow enough to wade in. The sea water, as so often happens in the tropics, is very clear, and with true eagles' eyes the natives easily detect their prey when near the surface. With perfect precision they gauge their aim. As is well known, due to light being refracted when passing through water, an object when seen under water appears to be in a different place to that in which it actually is. This fact is well known to the Andamanese

and the proper correction is given when sighting their arrow. For seeing things below the surface, their eyesight is truly marvelous. Sitting on their dugouts quite close to the water, they can see a turtle when swimming near the surface one hundred yards away.

Spending so much of their time on the water, they are fine swimmers and divers. From an early age the children play in the water, swimming about as much under the surface as on it. The average native has probably not much swimming speed, as his usual stroke is somewhat similar to that of a dog, but his powers of endurance are great. Swimming in the sea for long distances seems nothing to them and they appear at such times to be covering about half the distance under the water. They are excellent divers and, when at it, their heads just pop up at the surface for barely time to breathe and they are down again. The water is alive with sharks and at places along the shore there lives a very dangerous species of amphibious

cobra. Neither of these have terrors for the Andamanese. Without fear they will plunge into deep, shark-ridden water and, when after turtles, they will swim about rocks in the sea alive with sharks and yet they never have casualties.

Another branch of this same pygmy race are the Ongies of Little Andaman, an island lying just south of the three major members of the archipelago. These people have permanent habitations set, like the Andamanese, by the shore just within the edge of the jungle. This habitation is one large thatched hut entirely communal. These people are quite prone to wander long distances at sea. Such journeys may take several days traveling, but they do not spend the night at sea, usually stopping at some island en route.

In culture the Ongies are in every way just as primitive as the Andamanese. Their food is likewise composed of fish, roots, and screw palm. Although the particular groups visited were known to



HUNTING IN DUGOUT CANOES

In hunting turtle and dugong for food, spears about fifteen feet long are used. The spears are tipped with a removable barbed point

be friendly, we exercised care on first landing among them to note that those who had appeared out of the jungle on to the beach had no weapons. Any show of these would have been a distinct sign of hostility and landing at the time would not have been safe. Fortunately, due to the fact that they knew Mr. M. C. Bonington of Port Blair, we were received cordially. We visited two different parties of Ongies living at a distance of about ten miles from each other and their welcomes to us were very cordial. At the time, neither of these parties was living in its communal house, but had built for themselves temporary quarters. As it was during the dry

season, no covering of any kind had been put up. The jungle had merely been partially cleared and their beds erected. These latter were made of small boughs set up about four inches from the ground. On these they sat or lay all the time they were in camp. As the boughs were not quite even, they must have been frightfully uncomfortable, but no Ongie will ever lie on the ground.

One of the parties we visited had a temporary camp about a mile inland where they were in the process of making a dugout. Like the Andamanese, they hew out solid hardwood trees, but their finished product is a great deal larger. They are not quite as amphibious as the former and do not spend so much time on or in the

water. Bows, arrows, and spears they naturally make for collecting their food. Mr. Bonington had brought along a gun on the theory that "One never can tell," but it certainly proved entirely needless.

He, however, did know what he was about. More than once he had taken part in punitive raids against the natives when men had been killed, and it was solely due to his knowledge of and friendship with the Ongies that we were able to get into contact with them at all. Although inhabitants of the littoral, they showed every sign of being good jungle folk.

The trail to the inland camp where they were hewing out a dugout from a mammoth hardwood tree was none



BASKET WEAVING

The Andamanese have few domestic articles, using merely wooden receptacles for water, and native-made baskets

too good. It was only a temporary trail through a virgin tropical forest. One had to walk carefully and, even at that, tripping over parasitic vines and stumbling over uneven places was quite the order of the day for the whites. Not so with the natives. Young and old slipped easily along without making a sound. One would not have noticed the clearing where their camp was until right on it. It was nearly five o'clock in the afternoon and work for the day was over. Men, women, and children were idling about. Some had lain down on their rude beds. Of course they had known we were coming as news had filtered in to them from the shore when we landed and they had sent guides down for us. They, however,



A TURTLE FEAST

When hungry, a native will catch a turtle, cook it in its shell, and then eat the meat directly from the shell

showed no signs of welcome on our arrival; as a matter of fact, they seemed to take little notice of us at all. For half an hour we stayed about the camp. A group of middle-aged females sat on the edge of the unfinished dugout and watched us with colorless expressions. These latter showed the illness of distended stomach in great prominence. Finally, accompanied by a few men as guides and several children, we made our way back to the shore. Two days we spent among the Ongies and during this time it seemed to become more and more apparent to us that we were in good standing with them, although their faces or actions barely ever changed or showed the least emotion. We had taken the precaution of bringing some presents: large leaf tobacco of the very coarsest type, clay pipes, and a few cheap cotton clothes that were immediately put on. None of the aborigines smoke, as they have no natural sources of tobacco, yet they take very kindly to it when it is offered.

At last, when we came to leave them,

quite a little procession escorted us to the shore where our boat was anchored. Although the farewells must have been mutual, outward manifestations were only from our side.

It is curious and interesting to note that, although the aborigines are living in a pre-agricultural and wood age, with none of the benefits the human race has derived from civilization, they are absolutely self-sufficient, lack nothing, and are happy. They live the life of their choice and have escaped all the ills that so frequently attend civilization. For years hostile to intruders, they have avoided contact with other peoples and so have escaped their numerous diseases. Food at all times can be acquired in abundance, and so scanty are their clothes that the problem of making them is an almost negligible consideration. Their arts, or rather industries, are the making of weapons and dugouts. Water, which is abundant during the long and severe period of the southwest monsoon rains, becomes scanty during the end of the dry

season. As they practise no agriculture, this shortage of water is of no importance to them for there is always an ample supply for drinking purposes. During the driest periods water can always be obtained by digging in certain regular places well known to them. Fire is always kept up and food regularly cooked.

The story of how fire was first acquired by them is strangely wrapt up in mythology. The natives have absolutely no means of making fire, but it exists in every village or camp and is carefully kept burning. This is done by using a resinous wood and the fire is preserved in the hollow trunks of trees. When traveling, it is always brought along. The origin of it is completely unknown. They were firm in their statements that they had always had fire in the tribe and that it had been handed down from generation to generation. Where it first came from or how it was originally made, no one knew.

No amount of inquiry gained any further information.

The general health of the natives is good, although the trouble of a distended stomach, so commonly seen in the East and usually resulting from malnutrition, is very prevalent and frequently lasts among the women right up to middle age and on. Rickets and skin diseases are very rare. Like all primitive races, any contact with civilization tends to be much more harmful than good.

At one time the Government of Burma, under whose jurisdiction the islands fall, formed a small colony for the aborigines near Port Blair. Rather substantial dwellings were built for them and it was hoped that those who chose to live there might derive some benefits from their contact with the local civilization. This small colony is no more. Rather than any benefit, they reaped the ills which ravaged them and the place was forthwith shut down and its inmates returned to their



A RESTING PLACE OF BOUGHS

An Ongie will never lie on the ground. Beds are constructed of small boughs set up about four inches from the ground

natural haunts. As a result of this foolish and fatal experiment of the Government, the population of the Andamanese in a certain section has been reduced in numbers by fifty per cent in the last ten years. The trouble is not over yet, for, with the birth rate now at a standstill, it is only a question of time before this part of the general population will become completely wiped out.

Although the natives, both male and female, are very far from good looking, they are exceptionally cunning. In one respect they are like friendly animals. One can stroke their heads and faces as one would a dog, except that, when so treated, they show complete apathy and indifference. One characteristic they all have in common is that they are extremely fond of children. These latter may be born to the mother when she is very young, possibly only twelve to thirteen years old, but they do not live long. Forty is a ripe old age and above the average for those who have already become adult. Living all their lives in close proximity to one another and wearing few clothes, there is little prudery among them.

In marriage they are entirely monagamous and, among the Ongies in particular, the women have quite a high standing. Marriage vows are well kept and there is no promiscuity.

To those who come from a temperate zone, the climate of the islands would be considered a hot, unhealthy one. Lying, as they do in the southern part of the Bay of Bengal, their temperature is torrid and there is a six-months' intense rainy season when everything is always damp. During this part of the year the insect pests are

bad. Land leeches, such as one finds in the foothills of the Eastern Himalayas, ticks innumerable, sand flies and mosquitos that are frequently malarial, form the great pests. Like all aborigines, however, they are hardly bothered at all by that which would inflict agony on white men. Born and for generations bred in the environment of the islands, they become inured to the existing conditions and now mind little. One instance, however, will show that they are in part what one would call human. Some of the natives once showed us the remains of one of their temporary camps, at that time abandoned. They said that about a year ago they had been obliged to leave it and find another site as the sand flies were so exceptionally bad that life there was impossible.

Primitive tribes frequently practise nature worship as their only religion. The Andamanese, however, seem to observe no particular religion at all. Nature worship usually takes a form of devil worship, in other words, an appeal to the evil gods or spirits. These latter are supposedly responsible for the upsetting of the regularity of the lives of the natives by such causes as plague, famine, etc. Any action of the benevolent gods, which means no trouble, is often classed as normalcy. As the Andamanese lack nothing and have nothing to bother them, their lives are forever regular and there is no cognizance of any evil or benevolent gods at all. What is there to pray about either for or against? Lucky Andamanese, without having made the least effort, they have certainly solved the problem of living.





Entrance to the Cave as Seen from the Interior

PREHISTORIC IRON-SMELTING IN AFRICA

The Discovery of a Relic of Great Antiquity in a Cave of
Northern Rhodesia Throws New Light on the
Pre-history of Southern Africa

BY NINO DEL GRANDE

Archæological Engineer of the Italian Scientific Expedition

PHOTOGRAPHS BY THE AUTHOR

In the hope of learning something about the succession of the later culture phases of the prehistory of Southern Africa, Sig. del Grande and Prof. Raymond A. Dart, of the Italian Scientific Expedition began excavations at Mumbwa in Northern Rhodesia during June and July, 1930. It was in the course of these excavations that the iron-smelting furnace was unearthed. Mumbwa lies about 130 miles southwest of the Broken Hill Zinc and Copper Mines where the skull of Homo Rhodesiensis was discovered about ten years ago.

—THE EDITORS.

JUST in the heart of Africa, between the great river Kafue and the Lower Congo lie limitless plains of grass from nine to twelve feet in height, interspersed with vast stretches of trees and only rarely dotted with small, rounded hills. In the midst of this region, covering an area of about one hundred miles, we located, after months of research, a dozen caverns. They are today the home of African snakes, lions, and leopards. In conjunction with this difficulty was that

of natives whose nebulous traditions and superstitions cause them persistently to offset all attempts at exploration. In spite of these drawbacks, however, the work of the Italian Scientific Expedition was initiated and the various trial pit excavations in the caverns revealed evidence of human habitations.

When the most promising group of caverns had been chosen, actual camp was erected. It stood in the center of enormous limestones suggestive of an amphitheater

whose dark, demolished walls resembled those of an ancient castle.

The principal work of excavation was centered in the most imposing of the caverns, one rich in passages and openings. Necessarily it proceeded slowly and minutely. Successive layers, one foot in thickness, were excavated from the stratum of earth accumulated in the cavern through the milleniums. When excavated, each quantity of earth was strained through sieves of increasing fineness to eliminate the possible loss of the minutest particle of bone or worked stone. Native squadrons worked under the personal and constant supervision of Prof. Raymond A. Dart, of the University of Johannesburg, and the writer. In three months' work two hundred tons of earth were extracted, making an excavation twenty-two feet deep.

The cavern had reappeared in its former vast proportions; its irregular ceiling, sustained by gigantic pillars, formed narrow passages and wide hollows

completely sheltered from the storms, and we could easily read along the walls of the excavation the eloquent history of ages long past.

In the very depth of the excavation is a layer, about five feet in thickness, of red clay hardened almost to the texture of stone. In this layer are set the fossilized bones of various prehistoric animals that apparently had sought refuge there, or of beasts of prey in search of shelter in which to devour their captives.

We are led to believe that in this remote time man never lived here, nor in any part of this region. In a slightly later stratum we find the first evidences of man's appearance in small groups of primitive beings who hunted by means of a sling loaded with small, round stones. In this stratum we also find other stones roughly sharpened, which he used for mashing seeds, cutting skins, or cracking bones. They are one of the first signs of human intelligence.

Then again there is a negative period.



THE NORTHERN BLUFF OF THE MUMBWA ROCKS

The cavern in which the old iron-smelting furnace was discovered is situated within this bluff



AT THE MOUTH OF THE CAVE

Burning the "elephant grass" that surrounded the entrance to the cavern. Mumbwa is in the heart of a big game territory covered with luxuriant grass from eight to ten feet high

In about seven feet of earth not even a single animal bone is found. Change of climate or scarcity of game—both very essential to the life of primitive man—may have caused this long absence. This must have been very long, because we know that earth carried principally by wind and rain accumulates very slowly, and therefore the height of a single foot represents thousands of years.

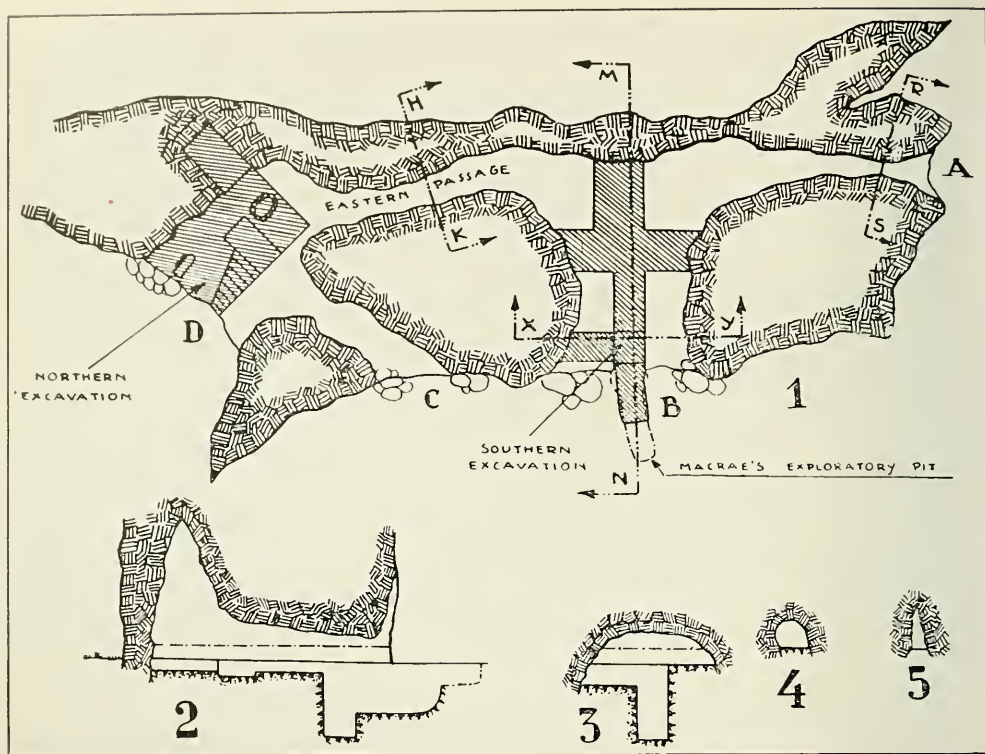
Then man appears again and in great numbers. This time we find him in a more advanced stage of civilization: the earth is filled with a great quantity of "stone implements." Man now recognizes the possibilities of quartz for this purpose. He breaks it up into minute pieces and from these he patiently constructs implements for various uses. There are knives of quartz for skinning animals, and rakers with which to clean the skins. By continued hammering and rubbing of stone on wood, he succeeds in shaping a sort of hook with which

he can extract snails from their shells.

The bow and arrow also makes its appearance at this time. With laborious exactness primitive man now constructs spears. He is an avid hunter, for as the bones and teeth extant show, the region was rich in game.

Rising steadily through the succeeding stratum for various feet, the quantity of implements begins to indicate the permanence in this cavern of the same people for thousands and thousands of years. Through generations these implements are handed down and perfected as they go. On reaching within two feet of the actual level we find implements completely perfected. Some worked in pure, transparent crystal-quartz are like scintillating gems

And now, in the two remaining feet of earth we find pieces of pottery scattered with the rest. Prehistoric man, who had achieved a crude artistry in shaping stone and working it to his use, was but a



THE EXCAVATIONS

(1) Ground plan of Mumbwa cavern showing entrances on south A, west B and C, and northwest D, and also the areas excavated (cross-hatched). (2) Longitudinal section through the southern portion of the cavern along line M, N. (3) Transverse section through the southern portion of the cavern along line X, Y. (4) Transverse section through internal (eastern) passage along line H, K. (5) Transverse section through southern passage along line R, S.

beginner in this new art of molding clay. But with the passing of the centuries he learns to produce in clay greater quantity and better quality of work. Now he feels the urge to decorate his ware. His drawings are crude and irregular at first but steadily increase in symmetry, though he is still limited artistically.

Contemporaneously, he gradually relinquishes the use of stone implements and concentrates on iron, which we find well represented in the most superficial stratum by a few necklaces, arrow points, and spear-tips. The number is small, because iron is precious and not to be discarded or forgotten like a piece of clay or stone. And so—after that superficial stratum that represents the last three or four centuries, we come quite imperceptibly

to the native of today. He takes no comfort in caverns which offer but a miserable refuge. Here, on the uppermost layer, is a recent handiwork in clay, some ashes, and the traces and remains of animals of all species: man is now master of this place.

However, during the excavation, we made a discovery of exceptional interest. It records an extraordinary event in the life of primitive man of that time.

At a depth of more than seven feet from the actual level of the cavern where the earth was rich in stone implements used by prehistoric man, we found about six hundred cubic feet of pure and compressed ashes, hard as rock. A little farther on we brought to light a furnace three feet in diameter, regularly con-

structed, stone on stone, the intervals filled with earth obviously long exposed to violent heat. On one side lay massed a number of unsuccessful fusions and wastes of furnace fire.

Our imaginations drop back five or six thousand years and we see the arrival of strangers. They, too, are primitive men, but happily the possessors of a formidable and miraculous secret. They know how to choose one stone from another and place it with portentous witchery in a great fire. With it they burn other stones, bones, and earth of special quality. Then they stir the fire to a brighter blaze and lift from it a seething substance of blinding redness. The mysterious object then grows black, hardens, and becomes pliable. It can be folded and pointed; gradually it is molded into blades, arrows, knives, implements, and ornaments of all kinds. This new substance is iron.

Obviously the cavern served in that time as workhouse and habitation for these strangers who had brought with them the wonderful secret. They must have been a minority, since the ordinary cave-dwellers continued to work in stone. These must have been reduced to the position of humble collaborators or slaves to the others. However it may have been, one day the strangers disappeared. Their departure may have been due to several reasons: pestilence, insufficient mineral iron, or some unexpected change in climate; or else they may have departed after having accumulated sufficient iron to take with them as booty. This may explain more logically and more conclusively the relative brevity of their work and the abruptness of its cessation. At any rate the strangers took their secret with them. It is undeniable that nothing but a renewed work in stone



ENTRANCE TO THE CAVERN FROM THE OUTSIDE

Nino del Grande and one of the natives examining the excavated material in search of stone implements



COLLECTION OF POTTERY OBJECTS

These fragments of pottery were found in the uppermost two feet of earth that had accumulated in the cavern through the milleniums



SAMPLE OF FIRE-FUSED MATERIAL

For fluxing purposes for preparing iron, charcoal, bone and quartz were found in abundant quantities in the refuse dumps



STONE IMPLEMENTS

Collection of Late Stone Age implements found in the earth of the cave, together with some human teeth and shell-beads for comparison



COLLECTION OF MOUSTIERIAN IMPLEMENTS

For comparison the photograph includes two palæoliths from the furnace stratum (at each end of upper row), and neolithic polished axe-head from furnace stratum (center of upper row)



VIEW LOOKING EASTWARD OF NORTHERN EXCAVATION

Showing the white ash stratum, and the oval furnace floor. Nino del Grande is examining some material found in the furnace

followed this brief era of advancement. The native cave-dwellers, slaves or collaborators, were in ignorance of the new method; they may also have been too lazy to practice it or too unintelligent to master it. Surely there must have been multitudes, disciplined and well supervised, because completely surrounding all the entrance to the cave is a great wall, a vast conglomerate of ash, iron mineral, and wastes from experiments in fusion. Only the combined efforts of hundreds of laborers could have achieved the stupendous task of piling and building this great mass.

It is permissible, however, to assert the great antiquity of this furnace, which proved to be the most ancient metallic workshop discovered in Africa. The cave is situated in surrounding earth whose

accumulation was very slow. Its general conditions are conducive to inference that from five thousand to six thousand years are represented by the seven feet of earth accumulated under the furnace.

It is not possible to attribute the iron work discovered to the Bantu, actual natives of Rhodesia, because too many factors dispose of this hypothesis. Their method of iron smelting is too recent and of an entirely different nature.

Then, too, the long interruption in the use of iron cannot be attributed to a lapse of memory among the individuals of the successive Bantu generation. It may be safe to say that the stratum in which the furnace was found denotes an age in which the actual native Bantu did not dream of a future existence in Africa.

It seems definite from the occurrences at Mumbwa that the smelters were foreign to this soil. The site of their emergence is unknown, but presumably it was somewhere along the Mediterranean littoral, or Egyptian or Mesopotamian center.

How did that primitive smelting art arrive in Southern Africa? Past writers have not hesitated to suggest for the explanation of Southern and Northern African homologies in prehistoric culture and art, most amazing migration of the human race, provided this occurred on land. It is more logical to believe that the migration in question was the bringing of the new cultural elements to the local southern Bushman by a relatively small group of skilled northern intruders. The obvious channel for that cultural migration was the eastern coast line, the sea and the water highways, such as, in this case, the Zambezi and Kafue rivers.

A partial confirmation of the hypothesis

of a water-borne cultural stream with respect to Mumbwa is found in the fact that water-products, such as shells, were in high repute as ornaments among the smelters—a tradition that is preserved to the present day in the sea-shell ornaments of the aristocracy of these parts. A further confirmation lies in the primitive watercraft of the Zambezi valley and the boat ceremonies of the inhabitants. But the soundest reason of all is the indisputable fact that the primitive culture-bringers throughout Europe were essentially a seafaring and river-navigation folk. The art of navigation had already been mastered by the Egyptians during the pre-dynastic period. Even in neolithic times the knowledge of adventurous sea-craftsmanship in dugout canoes had become rapidly disseminated throughout Europe. Doubtless the same navigational mechanism extended extremely rapidly at an equally early period all over the highways of the Indian Ocean.



General View of the Camp Set Up During the Process of Excavating



Photograph by Burton Holmes

From Ewing Galloway

A Cantonese Junk Under Full Sail

THE RIVERINE LIFE OF CANTON

A Study of a Strange Racial Group of Unknown Origin, that Forms a Picturesque Floating Population on the Waterways Around Canton

By H. L. SHAPIRO

Associate Curator of Physical Anthropology, American Museum

THE traveler, who makes his acquaintance with China by a pilgrimage to imperial Peiping, followed by an overland descent to Shanghai and concluding with a final call at Canton via Hongkong, has had ample opportunity to become prepared to regard the riverine population of Canton as the inevitable consequence of over-population. All along his route he has seen vast agricultural areas saturated with humanity, and large cities brimming with people. When he finally reaches the rich alluvial delta on which Canton is built, the pressure of population seems to have increased to the point where it can seek relief only by invading another element. So numerous are the craft of all varieties which in solid array line the shores of the river and the canals, that at first glance the very land itself appears to have encroached on the waterways which transect the city. In one section are the great sea-going junks

anchored in orderly rows, their masts in the distance like a forest of tall, slim conifers. Along the opposite shore the barge-like flower boats are massed in a solid phalanx. Up and down the river and through the canals pass a succession of slow cargo boats. Fastened alongside the shore, glutting the canals, and darting hither and yon are the ubiquitous sampans, minute ferry-boats, which are skillfully maneuvered by women. On all these craft of whatever description, people—usually whole families—have their existence, may never put foot ashore, and live by conventions peculiar to themselves.

This busy life on the rivers is not confined to Canton alone. Boat people may be seen in Hainan, Macao, Hongkong, Fuchow, and in many of the south China coastal ports; but only in Canton has this mode of life had so great and peculiar a development. The estimates of the river

population of Canton vary enormously, and it is difficult to see how it can be otherwise with so mobile a population. Williams states that at one time 84,000 boats were registered with the water police of Canton. But since many of these are engaged in the carrying trade and nothing is known about the replacement of old boats, it is impossible to judge accurately the fixed total population from the number of registered boats. Various guesses run from 150,000 to 300,000. As large as this sounds, it does not appear excessive after one has traversed the waterways of Canton and observed the thousands of bumping boats each with its resident family.

Not only do these people dwell upon the water, but they derive their livelihood solely from it. The commonest occupation in the city waterways is ferrying. Fishing is, however, an important economic factor. Fleets of junks fre-

quently go on fishing trips. The Chinese book of Koang-Tong-Sin-Yu, written in the Ching Dynasty, describes the river people fishing with nets. They were also said to dive for fish which they speared under water. Whaling in junks has been recorded as one of the activities of the Hainan water folk. In former days pearl-diving was a favorite pursuit of these people, but most of the oyster beds have been long exhausted. Perhaps the most important of the occupations of the river people is the transportation of cargoes from the interior to the coast. The agricultural produce of the inland is brought to the commercial ports and in return manufactured articles are carried back. Salt is also a valuable cargo.

The origin and antiquity of the boat people, or the Tan-kia as they are locally named, is not entirely clear. The Cantonese accept them as a natural part of the environment and, in response to ques-



Photograph by Publishers Photo Service

UNLOADING CRUSHED STONE

The division of labor in China is apparently not based on sex, for women take their place equally with men in the strenuous work of the stevedore



A CANTONESE SAMPAN

The ferrying on the waterways of Canton is mainly by means of thousands of sampans such as this

tions, suppose that they have always been there. The more scholarly quote authorities to prove that the Tan-kia arose by one of several sequences, according to the informant. I could discover little agreement on the origin of the boat population, even among the few who professed to know. A not very exhaustive search of the literature has been of no result in shedding light on this problem. It is, however, true that these people, or more accurately this mode of life, is very ancient in Canton. The following quotation taken from Yule's *Cathay and the Way Thither* is from a letter dated about 1330 and written by a Dominican friar:

"The realm of Cathay is peopled passing well; and it hath no few cities that be greater than Paris or Florence; and a great multitude of places full of inhabitants, and smaller cities past counting. It hath likewise store of fine meadows and pastures, and of sweet smelling herbs. And there be many great rivers, and great sheets of water throughout the empire; in so much that a good half of the realm and its territory is water. And on these waters dwell great multitudes of people because of the vast population that there

is in the said realm. They build wooden houses upon boats, and so their houses go up and down upon the waters; and the people go trafficking in their houses from one province to another, whilst they dwell in these houses with all their families, with their wives and children, and all their household utensils and necessities. And so they live upon the waters all the days of their life. And there the women be brought to bed, and do everything

else just as people do who dwell upon dry land. And if you ask of these folk where they were born? they reply nought else than they were born upon the waters, as I have told you. And seeing that there be these great multitudes dwelling thus both on water and on land, the folk are in such great numbers that the cattle of the



A TAN-KIA MAN

One of the few converts to Christianity among the river people of Canton who are generally impervious to Western ideas

country suffice not for them, wherefore they have to bring them from other countries and for that reason flesh-meat is dear there."

From the above excerpt it is evident that as long ago as six hundred years this river-dwelling population was an extensive and permanent feature of the life of Canton. Chinese sources speak of the Tan-kia, or the Long-Hou as they were named in earlier days, entering the country in the Tang Dynasty, 620-905 A.D.

Perhaps because of their very antiquity the origins of the Tan-kia are entirely traditional. Of the local beliefs concerning them, the most current one accounts for their life on the water because of non-payment of taxes. There are a number of variations to this story. The most circumstantial relates that in the beginning



CHINESE BOAT-WOMEN

The occupation of ferrying in Canton is conducted by the women of the Tan-kia population

these people lived along the lower delta, but after a flood year they were so impoverished they were unable to pay the usual land tax. Recognizing the difficulty of their position, the tax-collectors remitted the tax for that year. The next year, however, the same cry of impoverishment was again raised, but this time their plea went unheeded, and, in lieu of a money tax, eggs were collected. This form of egg taxation continued until the arrival of a new tax-collector who refused to accept eggs and demanded in money what was due the government. Fearful that they might be forced to pay, the people took to their boats and hid until after the departure of the tax-collectors. After a number of such frustrations the tax-collectors decided to retaliate. When at their next visit they found the people departed, they called in some villagers from the upper country whom they settled on the preëmpted lands. The "Egg People" or Tan-kia were then forbidden by official proclamation ever to own land again. They were denied the privilege of taking the state examination by which political preferment was possible, and they were prohibited the right to marry land people.



PROFILE OF A TAN-KIA MAN

In appearance this representative of Canton's boat population is like his neighbors who live ashore



SAMPANS AT MACAO

Macao, like Canton, has a population which exists exclusively on the water. The sampans here are similar to those seen in Canton

Another tradition has it that the Tan-kia are the remnants of the aboriginal population of southern China who were forced to retreat to a life on the water when their lands were conquered by northern invaders. To some extent this hypothesis fits the historical setting, for it is known that South China was invaded by northern hordes who swept down on to the rich lands of the south. In tacit agreement with this view, Williams states that the Tan-kia originated from the Miao-tse, an aboriginal tribe, which once extended far beyond its present restricted area in southwestern China. In ancient writings the Tan-kia were described as being very dark, which has been taken by some to confirm the belief that they represent the survivors of the dark-skinned autochthones of the region. Père Hoang mentions that the ancestors of the Tan-kia came from the islands of the south. The reference here is probably to Hainan and Formosa. I discovered still another tradition concerning these people. This story relates that after a disastrous defeat by Mongol invaders during the Sung Dynasty, a famous

northern general retreated with the remnants of his army to Canton where they "settled like ducks" on the water.

The linguistic evidence, according to Imbert, points to Fukien. The Tan-kia are said to use a language incomprehensible to the Cantonese but which resembles the more primitive of the



A VILLAGE ON STILTS

Here and there in Canton small squatter villages have begun to be erected by a few of the river people

dialects spoken in the neighboring province of Fukien where isolation has tended to preserve ancient customs as well.

Madrolle measured several Tan-kia from Hainan and obtained an average cephalic index of 81.69, which is similar to the mean for Cantonese. But however they may have arisen, they occupy an anomalous and peculiar position in Cantonese life. Because of their various disabilities which included non-ownership of land, disbarment from state examinations, ineligibility for marriage with land people, and peculiarities of customs, they were regarded as a pariah class. With the overthrow of the empire many of the restrictions binding the Tan-kia were abolished, yet so conservative are social habits that the position they occupy is

still a degraded one, and the term "Tan-kia" is one of reproach. And yet in some respects the life which the river people live is, contrasted with the bondage of the corresponding class on land, one of independence and variety.

The boats which serve as the dwellings of the Tan-kia include all the varieties which one may see on the waterways of South China, but they may be roughly divided into three major classes which do not, of course, embrace every type of vessel. The largest, and by far the most spectacular, are the junks. The enormous hulks of the junks loom large against the smaller frames of the other river boats, and, except for the foreign boats, this class of vessel is the largest on the river. They are usually a hundred feet long with a

much of this form of decoration has been eliminated, although the basic architectural plan of the old craft has been retained. The sails are usually brown and look like bat wings. They consist of strips of matting sewn together. Bamboo ribs are used to strengthen the sails and to carry the rings which join the sail to the mast. Often there is an additional mast forward but bowsprits are unknown. In the stern are the quarters for the women. Here also are the kitchens. Frequently one may see three generations of a family living on one of these junks.

These great junks may carry a crew of ten or more men and frequently make trips to Macao, Hongkong, Swatow, and other ports. The commonest of cargoes is salt, which is loaded at the coast and is redistributed at Canton. Although clumsy looking, the junk is very seaworthy, and because of its shallow draft it is very handy in riverine traffic. Undoubtedly these of today are the descendants of the great, proud junks which in the Middle Ages maintained crews of several hundred men each and which ranged as far



A CHINESE VILLAGE STREET

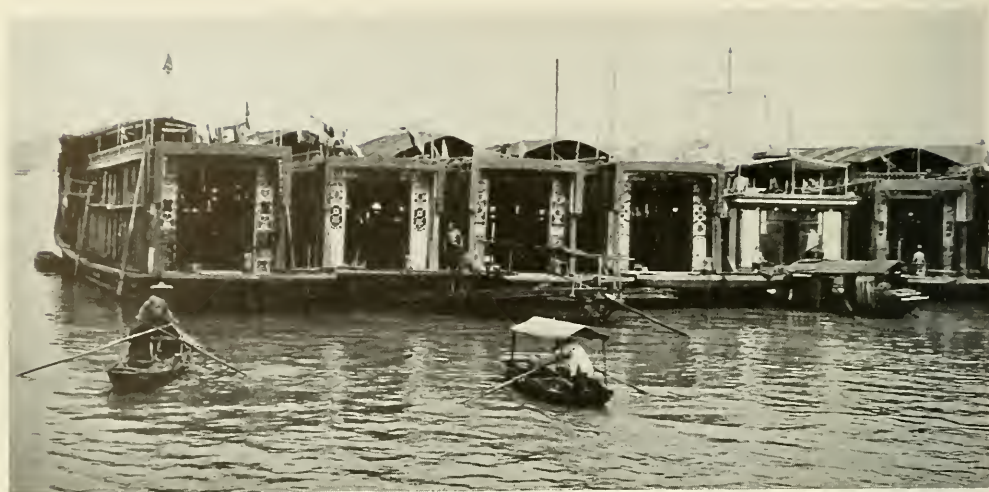
This scene from a small farming village near Canton gives an excellent contrast to the mode of life on the water

high balustraded stern like a great rostrum. The older vessels of this type were highly decorated to resemble a monstrous sea creature. An eye was painted on either side of the bow, the sides were covered with bands of brilliant color, and the stern was elaborately carved and intricately painted. In the newer junks



By R. Moulin, from *Ewing Galloway*
CROWDED CHINA

Such a scene may be duplicated in New York's lower east side, but in China it is far more typical



FLOWER BOATS

By Ewing Galloway

Highly decorated, these boats serve as tea houses where "sing-song" girls entertain the male clients

as India and as the islands of Indonesia.

A smaller type of vessel is the river cargo boat. These are essentially flat-bottomed scows or barges and are used only in river trade. They make slow, laborious trips up the West River and its tributaries, carrying the products of Canton and the coast, returning with loads of products from the interior and great cargoes of wood. Along the side is a wale or plank on which a man walks as he poles the boat against the current. Although much less comfortable than the junks, these craft, too, have their complement of inhabitants. The flower boats which are so numerous in one quarter of the river city appear to be boats of this type upon which a house has been superimposed. Anchored permanently, they serve as tea houses where gay parties of men are amused by the singing girls.

By far the most common boats on the river and the canals are the sampans. They may be counted by the thousands as they flit about carrying passengers. Almost exclusively they are propelled by women. In shape the sampans are pointed and high in the bow. They are frequently about twenty feet long. The central portion where the passengers sit is covered by an

arched bamboo frame over which matting or canvas is stretched. In bad weather the sides are rolled down to protect the occupant. These boats are kept scrupulously clean and gaily painted. Ordinarily, to manage a sampan requires two women, one of whom sits in the bow facing the passenger; the other stands astern behind the passenger and directs the course of the boat. Each sampan has its allotted anchorage to which it returns at night after the day's work is over. The skill manifested in negotiating the tangled traffic is a combination of oarsmanship, shouts of warning, and well-timed bumping. With the increased use of power boats the livelihood of these women is being reduced. The independent status of the boat-women is well exemplified on the sampans. Married women adopt this form of business, while their husbands are away on a cruise. Unmarried women, too, form associations and live a life of economic independence. It is said that the Tan-kia women may select their own mates, a very unusual performance in China, and may, if they so desire, contract extra-marital attachments without any consequent disgrace.

The complexity and the surge of life on

ONE OF CANTON'S
GLUTTED CANALS

The press of river boats is so thick that one cannot see the water on which they move

the river attendant on the requirements of several hundred thousand people may well be imagined. All the necessities are provided for this population without the need of ever going ashore. There are itinerant boats which purvey all varieties of food and other commodities that are ordinarily found in shops. Tinkers and smiths wander about in their crafts, stopping wherever there is a call for their services. Even weddings and funerals have their special boats which may be hired for the occasion.

Marriages are arranged by the young people themselves. A young man who has his heart fixed upon a particular girl will circle her junk, displaying sheaves of rice. The older tradition mentions corn. If the young lady looks upon this advance favorably, her response is in the language of flowers. She will arrange bouquets on her junk, thus assenting to

the offer of marriage. On the day of the nuptials the groom arrives bearing gifts and accompanied by the guests who beat on tom-toms and set off firecrackers in the customary fashion. The groom then triumphantly bears his bride off in his boat followed by a noisy cortege of revelers.

Death also has its appropriate ritual. When it is believed that an aged person is about to die he is borne ashore to the bank of the river, where a hut is built for him. Here he is guarded and watched by his male descendants until the last breath.

The household tasks of the women are, of course, reduced to a minimum. The management of a tiny establishment on the water is not a very laborious occupation, however inconvenient it may be. It is amusing to see how ingenious these water dwellers are in arranging for their comfort in a constricted space. Water,

A PEACEFUL SEA
MONSTER

The older junks were built to simulate fabulous sea creatures. The eyes of this one are clearly visible





MOVING A RIVER BED
These women are changing the course of a stream by moving the river clay by hand

not particularly clean, is abundant, and the small sampans are frequently scoured. Refuse is thrown into the water, which, added to the silt of the river, combines to make the water of the Pearl River about the most unattractive I have ever seen.

The children, who are much more familiar with the rock of a boat than with the solidity of land, are fastened by a long lead to the boat, and in addition they always carry tied to their backs a float which is sufficient to support them in the water should they fall overboard in their infantile quests.

For amusements there are the flower boats where tea is served and girls are provided as entertainers. These boats attract land people as well, and are a favorite place for male parties.

Although theoretically the river people never go ashore, in fact this is not rigidly adhered to at

present. One may see both men and women, usually barefooted, in the city. And along one part of the river there are small communities of river people who have built simple one-room shacks high on stilts over the muddy banks. In other ways, too, there have been considerable

changes in the status of these people. I visited newly established schools where the Tankia youngsters are taught. Unwholesome, dirty, dark, and fearfully overcrowded, these institutions of learning nevertheless represent a stride forward for the river people who never before were permitted to acquire the advantage of letters.

So distinctive and integrated is the life of the river, that even those who wish to aid them must conform externally to the same exigencies. One foreign missionary group to achieve its purpose has adopted a water life. This is the South China Boat Mission which was organized by Miss

FISHING IN CHINESE WATERS

This huge net is lowered into the water by releasing the guy ropes which support the four poles. The entrapped fish are scooped out by means of a long-handled net





By Ewing Galloway

"A WOMAN'S WORK IS NEVER DONE"

These Tan-kia women strap their infants to their backs and continue their labors with unconcern both to the baby and to themselves.

Florence Drew, who recognized the sad neglect of the Tan-kia and resolved to aid them. Since it was impossible to combine a land and water mission, the efforts of Miss Drew were wholly confined to the boat people. She has a central houseboat which is anchored in one of the canals. On board this boat she has her quarters and a large assembly room for meetings. In fine weather the upper deck is used. A number of daughter boats move up and down the river evangelizing at various points. These efforts, while unique among the river population, can not be said to have been enormously successful in number of conversions. The Tan-kia, like many Chinese, are resistant to foreign ideas and prefer to lead their own independent lives.

The intrinsic interest of the river population of Canton was called to my attention by Dr. Edward S. Craighill Handy who has an interesting theory re-

garding their relationships with other people. I was particularly anxious to notice whether or not they exhibited any physical differences from the land people by whom they are surrounded. My opportunity to observe the population was only a casually presented one. I found it very difficult to establish a rapport with them in the very limited time I had at my disposal and with a total ignorance of their language. They did not, however, appear to be strikingly different in general appearance from the land Chinese of the South. The women, it is true, occasionally provided a type which seemed reminiscent of the Malay-like people to the south of China, but the significance of this observation apart from objective evidence is very slight.

With the aid of an interpreter I did have several illuminating conversations. On one occasion two or three men admitted that their grandfathers had taken



Publishers Photo Service

WASHING DAY AT CANTON

The river people of Canton perform all their household functions aboard their boats. The laundry problem seems neatly solved in this picture

to a life on the water after being unable to maintain themselves on land. To what extent this may account for the vast numbers engaged in riverine life it is impossible to say. In any event, it does not appear impossible for landmen to adopt river life, and it may well be that in the course of centuries a great number have done so. Assuming that the Tan-kia did represent an aboriginal strain forced to the water, then by constant accessions from the lower



IN SHEKKI
A peaceful canal

stratum of the land people they might have become assimilated to the dominant physical type. But I see no reason why it is not a natural event in an over-populated country that part of that sorely harassed

population be forced to adopt a much more economical existence on the river. It is equally to be expected that in the course of time a depressed class, such as these river people were, without financial power and lacking education, would come under

various forms of disability, incur the contempt of the more favorably situated, and gradually acquire a peculiar and distinctive *modus vivendi* which would become crystallized into a species of folk-ways. Like

many other sociological phenomena the history of the riverine population has probably been a complex one, uniting in itself various trends and diverse elements. It would be a mistake to seek a single

historical cause, where a number have interacted. Consequently, the student of the Tan-kia, even though he find a tenuous thread connecting the present people with ancient aborigines or even Oceanic groups, must be prepared to recognize the strong modifying factors which might have been introduced in the course of centuries. De-

spite the significance of the Tan-kia both as an expression of economic stress and as an historical vestige, practically no investigations have been conducted among

them. To the sociologist they illustrate one of the varied ways of maintaining a foothold on life, while to the anthro-

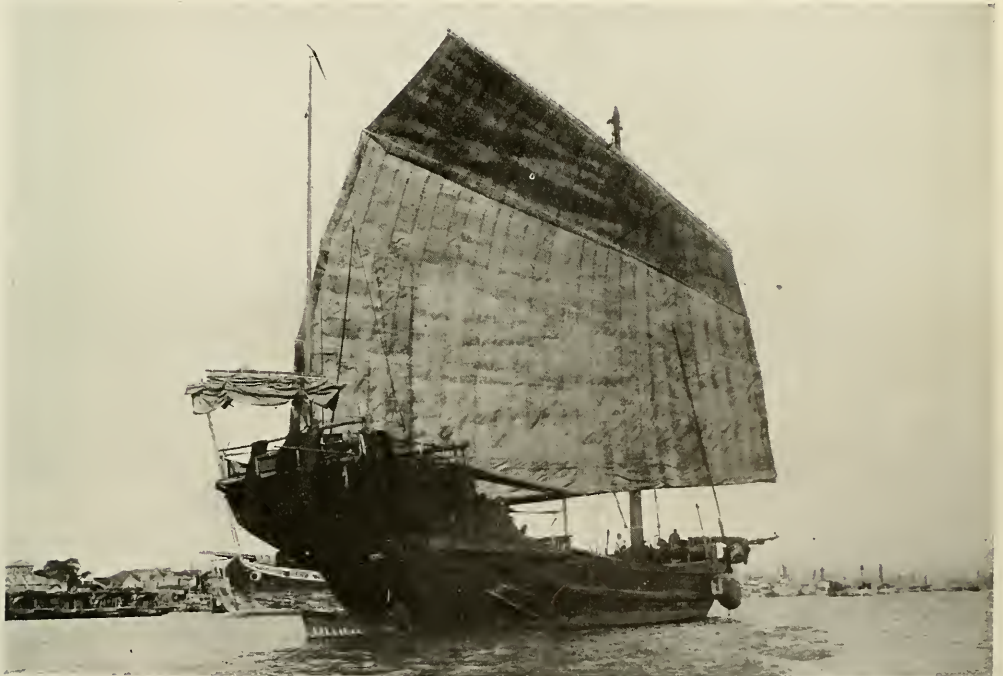
pologist they may represent an example of a tenacious survival of a primitive life surrounded by a more highly evolved society. At any event, whether or not they are a problem to the sociologist or an enigma to the an-

thropologist, they furnish a vivid splash of local color which forever remains in the kaleidoscopic impression of the traveler in China.



A JUNGLE OF BOATS

Hundreds of these junks are anchored together



By Burton Holmes, from Ewing Galloway

A MAJESTIC RELIC

These modern ships are like the ancient junks that sailed from China to distant seas centuries ago and returned laden with exotic products

STINGLESS BEES IN COMBAT

Observations on *Trigona pallida* Latreille on Barro Colorado Island

By HERBERT F. SCHWARZ

Research Associate in Hymenoptera, American Museum

BELTING the tropical regions of the earth and extending in the New World northward into Mexico and southward into Argentina, is a rather remarkable family of bees, consisting of a great many species and subspecies. These bees form perennial colonies, as does our honey bee, and produce honey—sometimes delicious and sometimes nauseating—in quantity. They are popularly known as stingless bees, for they lack an anal weapon of defense. By way of compensation, however, many of the species pinch rather penetratingly with their jaws and have the further unpleasant habit of crawling into the hair of anyone who molests them, because of which they are sometimes called “Haarwickler” by German writers.

One of these species of stingless bees, *Trigona pallida*, is widely distributed from at least Honduras southward across the northern tier of South American states into Brazil. In the Canal Zone it is particularly abundant and there some years ago it attracted the attention of Dr. William Morton Wheeler, who reported what he characterized as “a most extraordinary habit.” His note is so vivid that I quote it in full:

This light-yellow species [*Trigona pallida*] was common at a spot near Gatun, C. Z. on the relocated Panama R. R., where it exhibited a most extraordinary habit. At a wet ravine on one side of the track a barrel of black crude oil (with asphalt basis) had been placed as a supply for the men employed in exterminating mosquito larvæ and pupæ, and near it was a bucket which had been filled from the barrel. Perched around the rim of this bucket and crawling about the leaking spigot in the flat end of the barrel were great numbers of the bees, loading themselves with the oil! They could be seen collecting the oil with their fore legs and then transferring it to their

dilated hind tibiæ. In this occupation many had succeeded in daubing their whole body, including the wings, with the sticky, strong-smelling substance, and at first sight seemed to be trying to convert themselves into pitch-black *Trigonas*. They were not, of course, really endeavoring to adopt the prevailing style of coloration among the Central American species, but were merely collecting the oil for the purpose of kneading it up with their own waxy secretions, to form the cerumen with which they build their honey pots, brood-combs and nest entrances.

While sojourning on Barro Colorado Island in November–December, 1930, Dr. F. E. Lutz, Mr. E. I. Huntington, and I had two opportunities of witnessing the partiality of this species for oil. On one occasion the *pallida* bees were gathered in numbers on the top of an oil can, industriously collecting the spill of thick fluid. Only a foot or two away from this can was a ripe banana that we had placed there to attract insects. It was black with visiting *Trigona testacea* subspecies *cupira*, but not an individual of this bee was tempted to join the *pallida* assemblage at the near-by oil pool, nor did a single truant of *pallida* stray over to banquet on the fruit that proved so irresistible to the *cupira*. On this particular occasion the *pallida* did not behave with the abandon suggested by Wheeler; they were more meticulous. An examination of about a dozen specimens collected rarely showed the presence of oil on any parts of the body other than the plumose hairs of the tibiæ of the middle and hind pair of legs.

On the occasion about to be related, however, the bees succeeded in masquerading themselves almost to the extent that Wheeler has described. Toward 4:25 p.m. on November 21 Doctor Lutz called me and I knew by the tone of his voice that something unusual was

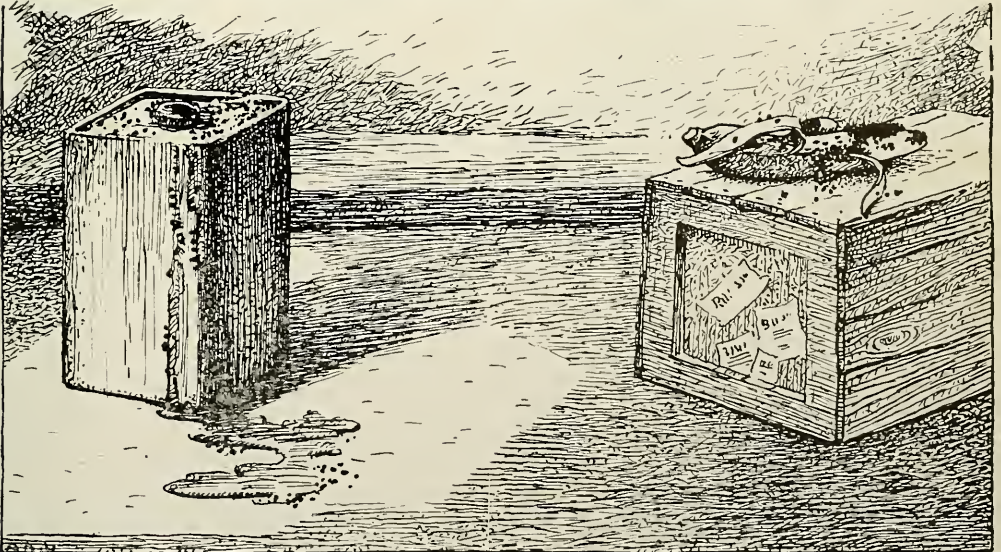
taking place. There, just in front of the laboratory of Barro Colorado Island, a small, agitated swarm of *Trigona pallida* was milling about in the air only a few feet above the ground. The action was suggestive of the mating flights of certain Bembecine wasps, an impression strengthened by the fact that every now and then a pair would drop to earth beneath the dancing swarm. However, the behavior of the bees was seemingly inspired by Mars rather than by Venus. All of those taken in pairs were workers—there were no males—and their attitude suggested that of combat. In almost all cases they were facing each other, gripping tightly with interlocked mandibles or tumbling over each other like two wrestlers, head to head and body to body. So unrelaxing was their hold that they failed to separate when I placed them in the killing bottle, and in death the mandibles of each still held the adversary gripped. Seven pairs of gladiators were thus collected but more remained uncollected.

Little by little the intense agitation subsided and the survivors turned their

attention to what, I suspect, had engaged them before the combat. They entered gradually one by one under a large inverted wooden box that concealed a gasoline engine. The box had a small opening below and through this the bees crawled or flew, but their action showed great timidity. They would approach the entrance only to retreat swiftly, then again muster courage to advance. Their behavior suggested that whatever it was that had so agitated them and prompted them to engage in sororicidal combat had its origin within the mysterious darkness of that box.

An examination of the combatants collected showed that in certain cases several parts of the body, including sometimes the wings, were smeared over and darkened, and presumably these bees had been engaged in gathering gasoline or grease from the engine just before the fracas.

On the following morning the box cover was removed and specimens of *pallida* were observed again visiting the engine, the trials of battle perhaps forgotten in the placid resumption of the daily routine.



Sketch by A. A. Jansson

EACH OBLIVIOUS TO THE ACTIVITY OF THE OTHER, TWO SPECIES OF *Trigona* BEES ARE HERE SHOWN AT THEIR LABORS. ON THE LEFT ARE MANY INDIVIDUALS OF *pallida* (= *kohli*) INTENT UPON GATHERING DROPS OF OIL FROM THE OVERFLOW OF A CAN. THE STICKY SUBSTANCE IS BEING ATTACHED TO THE HIND LEGS AND WILL ULTIMATELY BE USED IN THE CONSTRUCTION OF THE NEST. ON THE RIGHT IS A LARGE GATHERING OF *testacea cupira*, TEMPTED BY A RIPE BANANA THAT HAD BEEN EXPOSED IN THE HOPE THAT IT MIGHT PROVE A LURE TO INSECTS

GEORGE FREDERICK KUNZ

(1856-1932)

DR. GEORGE FREDERICK KUNZ was intimately associated with the work of the American Museum in its formative years, as he was also with the scientific life of New York City as far back as the 80's.

An enthusiastic and talented worker in the field of mineralogy, with an affable and impressive personality, he early succeeded in interesting the elder Mr. Morgan in the mineralogical collections of the Museum, with the result that two outstanding collections, the Bement Collection of Minerals and the Tiffany Collection of Gems, were acquired through the Morgan Gift.

During the years from 1904 to 1918 Doctor Kunz served as research curator of gems on the staff of the Museum, and later was made research associate of gems. Throughout his long, energetic, and productive life the Museum has held a high place among his many and varied interests, as is evidenced by the numerous and important gifts which have come to it directly through his good offices, notably the Collection of Elements in the Morgan Hall.

A man whose interests and connections threw him constantly in association with people of wealth and prominence, Doctor Kunz always found time to lend a willing ear to those who had yet their way to make in science. Self-made and largely self-educated, his sympathy was ever with the struggling neophyte, and many a scientist owes his start in life to the kindly interest and sound advice of this large-hearted man.

He was preëminently a man of amazing energy. During his productive years the amount of work that he did was truly colossal, and few indeed

of the volumes of the *American Journal of Science* covering this period but carry his name in their indices.

His interest was primarily in gem stones and no man in the world at the time of his death was so universally recognized as an expert on gems. His *Gems of North America*

published in 1890 is still a classic as is also his *Book of the Pearl* published in collaboration with Charles H. Stevenson in 1908. His *Curious Lore of Precious Stones* (1913), *Magic of Jewels and Charms* (1915), and *Rings* (1917) are veritable mines of unusual information. [So great was Kunz as an authority on gems that his knowledge of meteorites is apt to be overlooked, yet if we could conceive of so varied and prolific a talent as his concerning itself with nothing but meteorites, he would still on this ground deserve fame.]

And fame no doubt was his, for few have enjoyed such world-wide distinctions.

His decorations include that of an Officer of the Legion of Honor (France), Knight of the Order of St. Olaf (Norway), and Officer of the Order of the Rising Sun (Japan).

In the death of Doctor Kunz on June 29 science has lost an enthusiastic and prolific contributor, New York one of her most prominent and distinguished citizens, and the American Museum a faithful and generous friend.

Funeral services were held at the Cathedral of St. John the Divine in New York City on July 1. Representing the Museum at these obsequies were Dr. George H. Sherwood, Dr. William K. Gregory, Dr. Chester A. Reeds, and Mr. H. P. Whitlock.—H. P. W.



Wide World Photograph

GEORGE FREDERICK KUNZ

For twenty-eight years associated with the department of minerals and gems of the American Museum



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

EXPEDITIONS

ARCHÆOLOGICAL SURVEY.—Dr. Wendell C. Bennett is now on his way home from Bolivia where he has conducted very successful excavations in the neighborhood of Tiahuanaco. He plans to stop off en route at Panama and then fly to Venezuela where he will survey the archæology of that country as the guest of its government.

THE ARMSTRONG EXPEDITION TO SANTO DOMINGO has sent twenty-eight living rhinoceros iguanas to the new laboratories of experimental biology at the American Museum. These come at an opportune time when studies are in progress on heat regulation in reptiles. The expedition has had some unusual successes which will be reported on in greater detail in a later number of NATURAL HISTORY.

SOUTH AFRICAN MAMMALS.—Through the generosity of Mr. Arthur S. Vernay, the collection of South African mammals in the American Museum of Natural History has been enriched by the arrival of one hundred small mammals collected during 1930 by the Vernay-Lang Kalahari Expedition. These are only a part of the valuable material obtained by this expedition, for not only this Museum, but also the Field Museum, the British Museum, and the Transvaal Museum have benefited by Mr. Vernay's generosity.

This material has been worked up by Mr. Austin Roberts of the Transvaal Museum and according to Mr. Robert's report, 38 forms are represented in the American Museum's share of the collection. Among these are 15 newly-described forms with 43 paratypes. With perhaps one or two exceptions, this material is all new to the American Museum collection. This collection is especially rich in squirrels and the smaller carnivora. A series of 167 large mammals obtained by this expedition was received in January, 1931.

SOUTH AFRICAN BIRDS.—The 624 specimens of birds received from Mr. Vernay's expedition are likewise a notable addition to the collections of the American Museum. They represent 265 different forms, of which 32 were described as new by Mr. Austin Roberts from the material secured by the expedition. Many other species and races are new to the American Museum collection, and the whole of Mr. Vernay's latest gift is welcomed as a valuable aid to studies on African birds. Many of the wide-ranging and variable species were first made known from South African specimens, so that for taxonomic study it is essential to have representatives from that region. It has also been shown that many localized races are found in and near the Kalahari Desert.

Hitherto the South African material in the Museum has been rather inadequate, and it is gratifying to receive the present series of birds of prey, francolins, guinea fowl, bustards, sandgrouse, doves, hornbills, and smaller birds of so many families. For us they will throw new light on the geographic variation of birds in the great arid region of Southern Africa.

Together with the Vernay collection came a gift to the American Museum from Mr. Herbert Lang, a collection of 52 bird skins which he had made at various times in other parts of South Africa. These, too, will prove decidedly useful, and they include a fine pair of Verreaux's eagles, a lesser flamingo, honey-guides, and an African alpine swift.

ASTRONOMY

AT the annual meeting of the Amateur Astronomers Association on May 18, 1932, the following officers were elected for the year 1932-33: President, Dr. Clyde Fisher; First Vice-President Dr. Oswald Schlockow; Second Vice-president, Mr. Charles W. Elmer; Third Vice-president, Dr. Clement S. Brainin; Fourth Vice-President, Mr. Oliver P. Medsger; Fifth

Vice-president, Dr. R. E. Lee; Treasurer, Mr. Charles J. Liebmann; Secretary, Miss Marian Lockwood. The other members of the Executive Council which guides the destinies of the Association, are Stansbury Hagar, William Henry, D. S. Pickering, John A. Kingsbury, O. H. Caldwell.

THE Amateur Astronomers Association sent three groups to New England to view the total solar eclipse of August 31. One group went to Wolfeboro, N. H., under the leadership of Mr. Leo Mattersdorf, a member of the Association; a second group went to Fabyan, N. H., under the leadership of Miss Marian Lockwood, the secretary; and Mr. F. Pierce, another member of the society, was to meet a third group at Fabyan and then hike down through the mountains to North Conway, there to view the eclipse. The group under Mr. Mattersdorf, consisting of eleven persons, was successful in seeing most of the eclipse, although the total phase was observed through thin clouds. Baily's Beads, the so-called "Diamond Ring" prominences, and the shadow of the moon were all seen by this group. Birds were observed flying to their nests and cows running as if to their barns. Night hawks circled about for the short duration of darkness. No shadow bands were observed either before or after totality. The group in Fabyan were not successful in seeing the total phase at all. Once during the two-hour period of the eclipse the clouds thinned out sufficiently over the sun to show very dimly the bitten disc of that luminary. The darkness at totality was impressive, being as black as the blackest night.

Dr. Clyde Fisher flew above the clouds to photograph the eclipse and succeeded in making some interesting photographs of the phases. His altitude was 16,000 feet, or 8000 feet above the clouds. Doctor Fisher's plane was piloted by Casey Jones, co-pilot Miss Paula Lind, and his companion on the trip was Leopold Godowsky, the musician. Doctor Fisher also made motion pictures of the eclipse.

A group of forty members of the Junior Astronomy Club of the American Museum, under the direction of Miss Dorothy Bennett, made successful observations of the total solar eclipse from North Limington, Maine.

THE Amateur Astronomers Association will have its first meeting of the fall season on Wednesday, October 5, at 8:15 P.M., in the large auditorium of the American Museum of Natural History. All those interested in astronomy are urged to attend. The lecturer for this first meeting will be Dr. Clyde Fisher, the president of the

organization, who will speak on "Astronomical Adventures in the Southwest," describing his visits this summer to Mt. Wilson Observatory, Lowell Observatory, in Flagstaff, Arizona, and his investigations of Meteor Crater in Arizona. The lecture will be illustrated with lantern slides. On Wednesday, October 19, the officers of the Association are planning an Eclipse Night, when the various experiences of the observers will be recounted. Doctor Fisher will describe his airplane experiences photographing the eclipse, and Mr. Leo Mattersdorf will tell of the group from the Society which met at Wolfeboro to observe the eclipse. Time will be given for other speakers of interest. Anyone wishing to obtain information concerning the Amateur Astronomers Association, should address inquiries to Miss Marian Lockwood, Secretary Amateur Astronomers Association, American Museum of Natural History.

CONSERVATION

WHALES.—The Council for the Preservation of Whales, through its executive secretary, Mr. A. Brazier Howell has sent the following informatory letter to its members, under date of June 25, 1932.

TO THE MEMBERS OF THE COUNCIL:

As a result of the international conference on whaling held under the auspices of the League of Nations in Berlin during the spring of 1930, which was attended by Dr. Remington Kellogg, as a representative of the Council, the Economic Committee of the League reported favorably (June 14, 1930) on the recommendations that had been offered in behalf of whales.

The Senate Special Committee on Wild Life Resources held on March 20, 1931, a hearing (subsequently published) on whales, at which Messrs. Radcliffe, Palmer, Kellogg, and Howell appeared for the Council for the Conservation of Whales and testified to the urgent need for international regulation of whaling. The matter was referred to the attention of Senator Norbeck.

On September 19, 1931, there was opened by the League of Nations a Convention for the Regulation of Whaling, which was in due time submitted for the signatures of members of the League and other nations interested. Briefly this provides for the total protection of Right Whales and of calves of all species, as well as of cows accompanied by calves, full utilization of carcasses, remuneration of crews on the basis of size rather than of numbers of whales secured, licensing of whalers, and the gathering of statistics. The provisions are all excellent and have the unqualified support of the Council.

On behalf of the United States this Convention was signed March 31, 1932, at Geneva by Ambassador Wilson, and also by the plenipotentiaries of Albania, Germany, Belgium, Great Britain, Northern Ireland, Canada, Australia, New Zealand, Union of South Africa, India, Colombia, Denmark, Spain, Finland, France, Greece, Italy, Mexico, Norway, Netherlands, Poland, Rumania, Switzerland, Czechoslovakia, Yugoslavia, and Turkey. Subsequent ratification by each nation is, however, a necessity.

On June 8, 1932, Mr. Radcliffe, on behalf of the Council, testified before the Senate Committee on Foreign Relations in favor of the Convention, and on June 10, 1932, the matter was approved for ratification by the United States Senate. It appears that this country has the honor of being the first nation formally to ratify the Convention.

In order to become effective the Convention must be ratified by at least seven nations, including Norway and Great Britain. This will doubtless be accomplished shortly.

Your Council is expected to lend its aid, when needed, in preparing and hastening the passage next fall of enabling legislation to provide for the proper operation in this country of the convention, which should be a matter of no great difficulty.

The accomplishment of international legislation is a tedious process and it is only because of the efforts of Mr. Radcliffe, of the Bureau of Fisheries, Dr. Palmer of the Biological Survey, and Senator Norbeck, that the present results have not been further delayed.

SUGAR PINE FOREST FOR YOSEMITE NATIONAL PARK.—On April 23, in the first session of the 72nd Congress Senator Nye introduced in the Senate a bill to restore to the Yosemite National Park, of which it was originally a part, the magnificent forest of sugar pines through which passes the Big Oak Flat road (the highway from Stockton to the Yosemite Valley), as well as the route from the Yosemite Valley, the Tioga Pass and the Hetch Hetchy dam.

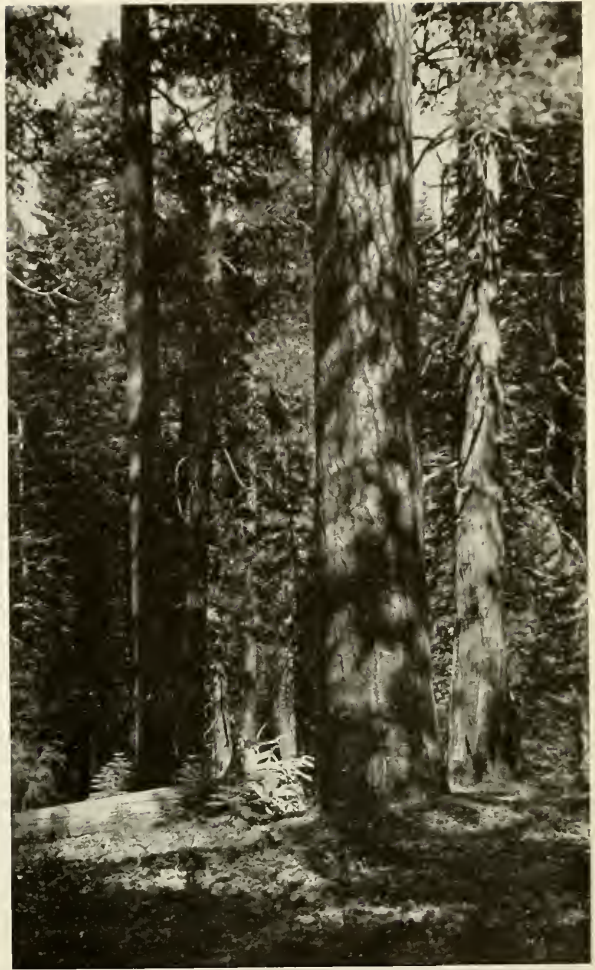
This beautiful region, which is one of the main tourist routes, was a favorite haunt of John Muir and is described in a number of places in his writings. The timber is privately owned and will be cut, unless acquired by the Government. The Bill (No. S. 4472) proposes to acquire this tract by giving in exchange other timber now in government ownership in some region not of scenic importance, and involves no appropriation.

If you are a member of some organization interested in conservation of nature, in automobile touring, or outdoor life, get it to take up the fight and protest to the Secretaries of the Interior and Agriculture, also to its Senators and Congressmen, against the devastation of the region. Personal letters and appeals to those officials will also help.

THE Shenandoah National Forest, which lies approximately one hundred miles southwest of the Nation's capital, has been renamed the George Washington National Forest by executive order of President Hoover.

The Secretary of Agriculture, upon recommendation of R. Y. Stuart, chief of the Forest Service, U. S. Department of Agriculture, chose this forest in Virginia and West Virginia as most fitting to be named as a perpetual memorial to the Father of his Country. It is in a region once frequently traversed and in part surveyed by George Washington.

The George Washington National Forest is the largest in Virginia. It stretches for nearly one hundred miles along the summits and slopes of the Shenandoah Mountains and for a shorter



Photograph by W. G. Van Name

MENACED WITH DESTRUCTION

Western yellow pine and incense cedar in the area that is to be logged

distance along the Massanutten Range. Its gross area is 802,700 acres, more than half of which has already been acquired by the Government.

This is the second National Forest to be named for a president of the United States this year. The Colorado National Forest was recently named the Roosevelt. Other existing National Forests named for presidents are the Lincoln in New Mexico and the Cleveland in California.

DISTRICT OF COLUMBIA MADE A BIRD SANCTUARY.—By act of Congress approved July 14, the District of Columbia is in effect made a bird sanctuary. The new law repeals the provision of the District of Columbia game law of 1906 that allowed shooting on parts



GEORGES CUVIER
(1769-1832)

The centenary of whose death is being observed this year. His regalia is that of a member of the Academy of Sciences of Paris

of the Eastern Branch and on parts of the Virginia side of the Potomac River within the District.

MAMMALS

NEW MAMMAL COLLECTION FOR MUSEUM.—Mr. Hedin Bronner of New York, spent the summer months in studying and collecting mammals in the vicinity of Trondhjem, Norway. His collection will be presented to the American Museum at the expiration of his work.

DURING the month of August, Robert T. Hatt continued his studies on the mammals of Leelanau County, Michigan. Collecting was done on both the mainland and on North Manitou Island, in Lake Michigan. On this large island only a few mammals have established themselves but some of these have attained unusual abundance.

CENTENARY OF DEATH OF CUVIER

THIS summer marks the rounding out of a century since the passing of the great French naturalist, Georges Cuvier, whose contributions to systematic zoology, comparative anatomy, and paleontology have won for him a distinguished place among the greatest scientists of all times.

Montbéliard, where he was born on August 23, 1769, is paying homage to his life and work in a special memorial celebration, and Le Muséum National d'Histoire Naturelle is devoting a special issue of its *Archives* to the famous savant who passed almost all the years of his life studying, working, and teaching within its walls.

From 1784 to 1788 Cuvier attended the Stuttgart Caroline Academy, and it was during these years that he first became interested in natural history, while collecting herbs and insects and making dissections of the latter.

On Cuvier's return to Montbéliard he became tutor to the children of the Comte d'Héricy. He found time to

pursue his studies of plants and insects, and at every opportunity he enlarged the scope of his investigations. When he was twenty-five years old, he met A. H. Tessier, the agriculturist, who was so impressed with his erudition that he brought Cuvier to the attention of such men as Parmentier, Jussieu, Daubenton, and Geoffroy-Saint-Hilaire.

Through the influence of Lacépède, Lamarck, and others, he was appointed in 1795 as assistant to Mertrud, the professor of comparative anatomy at the Muséum d'Histoire Naturelle. In 1802 he succeeded his superior as professor of that science, and laid the foundations of the collection of comparative anatomy that is still one of the great intellectual attractions of that Museum.

During 1802 also he was appointed commissary of the National Institute to accompany the inspectors-general of public institutions, visiting

southern France in this capacity. In 1803 he was made Perpetual Secretary of the Institute in the department of physical and natural sciences. He held this position for thirty years.

In 1808 Cuvier was elected to the Council of the Imperial University, and before the fall of Napoleon he had been elected to the Council of State. He was also made chancellor of the University, and in 1831 Louis Philippe raised him to the rank of peer of France.

He died May 13, 1832, in his 62nd year.

MEETINGS OF SOCIETIES

THE THIRD INTERNATIONAL CONGRESS OF EUGENICS met at the American Museum August 22-23. A summary of the proceedings will appear in a later issue of NATURAL HISTORY. For the benefit of schools and other educational societies which may open during September, the exhibits that have been especially prepared for this Congress will remain on view in Education Hall of the School Service Building until October 6.

HONORS

PROF. WILLIAM K. GREGORY was elected a Foreign Correspondent of the Geological Society of London on June 22, 1932.

SCIENCE OF MAN

JAPANESE SWORD FURNITURE.—The Japanese ethnological collections in the American Mu-



CUVIER AT ABOUT THIRTEEN YEARS OF AGE. He is holding in his hands the large jawbone of an animal. From a photograph of a painting by Vyrsek



STATUE OF CUVIER

This memorial of the famous scientist stands in the town of his birth, Montbéliard, France

seum have recently been enriched by the addition of a collection of sword furniture consisting of sword guards, fuchi, kashira, menuki, etc., and a series of netsuke presented by Dr. Walter L. Hildburgh. The sword furniture is a particularly acceptable addition to the Japanese collections, since up to the time of Doctor Hildburgh's gift the Museum possessed no examples of this specialized art. The chief interest lies not so much in the use of these adjuncts to the sword, but in their demonstration of the unexcelled utilization of metal alloys in the creation of design by the Japanese. The intricacy of the composition and the range of designs, which have their basis in Japanese tradition and natural environment, have long excited the admiration of art connoisseurs.

JEWELRY FROM THE FAR EAST.—In memory of their father, the late Henry Hildburgh, Dr. Walter L. Hildburgh and Sydney Cornelius Hildburgh have recently presented to the department of anthropology of the American Museum a large and comprehensive collection of native jewelry from the peoples of India, China, Korea, the Straits Settlements, and other far eastern countries. Hitherto this ornamental phase of work in metal has been very scantily represented in the collections from that part of the world.

NEW PUBLICATIONS

The Social Life of Monkeys and Apes.—By S. Zuckerman, Harcourt, Brace and Company, New York.

FEW books written in recent years are of more general significance to the naturalist than the splendidly illustrated volume by Doctor Zuckerman, the distinguished anatomist, of the Zoological Society of London. Naturalists have often wondered why birds hold together in flocks, or fish in schools. The mechanisms which, bind individuals into colonies or societies is not, however, merely a matter for speculation. Many laboratories in recent years have presented a wealth of exact information in this field. Doctor Zuckerman's scholarly analysis of monkey and ape societies may well be placed in the forefront of these recent studies.

Monkey society like many other animal societies is based on a system of dominance. In the baboon colony the "overlord" maintains his harem by strength. The adult females tend to remain near their overlords because they are never entirely out of œstrus. The social position of the "wives" within the harem is determined by the particular phase of œstrus in which they happen to be. Sexual responses appear very early in the life of many primates and they may be used in non-sexual situations for material gain. Thus movements that arouse sexual response are frequently used to divert the anger-reactions of a more powerful associate. Although sex is the chief bond in ape society there are other consolidating forces. Of these the most important appears to be the instinct of apes to groom fur when and wherever they can find it.

Oddly enough the care of the young is of minor importance in holding the family together. Monkeys groom and nurse dead young with the same persistence they display toward their living offspring. Mutual aid both within the family and the society can be referred to an endocrine and reflex basis which is shown by Doctor Zuckerman to have a very real existence in fact.

The author has had an unrivaled opportunity to study baboons both in the London Zoo and in the field. His book includes a concise summary of his observations on this highly social primate. Nevertheless, a part of the book which is even more valuable to the general zoölogist is the introductory chapters dealing with the physiology and psychology of the sex cycle in mammals. Some recent discoveries such as those on the hormone of lactation are not included, but on the whole these chapters represent the most comprehensive and yet readable review of the field which has recently appeared.—G. K. N.

Die Biologie der Kleinschmetterlinge (Biology of Micro-lepidoptera). By K. T. Schütze. Published by the Inter-Nationalen Entomologischen Verein E. V. Frankfurt am Main, Germany.

OF the 235 pages of this work, 207 are devoted to lists of "micro" larvæ, short descriptions, and host plants. The remaining pages contain indices to plants, insects, bibliography, and introduction. The plant arrangement followed is that of H. Wagner in *der Illustrierten deutschen Flora* and under each genus of plants, and often each species, is given a list of the caterpillars feeding thereon, together with the characteristic appearance of their work, and a brief description of the cocoon. According to the author, the work is the result of fifty years' study of the group, combined with all records contained in the available literature, and includes only a small number of records from outside of Germany. In the introduction, Herr Schütze deplors the endless description of varieties, aberrations, forms, races, etc., attempts at hybridization, effect of heat and cold, and even the study of exotic forms. In the stead of these things, he would have the students of entomology spend their time learning something about the natural history of the local insects. This work should prove of value to all those interested in economic entomology, and will provide an excellent guide to students of micro-lepidoptera who desire to secure specimens by rearing them.—C. H. C.

NEW MEMBERS

Since the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total membership 11,532.

Sustaining Member

Miss ELLA HENCKEN

Annual Members

Mrs. JOHN TYSSOWSKI.

Dr. LOUIS KARMIÖHL.

Major HOWARD A. CIDDINGS.

Messrs. E. URNER GOODMAN, Wm. A. HYMAN, W. U. PARSONS, FREDERICK B. SILLIMAN.

Associate Members

Dr. EVANGELINE W. YOUNG.

Mesdames THOMAS R. BAKER, CHARLES FRANCIS CLISE, E. ESCHER-ABEGG, CHAS. S. HAMNER, CHARLES V. HARRISON, ANSON P. S. HOYT, RUSSELL LONG, CARRIE B. SHAVER, ARTHUR STUPKA, WILLIAM LAMONT TAYLOR.

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JOSLIN, LOTTIE LYONS, MARY FRANCES MATTISON, MARIAN G. PAGE, MARY REDDICK, ADELINE THURSTON, GEORGIA WARREN.

Rev. Dr. WINFIELD BURGGRAAFF.

Doctors V. ANDERSON, PAUL G. BOHR, H. W. MITTEN, HUGH J. MORGAN, FRANK E. SMITH, PAUL WITHINGTON.

Messrs. CLAUDE ABRAMSON, ROBERT M. ANDERSON, JOHN

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BERKOWITZ, H. S. BLAIR, A. J. BROWN, NOAH BUDIN,

ROBERT GIBSON CHAFFEE, E. T. CHASE, CHARLES C.

CURTIS, JOHN DAWSON, WALTER C. DETTE, J. W. ELLIS,

GORDON R. FREDERICK, RAYMOND C. FORCE, JR., JOSEPH

B. FORSYTH, C. KEITH GEBHARDT, RAYMOND GRIFFITH,

ROBERT BRIAN GROSJEAN, W. W. HEATHMAN, ROBERT G.

HENDERSON, GEO. N. KING, SIDNEY A. NESBIT, E. B.

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BOBB SCHAEFFER, FREDERIC B. SCHRAMM, ARTHUR M.

SHARER, JR., MARSHALL E. STEWART, HOWARD T. STORIE,

NORTH STORMS, GILBERT TOMPKINS, WOLCOTT TUCKER-

MAN, MALCOLM S. Mc.N WATTS, JR., ALBERT B. WELLS,

ELBERT A. WICKES, MURPHY M. WILLIAMS, KIMBALL R.

WOODBURY.

Masters IRVING SEAMAN, JOHN SUETTERLE TAYLOR.

SCIENTIFIC STAFF (Continued)

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E. W. GUDGER, PH.D., Bibliographer and Associate
FRANCESCA R. LAMONTE, B.A., Assistant Curator
CHARLES H. TOWNSEND, SC.D., Research Associate
C. M. BREDER, JR., Research Associate
LOUIS HUSSAKOF, PH.D., Research Associate in Devonian Fishes
VAN CAMPEN HEILNER, M.Sc., Field Representative
*Also Research Associate in Paleontology and Associate in Physical Anthropology

Amphibians and Reptiles, and Experimental Biology

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WILLIAM DOUGLAS BURDEN, A.M., Research Associate
FRANK S. MATHEWS, M.D., Research Associate
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O. M. HELFF, PH.D., Research Associate

Birds

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ROBERT CUSHMAN MURPHY, D.Sc., Curator of Oceanic Birds
JAMES P. CHAPIN, PH.D., Associate Curator of Birds of the Eastern Hemisphere
JOHN T. ZIMMER, M.A., Associate Curator of Birds of the Western Hemisphere
ELSIE M. B. NAUMBURG, Research Associate
ALBERT R. BRAND, Associate in Ornithology

Mammals of the World

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MARCELLE ROIGNEAU, Staff Assistant in Comparative Anatomy
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RONALD L. OLSON, PH.D., Research Associate in Peruvian Archaeology

Asiatic Exploration and Research

ROY CHAPMAN ANDREWS, SC.D., Curator-in-Chief
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CHARLES P. BERKEY, PH.D., SC.D., [Columbia University], Research Associate in Geology
AMADEUS W. GRABAU, S.D., [National Geological Survey of China], Research Associate
PÈRE TEILHARD DE CHARDIN [National Geological Survey of China], Research Associate in Mammalian Paleontology

Preparation and Exhibition

JAMES L. CLARK, Vice-Director (In Charge)
ALBERT E. BUTLER, Associate Chief

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GEORGE N. PINDAR, Chairman

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BLAZING THE TRAIL

SURROUNDED by the forests of Cambodia, and lying to the north of the Great Lake (Tonle-Sap) are to be found the ruins of some of the most remarkable structures ever erected by men. These ruins comprise the long deserted city of Angkor-Thom and the well preserved city of Angkor-Vat.

Erected in the latter part of the Ninth Century A.D., but deserted long ago and all but covered by the insidious growth of the jungle, these ruins, which are to be measured by the square mile, and include innumerable towers and walls and carven images, stand today as a magnificent architectural record of what must have been a highly energetic and unusually artistic people.

NATURAL HISTORY is glad to be able to publish in its next number an account and a description by Dr. H. L. Shapiro, of the American Museum's Department of Anthropology, of these unusual and seldom visited records of the ancient Khmer civilization.

AMONG modern ornithologists the name of Frank M. Chapman stands high, and NATURAL HISTORY is always pleased when it is able to obtain from his pen any account of his fascinating observations. One of Doctor Chapman's favorite spots in the field is the island of Barro Colorado in the Panama Canal Zone, and it is of this spot that he has written in recounting his experiences while observing the habits of those unusually interesting little birds, Gould's manakins. Illustrated by a number of photographs taken in the semi-dark jungle, on which Mr. Francis L. Jaques has painted the birds (for the limited light and smallness of the birds made it impossible to photograph them clearly), this article is one of the most delightful that NATURAL HISTORY has yet had from Doctor Chapman's pen. This material will appear in the November-December number.

"A Pair of Canvasback Ducks"

On the cover of this issue of NATURAL HISTORY is from a painting by Francis L. Jaques, staff artist at the American Museum. The birds are depicted in flight over a pond on the estate in England of Viscount Grey of Fallodon, who supports a veritable bird life in this delightful spot. While this canvasback is a north American duck, it was introduced successfully into England some years ago, and in 1929 Lord Grey obtained a pair for Fallodon. These ducks and their offspring remain here voluntarily during most of the year, even throughout the autumn months when migration instinct is strongest. In Mr. Jaques painting the duck and drake are shown in the full plumage which they assume in the fall and carry until midsummer.

IN the July-August number of NATURAL HISTORY there appeared an article by Dr. Clyde Fisher in which solar eclipses were discussed. In the November-December number there will appear another article by the same author in which he will describe in detail the phenomena of the total eclipse of August 31, which he made thorough plans to observe. Those readers of NATURAL HISTORY who were so fortunate to be in the path of the total eclipse will find it interesting to compare Doctor Fisher's observations with their own.

BRAZIL is a land greater in area than is continental United States. Furthermore, it lies principally in the tropics, with the result that its wild life is extraordinarily rich and varied. NATURAL HISTORY is more than usually fortunate in being able to announce for the coming number an article on the wild life of this enormous region, written by Dr. Bertha Lutz of the Instituto Oswaldo Cruz in Rio de Janeiro, who, during a recent visit to the United States, wrote an article for NATURAL HISTORY readers.

DR. Robert Cushman Murphy, of the American Museum's Department of Birds, who recently spent several

months working at the Zoological Museum in Tring, will present for the readers of this magazine his observations and impressions of English natural history between snow-time and hawthorn bloom.

STEGOSAURUS, a spine-armored dinosaur that lived 125,000,000 years ago, is the subject of an article prepared by Barnum Brown of the American Museum's Department of Palæontology.

FOR the next number of NATURAL HISTORY, H. C. Raven, of the American Museum's Department of Comparative and Human Anatomy, has written an article on the water buffalo of the Far East.

THE AMERICAN MUSEUM OF NATURAL HISTORY

FOUNDED IN 1869

SIXTY-ONE 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 NEARLY 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. Nearly 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	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

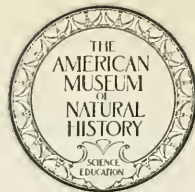
Series of illustrated lectures held on alternate Thursday evenings in the autumn and spring of the year are open only to members of the class of \$10 annually or higher or to those holding tickets given them by members.

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 have been constantly in the field for years, gathering information in many odd corners of the world. During 1931 twenty-three expeditions visited many distant portions of the globe. In 1932, however, owing to the limitations of funds, expeditions will necessarily have to be eliminated except as they are financed by gifts. In this work of exploration, consequently, the American Museum especially needs the generous help of its many friends in order to further the scientific work of the institution. Contributions to this phase of the work of the Museum are of more than usual value, and the Museum will be glad to discuss any angle of its delayed program of exploration with anyone interested in aiding this work financially.

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 108,000 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 coöperating 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.

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SCULPTURES FROM ANGKOR

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Photograph by H. L. Shapiro

"THE LEPER KING"

Almost intact, this example of Khmer artistic skill is commonly regarded as one of the finest pieces of sculpture produced by the ancient Cambodians. It is, however, neither a king nor a leper, but a diety.

Its present appellation is no doubt derived from its weathered state

See "The Ruins at Angkor," Page 453

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THE RUINS AT ANGKOR

Architectural Masterpieces of a Former Civilization in the Cambodian Jungle—
Mute Witnesses of the Splendor of the Ancient Khmers

By. H. L. SHAPIRO

Associate Curator of Physical Anthropology, American Museum

PHOTOGRAPHS BY THE AUTHOR

IT is a pleasing parallel to conceive the archæological achievements of the past in terms of geological elevation. Conceding some latitude to this figure, we may permit the peaks and mountains of nature, forming great ranges and systems and leveling off through minor elevations into flat plains, to illustrate in a fashion the spatial pattern of the great civilizations of prehistory. One such range of archæological mountains stretches from the Valley of Mexico to Peru with culminating peaks represented by the Mayas in Yucatan and by the Incas in Peru. Another and greater one rises in Rome and follows a horizontal belt to the far end of Asia. The Olympian heights of Greece, Egypt, Babylonia, Persia, and India bestow grandeur to this pregnant strip of the earth's surface.

Among these areas rich in human accomplishment a not inconsiderable position must be awarded to Cambodia. This land, now a part of France's colonial province in Southeastern Asia, adjoins Siam on the west and Indo-china on the east. A millenium ago Cambodia was

the scene of one of the proudest kingdoms in the Orient with powerful armies and a rich court. Today, except for the sculptures and the architectural monuments of Angkor, it is scarcely known and then only to a few travelers and scholars.

The first intimation that came to the west of the existence of the ruins of a once vast and advanced civilization in Cambodia was in 1601 with the publication by Ribadeneyra, in Barcelona, of his voyages to the East. In this work he mentioned Angkor, which had been discovered by Portuguese and Spaniards in 1564. At about the same time two other Spanish accounts appeared but without detail concerning the ruins. Somewhat later, in 1669, a Dutchman named Van Wusthof, issued in Haarlem a fuller account of the marvels of Angkor. Interest in Angkor, however, lapsed—if it can be said ever to have been aroused—until early in the Nineteenth Century, when Abel Rémusat brought out a French translation of a Thirteenth Century description of Cambodia by a Chinese traveler.



ANGKOR-WAT

A wat signifies a temple. This one at Angkor represents the acme of Khmer architecture, for after its construction new building ceased

The modern interest in Cambodia may really be dated from a visit made by Mouhot in 1861, from which he returned full of the inevitable enthusiasm for Khmer art. Doudart de Lagrée in 1866 and Delaporte in 1873 added fuel to the growing fire of zeal among a small group of enthusiasts for Cambodian civilization. It is to the French that we owe all our knowledge of the Khmer civilization in Cambodia, for in 1863 France established a protectorate over the Khmer kingdom, which was being broken up by surges from Siam and Annam, and made it possible for French scholars to study the remarkable remains that were found abundantly throughout the province. Unfortunately no spade archæology has been encouraged in Cambodia, so that knowledge concerning the origins of the Khmer culture is confined to erudite probings among inscriptions and scholarly analyses of æsthetic patterns. It is this

aspect of the *corpus* of information concerning the ruins of Cambodia and their builders that has encouraged the application to Khmer origins of that romantic word—mysterious. The Khmer art and the Khmer civilization of Cambodia are no more mysterious than any other cultural phenomenon about which our information is not yet full enough to answer the question of its origin.

The most frequently figured of all Khmer monuments in Cambodia are the ruins of Angkor. Both their intrinsic beauty and accessibility have contributed to establish these remains in the popular conception as synonymous with Khmer art; but it would be misleading to think of this brilliant civilization as represented only by Angkor, for scattered throughout Cambodia are more than eight hundred temples and other edifices. How many more will come to light when exhaustive investigations are made no one can predict.

This abundance, however, of considerable architectural monuments gives some indication of the activity and fertility of the civilization which gave birth to them. The buildings which have become completely dilapidated, the numerous structures built of perishable wood, the villages and cities full of houses constructed then as now of fragile and unresisting materials must have served as a populous decor for the major structures in stone which have survived the ravages of time. In the hot, moist climate of Cambodia, where the jungle invades the abandoned clearing with sure inevitability, even buildings of stone cannot survive its deadly embrace. Sad as it is to see these stone and brick monuments of the Khmer spirit, mute in the coils of the forest, their crumbling grandeur nevertheless appeals perhaps more profoundly to our modern taste than they would have in their fresh perfection surrounded by the squalor of mankind.

Bearing in mind that the dirt archaeology of Cambodia is still nonexistent and that to the future belong many revelations concerning the origins of its civilization, it is at present established from dated inscriptions on some of the buildings that Khmer architecture has a history which goes back at least to the Fifth or Sixth Century and terminates in the Thirteenth. The former date will unquestionably be extended further into antiquity when more is known about the beginnings of the Khmer civilization, but the latter date seems destined to stand as the terminus of the active period of this culture. Although the Khmer empire continued even after 1300 as an independent state, the attacks of the Siamese were no longer resisted as they had been, and sacking by their neighbors reduced the Khmers to a state of impotence and powerlessness to debate the partition of their territory by encroaching



THE CENTRAL TOWER OF ANGKOR-WAT

Above the innermost sanctuary rises a central tower of stone. The staircase leading up to it forms a dominant feature in the architecture



A KHMER RELIEF

The walls of Angkor-Wat are literally encrusted with exquisite carvings such as this one representing a divinity



STONE DECORATION

Besides human figures, animal and floral designs are commonly employed in the decorative stone carving at Angkor



AN EXAMPLE OF CAMBODIAN ART

The treatment of the human figure is not distinguished by great anatomical knowledge. Conventionalization, on the contrary is the characteristic note



A CLOSE-UP

The traditionalism and uniformity in Khmer art is apparent here as in the preceding photographs. Attention is drawn to the figure as a symbol and design element rather than because of its realism



VILLAGERS AT ANGKOR

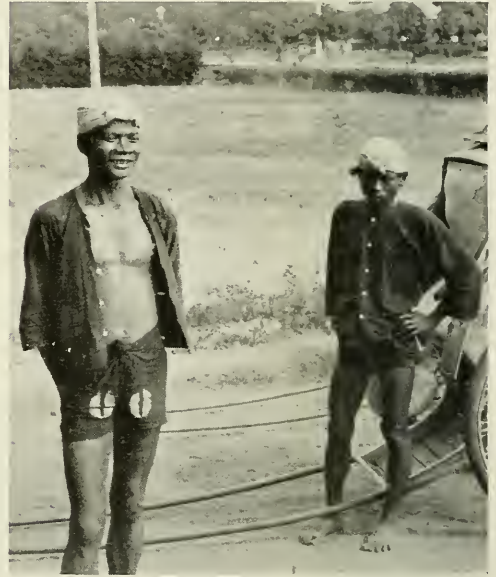
A small native settlement of Khmers is situated near Angkor. Many of the villagers earn their livelihood from the tourists

conquerors. The assumption of French control prevented the final humiliation of Cambodia at the hands of its enemies, but it also spelt the complete exhaustion of a formerly vigorous people who accepted the peace of foreign control.

To attempt here to describe adequately the sculptural and architectural remains of the Khmers would be presumptuous at the very least. That is a subject worthy of a monograph and possible only to a specialist profoundly devoted to this intricate field. Even the task which I have set myself, to describe something of Angkor as seen by a casual visitor, seems stupendous. Just as the art critic before a masterpiece is reduced to a mere description of its subject, an analysis of its technique, or a dissertation on its composition, the visitor before Angkor-Wat can only enumerate the details. For Angkor-Wat is a work of art, a masterpiece of architecture, and the essential quality which illuminates it

escapes the verbal power of its admirer as completely as a masterly painting eludes the pin of one who seeks to impale it as one would a butterfly.

The ruins of Angkor consist of the Temple or Wat, and of the city itself—containing royal edifices inhabited by the king, public buildings of various kinds,



RICKSHAW BOY

At Pnom Penh, one of the important towns of Cambodia, rickshaws have been introduced as a principal means of conveyance

pavilions and other structures. Much of Angkor-Thom, or the city, was erected in the Ninth and Tenth Centuries. Angkor-Wat itself is dated, at least its completion, in the Twelfth Century, at the end of the classic period. The temple, which is the first structure to meet the eye as one approaches by motor over an excellent road from Siem Reap, is in a fine state of preservation. The French, who have recognized the preciousness of this ruin, have cleared the jungle and skillfully restored in part the gravest ravages so that something of its original quality is still discernible. Surrounded by a wide moat green with lotus pads, the

five towers of the inner sanctuary dominate the approach. Crossing the moat and leading up to the outer wall, which encloses the temple, is a wide, stone-paved avenue bordered by a serpent balustrade—the Naga motive so common in Khmer art. Passing through the portal of the outer wall, one continues along another stone-flagged avenue. The use of the vista by means of these impressive avenues subconsciously reacts upon the visitor who very soon feels the emotion of a suppliant approaching the remote and awful shrine.

In front of the main entrance to the wat are two small edifices on either side of the



BY THE ROADSIDE

These women are resting by the roadside. Like most Cambodian women, they wear their hair cut short

avenue, both in the same state of ruin. Between these buildings and the wat are two square ponds. As one comes closer the wat appears to raise itself in powerful grandeur, and the mind becomes bewildered with the richness of detail. To the tourist, with his anxiety to see everything, the feast spread before him seems indigest-

ible, but I imagine that to the initiated Khmer who felt no compulsion to linger over the minutiae the setting of exuberant adornment must have exerted a profound impression.

The temple itself consists of a series of square terraces, each supporting a corbelled gallery whose roof ends where the roof of the one below begins, so that at a casual glance the whole edifice rises by easy stages to the central fane which is marked by a cylindrico-conical tower. Each of the corners of the topmost gallery also has a tower similar to the central one. Stone staircases project out from the central gallery and impart an aspect of seclusion to the sanctuary where sits a gilded Buddha.

Only the lowest and initial gallery has its inner wall completely covered by a frieze cut in low relief, representing scenes from the Ramayana and the Mahabharata sacred to Hindu culture. Here are figured battle scenes, triumphal processions, mythical creatures and gods in various



A VILLAGE MARKET PLACE

The markets are rather informal affairs but intensely interesting because of the variety of exotic foods on sale



A GALLERY AT ANGKOR-WAT

The first stage of the wat consists of a square, corbelled gallery. The inner wall is completely covered by low reliefs. Square pillars support the opposite span of the vault

crystallization of a long succession of architectural experiments. The decoration, too, is astonishingly conventionalized, hardly deviating at any point from a uniform style, as though a whole school of craftsmen, trained under one master, executed it. The uniformity of the decoration and the perfection of the ground plan indicate

hieratic attitudes. But throughout the entire structure dancing Apsaras and numerous divinities are cut into stone pillars and walls, and an amazing decoration of a lace-like texture covers lintels and pillars. In the lower gallery traces of color are still visible on the protected inner wall indicating a former richness of pigment that would perhaps now seem out of place in so classic a setting. The rich details which spring to mind and which one feels are worthy of description would perhaps only make tedious reading. But before passing on it might be enlightening to quote from my notes which have, despite their superficiality, the virtue of a fresh impression.

My principal feeling in regarding the structure as a whole is one of wonder at its masterly symmetry. It is so precise and so meticulously faithful to a unified plan that it has the appearance of a formalized technique—the

that perhaps Angkor Wat was completed in a relatively short time, under the direction of one man, assisted, of course, by an enormous number of artists. There is a hard, jewel-like quality about the Wat, which, although a consummate achievement of its kind, lacks the quality of spontaneity which we find pleasing. As an anonymous expression of a national art it is superb.

I confess reluctance to enter into any further detail concerning the ruins of the city of Angkor. The tourist may spend days without ennui wandering about seeing ever new aspects of startling beauty, and the student might spend years of absorption trying to encompass all that



BUDDHIST MONKS

Buddhist monks with shaven heads and yellow togas still haunt the halls at Angkor-Wat. Here they are descending one of the steep staircases abutting from the central quadrangle



A LIVELY BATTLE SCENE

The profusion of detail combined with a nice balance is typical of most of the relief that adorns the inner wall of the first gallery at the wat

were worthy of study; but it would only be tedious, piling up descriptions from an uninspired pen. However, some of the best known examples of Khmer art to be found in this vast conglomeration of ruins merit at least a brief mention. Surmounting a building, known as the Bayon, are lofty towers in stone on which have been carved the four faces of Siva, to whose cult this temple was devoted. The same enigmatic expression which is characteristic of Khmer sculptured heads is also reproduced in these faces of the deity.

Deeper in the city are the remains of the Elephant Pavilion on which the royal family were said to sit as they watched the long processions and witnessed the games. It receives its name from a frieze of elephants which fills the wall of the platform. Its length is 350 meters. As one passes from ruin to ruin, some in stone, others of brick, the magnificence which it represents is borne in heavily on the susceptible mind, and a feeling of sadness accompanies it, for decay is

everywhere manifest. The process of disintegration becomes dramatically illustrated by *tableaux vivants* of lovely stone buildings enwrapped in the roots of giant trees. One can almost feel the powerful forces of the roots which slowly wedge their way between the joints and displace huge blocks of stone.

The sources of information concerning the life, the history, and the origins of the Khmers have been principally the Sanscrit inscriptions found on the walls of buildings, the bas reliefs which decorate the galleries of the temples, the traditions both of the Khmers and their neighbors, and the factual accounts written by early Chinese travelers. In these circumstances it is clear that the early history and origin of the Cambodians must of necessity be largely conjectural and subject to the individual interpretation of each historian who has dealt with the reconstructed past of the Khmers. I shall do no more than give a cursory resumé of the story.

There is reason to believe that even



AN AVENUE OF BUDDHAS

Heroic in size, these smiling Buddhas, seated in two long rows facing each other, support the body of a long serpent which rears its spread hood as an impressive Naga



SIVA OF THE FOUR FACES

On each of the four faces of these towers of the Bayon at Angkor are repeated the gigantic lineaments of Siva, a diety carried over from India



THE FIRST GALLERY OF ANGKOR-WAT

On page 460 the interior view of this gallery is reproduced. Here the exterior reveals how cloistered in appearance are the galleries of Angkor-Wat



ANOTHER ASCENT

After the long, stone-flagged approach and the ascent through long, dim corridors, these staircases on each of the four sides of the inner structure impart a sensation of religious seclusion



A KHMER HEAD

Khmer art seems epitomized in this exquisite head. Its fascination is apparent, and particularly in its many facets of expression

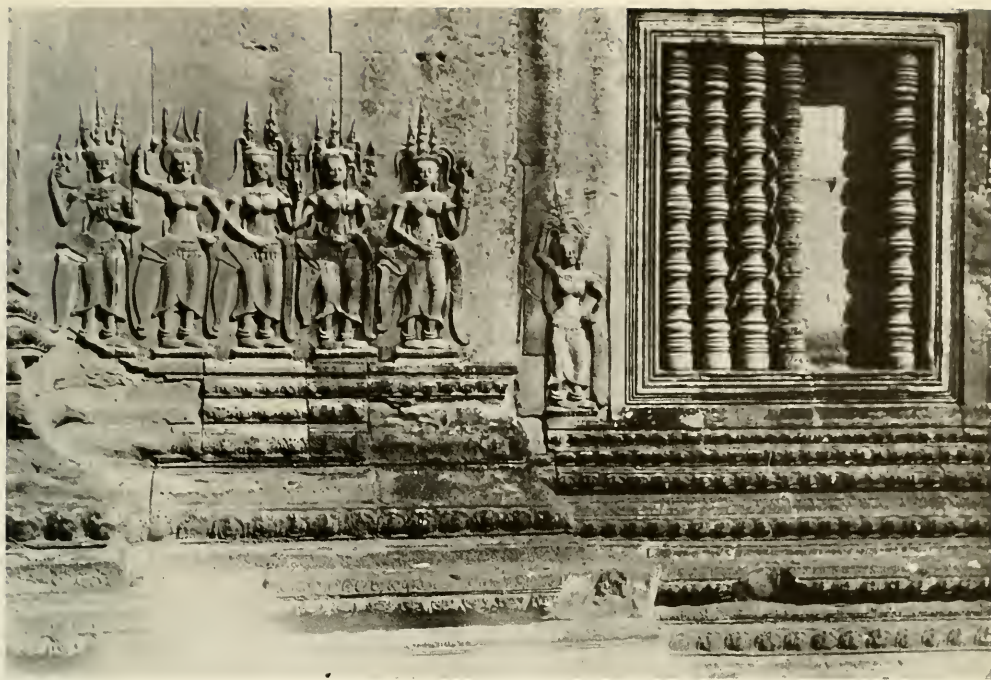
before the beginning of the Christian era contact had been established between India and the country now known as Cambodia. Early Buddhistic influences probably seeped through by way of Burma, and Hindu commerce carried the seeds of the same culture by sea. The area including the present Cambodia, part of Cochin China, and Siam was known formerly as Founan. It was this country of Founan, as yet undistinguished by the Khmer civilization, that is referred to in ancient tradition. One such, quoted by Pelliot, takes the form of a legend in which a Brahman prince is assured by a divinity of success to his arms if he invade Founan. The story relates his conquest and his subsequent

marriage to a native princess. This legend has been taken to indicate the fact that an invasion from India swept into Cambodia at least two thousand years ago.

On a recent visit to Angkor, Prof. Henry Fairfield Osborn made several very significant observations which corroborate the hypothesis of a dominating Indian influence on the culture of the Khmers. He noted that the horses represented in the reliefs were similar to the Arabian type which has been imported into India from time immemorial. The sculptured elephants, too, he found to be like the Indian war elephant.

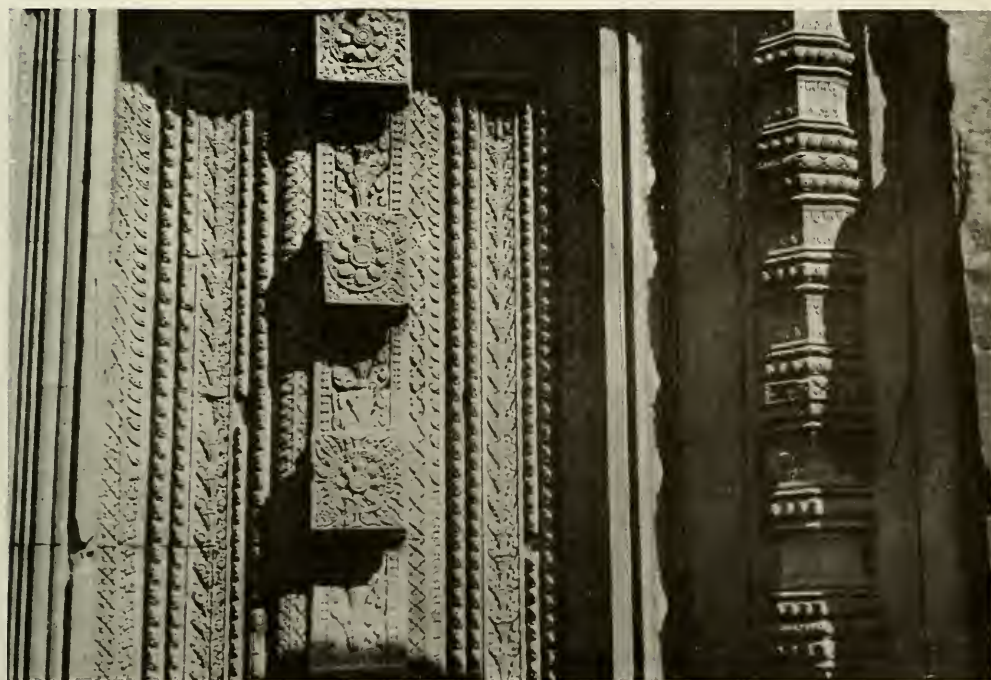
As early as the Third Century A.D. association with China is attested by Chinese annals in which the inhabitants of Founan are described and embassies which passed between the two countries are mentioned.

Apparently from then on, Chinese commercial agents sought in Cambodia the precious products of the country such as ivory, gold, tin, copper, peacock feathers, and perfumed gums, for the evidence becomes increasingly abundant of the commercial monopoly exercised by the Chinese. But the spiritual and cultural bonds with India continued to be the predominating force in the life of Cambodia. Brahmanism with its divinities engulfed the imagination of the Khmers about the Fifth Century. Tradition again pieces out the story by supplying another invasion from India, as this time political refugees, expelled from India, set up a ruling aristocracy in Cambodia. The subsequent history of these invading Indians is not



ASPECT OF A NATIONAL ART

These characteristic notched columns are commonly employed in window-like openings. Note the conventionalized treatment of the figures and the standardized dress



A STONE DOOR

This beautiful door in a small building was found deep in the ruined city of Angkor. Even among so much excellent stone cutting this stands out as a brilliant example of the art



LION EN GARDANT

This figure has obvious resemblances to the dogs or lions of Fo which are ubiquitous in Japan and China

clear, but soon after, a people speaking the Khmer language and with a capital at Sambor established the kingdom of Cambodia, which gradually extended its sway to include most of what was known as Founan in the earlier accounts. It is to these people that we owe the Khmer art of Cambodia, for they celebrated their conquests and glorified their prestige by the erection of magnificent edifices and temples.

During a period which lasted from at least the Sixth Century to the Thirteenth the Khmers were actively engaged in war and aggrandizement. Their contacts were not only with their immediate neighbors but extended from China to

India and Java. Indeed, it is supposed that at one time Java was nominally if not actually in tribute to Cambodia. About the Ninth Century, a more protected capital was sought, and a new city was erected at Angkor. From then until the Twelfth Century the classic and full-blown development of Khmer art flourished.

The glory of Angkor at its proudest has been well described by Tcheou-ta-Kouan, a Chinese traveler of the Thirteenth Century. The royal processions, the towers of gold and ivory, the rich temples assigned to the worship of the Brahmanic and Buddhistic pantheons, the hordes of slaves captured in war, and the reign of luxury and splendor impressed even the Chinese coming from one of the richest

empires in history. This superb gesture seems to have exhausted the powers of the Khmers for, after the Thirteenth Century, new building ceased, and the success of their barbarous neighbors on the field of battle began to eat into the hegemony of the Cambodian rulers. Particularly threatening were the Thai people who had invaded Siam from the north and were vigorously expanding their realm. It is supposed that these Siamese were responsible for the sacking of Angkor, for in the Seventeenth Century Angkor was already in a ruinous state. By the intervention of France at the end of the Nineteenth Century the final engulfment of Cambodia by Siam was prevented.

THE ROOFS OF
ANGKOR-WAT

From the inner portion of the temple one can look back over the roofs to the long avenue by which one reaches the wat



This brief history indicates roughly the sources from which Khmer art might have drawn its inspiration. Groslier has recognized both a southern and a northern India influence in the civilization of Cambodia. If the bond connecting the Khmers and the Hindus were strong, its strength depended mainly on the spiritual values shared by both people. For there is little evidence that the Indians after the dawn of Cambodian history engaged in extensive commercial exchange with the Khmers. Undoubtedly some commerce did exist between Cambodia and India, but the bulk of the trading from the Third Century on was with the Chinese, who in a very modern manner dispatched agents to report on the commercial prospects of the Khmers. From this source, indeed, have come some of the most enlightening contemporary

descriptions which exist on the life and the activities of the Khmers.

Some students profess to see in the technical and material accoutrements of the Khmers a profound influence exerted by the Chinese, although these latter have made but little impress on the spiritual and religious ideas and practically no contributions to the æsthetics of the Khmers. Groslier finds the influence of the Chinese particularly evident in the pottery of the Khmers. Words of a technical nature seem derived from China, although the wares themselves are less affected by Chinese styles.

Still another influence, which has been recognized by some as playing an important part in the development of the Khmer art, is derived from Java where an active culture flourished, and whence traders ar-



THE ELEPHANT PAVILION

Three stairways lead up on to the pavilion from which the king viewed processions and games. The decorative element is the elephant, the trunks of which may be seen flanking the stairs in the foreground

rived bearing new ideas some of which were incorporated into the Khmer complex. But as Groslier has pointed out, it would be fallacious to assume that the Cambodians owed everything to foreign influences. Such is not the case. Although we may see certain eclectic influences at work selecting various elements from outside sources, these selective tendencies were those of an individual culture able to recognize what it could or could not use to advantage, and never is it swamped beneath an undigested mass of foreign modes. The Khmer art is both characteristic and national, and at the base of its development is a strong aboriginal foundation from which it grew, assimilating only what had an affinity with the essential quality of its own production. Under the thick layer of Indian mythological ideology exist a vigorous and unique art and architecture. The distinctive combination of the various elements which constitute a typical wat or temple is alone characteristic of the Khmers. The tower of cylindrico-conical form, the jutting staircase forming an architectural feature of the building, the nature of the capitals, the uncolored walls, the galleries built with an ogival corbel are all features that are special to Khmer construction but which are never or rarely to be found in India.

It has been suggested that the civilization of the Khmers has influenced the Mayas of Yucatan. This thesis, although rejected by experts, has found its way into popular writing, and it occasionally reappears as a new and startling discovery. Very little, indeed, can be said in favor of such a relationship between the Mayas and the Khmers, and much against it. The intrinsic content of the art of the Khmers, the style of its execution, and the architecture are totally distinct from the esthetic pattern of the Mayas. The pyramidal base for the construction of temples and the use of the serpent, the

two major arguments employed by those who see a connection, are merely verbal resemblances. They have no basis in fact, for, when the pyramids of Yucatan are compared with those in Cambodia, one sees that in the New World the pyramid served as a sub-structure upon which, high above, the relatively small temple rested. In Cambodia, on the contrary, the temple was an integral part of the stepped pyramid, being built on its terraces. The Naga or serpent motive in Khmer art, on inspection more than casual, is also clearly not the same as the Quetzalcoatl of the Mayas. But even on the grounds of chronology there is an insurmountable difficulty. At about the beginning of the Christian era, or very soon after, important and flourishing cities already existed in Yucatan with an art style and architecture peculiar to the Maya culture. In Cambodia, on the other hand, the first dated buildings are placed considerably later, in the Sixth Century. It would be hard, therefore, to account for Khmer art affecting the Maya esthetics either in style or content.

But what of the people who built these remarkable edifices? Do they exist today or are they a lost people? Unfortunately here again we must rely on indirect evidence. The Khmers had that custom, vile in the eyes of the physical anthropologist, of cremating their dead, so that we have no remains by which we can estimate the racial characters of the builders of Angkor. The earliest verbal descriptions of the type of man characteristic of Founan, the ancient Cambodia, are to be found in the accounts of the Chinese travelers already mentioned. In the Third Century one observer described the inhabitants of Founan as "ugly and black, their hair is frizzy." The following Chinese description has survived from the Sixth Century:

The custom in Founan was to go about primitively with the body naked and tattooed and the

hair hanging down the back. Actually the men of this country are ugly and black with frizzy hair.

It was also remarked that the women, leading a secluded life, and the aristocracy were lighter in color.

It is difficult, however, to estimate the value of these Chinese descriptions. A pertinent observation has been made that among the living primitive people of the remote interior the skin color although darkened by exposure is not negroid. Furthermore, a straight-haired, light-skinned Chinese might naturally despise and over-emphasize the differing traits of another people. The modern Khmers have wavy hair and this type of hair is frequently reproduced in the sculpture. A good case, by the comparative study of the facial types represented in sculpture, may be advanced that the present Cambodian is a descendant of the ancient builders of Khmer architecture. Naturally in a conventionalized and decorative art, the favored type has been idealized and refined into an almost ethereal expression, yet it is possible to discern in these stone lineaments national traits that may still

be found in the living population. The wide and slightly pouting mouth and the shape of the face to be seen in the sculptures are likewise present in the modern Cambodian.

It is noteworthy that neither in the sculpture nor in the modern Khmer is there much evidence of Chinese mixture. The mongoloid eye with its epicanthic fold and the glabrosity of the Chinese are not dominant features in the racial picture of the Khmer. His eye is straight and lacks a fold, and his greater pilosity is evident in the moustache, beard, and body hair. Some students of the Khmers have on tenuous evidence assigned these people to the Aryan or Caucasian branch of mankind. To my eye, it is true, the Khmer shows some resemblance to certain Indian types, but there are other elements present which are not Caucasian and which impart a suggestion of a mixed people. But whatever the racial composition of the Cambodian may be, it seems probable the present people are derived from the population responsible for the Khmer civilization.



THE APPROACH TO ANGKOR-WAT

The first avenue, pictured here, leads to the outer wall over a moat covered by lotus. After one has passed through the first portal, the view shown on page 454 is revealed

FROM A TROPICAL AIR CASTLE

The Courtship of Gould's Manakin

BY FRANK M. CHAPMAN

Curator-in-Chief, Department of Birds, American Museum

IF there is any truth in the saying that "the proper study of mankind is man," it may be assumed that there is a measure of merit in the study of manakins. But regardless of reason, I defy any bird student to resist the fascination of these quaint and curious little birds once he has made their acquaintance.

As a child, I had a firm belief in the existence of leprechauns, the little fairies of Ireland. As a man, I find my leprechauns satisfactorily transformed into manakins. Wearing costumes fairies might envy, the makers of mysteriously produced calls, doers of strange deeds, manakins are, in truth, less birds than wood sprites.

Manakins are found throughout the greater part of tropical America. They number about forty species, of which two inhabit Barro Colorado Island in the Canal Zone. One of these is dressed in silky black with a bright red cap and yellow trousers; the other wears a mixed costume of green and black, with a wide shirt-front and broad collar of orange and a cap of black.

Of the first, properly known as the red-capped manakin, I have already written in *My Tropical Air Castle*, pp. 175-178. The other, Gould's manakin (*Manacus vitellinus*), although more numerous, is the more elusive of the two. Nearly every time I go into the forest or paddle about the island's shoreline, I hear its notes and singular cracking *snap* and sharp rattling *whirrs*, but the bird is usually invisible. The red-capped species lives at a height of from fifteen to thirty feet, and is observed with comparative ease, but the species named for John

Gould inhabits the lower growth, ranging from the ground upward to six or eight feet, where, in spite of its bright color, it is not readily seen.

The courtship display of the red-capped manakin is so amazing that I was confident an intensive study of the orange-breasted species would reveal equally, perhaps even more surprising sexual demonstrations. Year after year I had made casual but fruitless attempts to become familiar with the habits of this species. Returning to Barro Colorado in the winter of 1932, I determined to penetrate the innermost circles of manakin-dom. As so often happens, concentration and singleness of purpose won their reward. For two months I was an almost daily attendant at the stage on which the drama of their life is played and at the end of this time had acquired sufficient insight into their customs to present the outline that follows. But just as our study of man is never ending, so I believe that the study of manakins will continue to reveal new facts. Certainly I never passed an hour with them up to the day of my last visit without seeing something I had not seen before. So what I have to say here may be considered as only a preliminary contribution to what I venture to predict will become one of the most notable of bird biographies. I shall first give an outline of what I believe to be the nesting habits of *Manacus vitellinus*, and follow it with a statement of the facts on which it is based.

Gould's manakin has a long nesting period lasting at least through the dry season—December to April—and pos-

sibly longer. During this time the males live in groups of from three or four to a dozen individuals. Each bird clears a small space on the floor of the forest which is the focal point of its existence and the scene of the remarkable performances designed to attract the female. This space I have called the "court." The female is associated with the male only during the period of wooing (which occurs in and near the court) and of egg fertilization. She builds the nest and rears the young unaided by the male, who has no connection with the home life of his species. Their sexual relations, therefore, resemble those existing among humming birds, more particularly the members of the genus *Phæthornis* in which the males have a fixed place or *lek* where they sing and display themselves.

The fact that in manakins the activities connected with courtship are conducted day after day, month after month, at the

same place, permits of prolonged, continuous, intensive observation of the individual and its associates. One, therefore, sees not only incidents intelligible in themselves, but through their frequent repetition, learns the significance of actions whose intent is less obvious. The two sets of observations combined help to form what the animal psychologist terms a "pattern of behavior."

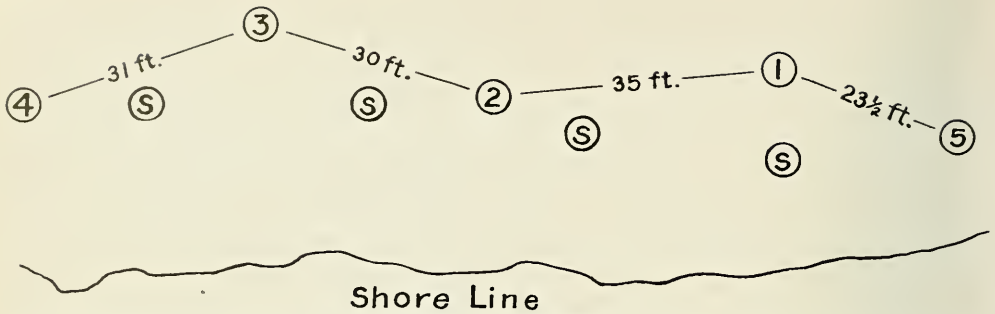
THE COURT.—It was a memorable morning when I learned that Gould's manakin was the maker and owner of the bare space on the forest floor that I found beneath the branch on which one of these birds had been perching. Somewhat similar spaces are, however, made by ocelots, and it was not until I had repeated the observation several times, that I was convinced of its meaning; then I wondered why it had taken me so long a time to make the discovery.

During the nesting season the life of



THE MANAKINS' FOREST

General character of the undergrowth and covering of the forest floor where the Laboratory manakins made their "courts"



POSITION OF COURTS

Diagram showing, in figures, the five "courts" of the Laboratory group of manakins and the station (S) of the observer when studying the behavior of their occupants

the male is restricted to the court and its immediate vicinity. At intervals of approximately one hour he flies away swiftly with the apparent object of securing food, and usually returns within a space of four minutes, sometimes with a berry in his bill.

As the stage on which, at this period, the life of the male, and occasionally that of the female, is lived, we should first have some conception of the character of the place which the chief actor has prepared for his display.

This stage, or court, is irregularly elliptical in outline and averages two and a half feet long by twenty inches in width. Except in the middle, the hard, bare earth is as clean as though swept by a broom. Immovable roots remain, but no leaf is permitted to stay in the court of a male whose sexual activities are at their height. The bird's first duties in the morning are to clean court. Small leaves are carried in its bill to a height of about three feet and dropped at the same distance from the court. Large ones are taken in a more direct line to the edge of the court. One that I saw removed measured $10\frac{1}{2} \times 3\frac{3}{8}$ inches and was therefore two and a half times longer than the bird.

To test the bird's color sense, I placed the red petals of the passion flower and green leaves of about the same size in a court. Sometimes one, sometimes the

other was removed first, from which it would appear that the bird is no more responsive to red than it is to green.

The courts are placed in forests with an undergrowth of small saplings, several of which grow about their borders. There appears to be no regularity in connection with their location in regard to one another. In one instance two courts were only twelve feet apart, while two others of the same group were each two hundred feet away in different directions. But the five courts of the group which I studied most closely were set at approximately equal distances of about thirty feet from each other. By taking a favorable position behind a tree or bush it was therefore possible for me to have two courts under close observation at the same time.

THE NEST.—I found only one nest of Gould's manakin and counted myself very fortunate to discover that. It was a rather lightly constructed, small, shallow bowl, placed in the fork of a branch about five feet from the ground and contained two eggs which were heavily streaked with reddish brown. As compared with that of the court, the life of the nest is a humdrum affair. The male, ever on the alert for his mate of the moment, leads an exciting existence. But the female, after her visit to court, is occupied with the household duties of incubation and care of the resulting offspring. Not once, during my

several periods of watching, did I see a male near the nest, but in the distance, about a hundred yards away, I could hear their notes and calls.

NOTES AND CALLS.—Before we take our post near a manakin court, we should have some conception of the various sounds, both vocal and mechanical, which form so important a part of court life. Gould's manakin is not a songster; a rather insignificant but not unmusical *pee-yóu* and *pee-yuk* with their variants, and a soft *chee-poooh* form its vocal repertoire; but as a maker of mechanical or instrumental "music" it is distinguished among birds. Its sharp, explosive *snap!* and sudden startling, snapping roll, can, under favorable conditions, be heard for a distance of three hundred yards. Its reedy *whir-r-r* is lower in tone and audible only when one is within two hundred feet of the performer.

It has been said that the *snap!* is produced by the mandibles but, in spite of its sharp, explosive, almost metallic character, I am convinced⁷ that it is created by the snapping together of the inner wing-feathers. I base this opinion on both negative and positive evidence. Only the male "snaps," and if the mandibles were the snapping organs, they would presumably be heavier in the male than in the female, whereas they are alike in both sexes. Moreover, the snapping roll, which is merely a succession of

small snaps following one another with inconceivable rapidity, is, beyond question, produced by the wing-quills. The bird, when "rolling," leans slightly forward and downward, the wings are held aloft over the back, but without apparently touching, the feathers may be seen to be in motion, while the wing as a whole retains its upright position, and the result is a startling roll lasting a second or two.

If this surprisingly loud sound can be created by the wing-quills it follows that the single *snap* may also be attributed to them. It is given only as the bird jumps, and its greater volume appears to be the



A MOUNTED FEMALE MANAKIN

The specimen invariably aroused the excited attention of the males. They quickly discovered it at a distance of even forty feet through the undergrowth

result of the increased force, accompanying the muscular effort of jumping, with which the vanes of the feathers are brought together. These vanes grow from exceptionally strong shafts and are broad and stiffened. By sweeping one's fingers across their tips a sound is produced which suggests that created by the bird through an incredible muscular control.

The low, reedy *whirr* I attribute to the passage through the air of the narrowly webbed outer primaries. It can be made by the perching bird with wings slightly elevated, but usually accompanies the jump upward to a perch, when the bird ends a series of evolutions in court.

RELATIONS OF THE MALES.—Although ardent rivals for the attention of the female, the males, as a rule, are on excellent terms with one another, and court rights are rigidly recognized. It is apparently to their interests, and hence to that of their species, to live in groups rather

than singly, and constant warfare would distract them from the main, almost sole, object of their existence and thus prohibit group organization.

When not displaying, each bird is perched above or near its court. Close neighbors sometimes perch midway between their respective courts, often sitting within six inches of one another. In two instances of this kind, occurring in widely separated groups, one male—and always the same—recognized the dominance of the other (further proved by experiments to be related) by actions which suggested a type of courtship. In what I called the Laboratory group, No. 3, for example, was submissive to No. 2; and when, as often happened, the two birds were perched side by side, No. 3 apparently tried to win the attention of its companion by hopping about, or sliding toward it and nervously turning its head from side to side. No note was uttered or sound



CLEANING COURT

The owner of court No. 3 removes a leaf that had fallen in the court. It was $10\frac{1}{2}$ inches long, or more than twice the length of the bird. The bird was drawn on the photograph by F. L. Jaques



THE SNAPPING ROLL

The figure (drawn by F. L. Jaques on a photograph of "court" No. 2) shows the position maintained by the wings during this performance. The resulting sound is apparently produced by an independent movement of the enlarged inner wing quills

made. This demonstration, which may last for ten minutes, is too pronounced to be meaningless, but I did not discover its significance.

An exception to the absence of actual conflict among the males was furnished by two members of this same group. One had a slightly darker, more orange breast than the other and they stand in my notes as "Dark" and "Pale." "Dark" was dominant and always the aggressor; but for three weeks "Pale" persistently disputed his claim to court No. 1. Meanwhile the court was uncared for and neither bird displayed in it freely. Their actions admirably illustrated how impossible it is for a bird actively to defend its rights and woo the female at the same time.

Finally, persistence apparently won. "Pale" acquired possession of the court, and a new court, No. 5, was cleared thirty-

odd feet farther west, presumably by "Dark," but the identity of its owner was not definitely determined.

COURT LIFE.—With this preparation, come with me as I go for my morning period of observation of the group nearest the Laboratory. Entering a cayuca at our pier, we paddle silently over the glassy water up a golden pathway toward the rising sun to disembark cautiously on a steeply shelving, wooded bank, bordering a neighboring cove.

The birds were usually heard calling, snapping, or whirring as I approached. My landing disturbed them but little, and within a few minutes after I had taken my position they returned to their stations. Watch these quaint little birds perched demurely within eight or ten feet of us and not more than five feet from the ground. Occasionally one utters a barely audible, plaintive note, but



THE SNAP !

The bird (drawn by F. L. Jaques on a photograph of "court" No. 1) is shown as, with "beard" extended it jumps around the court, producing a loud snap with each jump

they seem more asleep than awake and give no indication of the amazing activity they may soon exhibit.

Ten or fifteen minutes pass. Trogons call; through the undergrowth I see a wood rail picking its way cautiously over the leaves; a toucan yelps, and a manakin, which I recognize as the owner of court No. 3, moves uneasily. Something has evidently begun to ferment within him. He flits his wings nervously, calls *pee-yóu*, hops restlessly from limb to limb, and erects the elongated feathers on his throat forming a "beard." His activity increases, the calls are louder and uttered more frequently, the "beard" is thrown forward beyond the bill and, suddenly, with uplifted wings, he springs his rattle in a snapping *whir-r-r* followed by the call *chee-poo*. Meanwhile he has been approaching his court, and as he enters its confines, with a single loud *snap!* he jumps across it only to jump immediately

back and, with each jump, there is a snap. So he proceeds *snap-snap, snap-snap*, backward and forward, a foot or two above the ground, alighting on the slender upright saplings at the border of the court. Or he may go around the margin of the court when, not having to reverse, his speed is increased and the snaps average two to the second.

After six to ten jumps, with their accompanying snaps, the inspired performer may, with a reedy *whirr*, spring upward to a perch just above the court, he may remove a leaf, or he may alight in the court. In the latter case the beard is extended far beyond the tip of the bill, the neck outstretched when the cap becomes a black ellipse in the center of a surprisingly long, yellow area. The head is then turned rigidly on one side in a pose such as the bird might assume if it were looking under a bed.

Resuming a more normal attitude, but

with the beard still extended, the bird now jumps to and from root to root, in the court, silently, or with a low *snip-snip*—(evidently a snap in the bud) and always, even if the distance covered is not more than six inches, in some miraculous manner it reverses its position while in the air, so that it always alights facing the spot from which it jumped.

When the tide of sexual excitement ran high, the bird also pressed the tip of its bill into the end of a slender, upright stick at the side of the court and, with fluttering wings, maintained its body in a nearly horizontal position like a moored dirigible, then, with bill still touching the "mast," fluttered its way to the court. On several occasions, with the body nearly perpendicular, it continued this evolution after reaching the ground, by standing on its head in the court and fluttering its wings.

As was to be expected, there was much individual variation in the nature of these court displays, dependent, doubtless, on the actor's sexual condition; that is, the period, whether early or late, of its mating season. No. 3, however, was a star performer and repeatedly exhibited all its tricks. Its feelings evidently relieved by this demonstration, the bird then returned to its perch and again became a quiet, demure little creature.

When the birds were thus prompted to go to court, I was struck by the relation of their performance to certain phases of bird migration. Impelled from within by a fundamentally sexual motive, the bird was induced to go to a certain place for a certain purpose. This purpose accomplished it returned to the starting point. The warbler that migrates to and fro between Colombia and Canada is prompted by a similar impulse.

Visits to court are also inspired by the



JUMPING IN "COURT"

In this performance the bird (drawn by F. L. Jaques on a photograph of "court" No. 1) with "beard" extended jumps rapidly to and fro within the court, reversing its position in the air

court activities of other birds and by the presence of the female. The loud, snapping *whirr*, with its following *chee-poooh*, is an unmistakable evidence of aroused sexual activity and, whatever its initial cause, is usually repeated from court to court until the whole group of birds is alert. One after the other now goes to court to snap and display, and the air is vibrant with their calls, snaps, and whirrs. Thus, by loudly advertising their presence, no one bird is permitted to have an undue advantage over its fellows in attracting the attention of the female.

THE COMING OF THE FEMALE.—The sole apparent object of these demonstrations is

to induce the female to come to court and take part in its activities as a preliminary to mating. The life of the male at this period is, therefore, one continued watch for the coming of the female. As he perches above or near his court, he may seem to be dozing, but the moment a female comes in sight (and he sees her at incredible distances) he is at once fully alert.

The uniform leaf-green color of the female and the fact that she is usually silent make her a very difficult object for human eyes to detect. But even when she was invisible I felt that I could sense her presence by the actions of the males.

Their response to her coming was immediate and pronounced. Calls were quickly followed by snapping *whirrs*, the birds soon went to their respective courts to snap, and the excitement at once spread through the group.

In some instances several males left their courts in pursuit of the female but I was never able to determine just what happened on these occasions. When, however, the males restricted their wooing to court display, they set the stage for an exhibition of what seemed to be undoubted sexual selection.

What factors influenced the female in her choice I was unable to determine. I did learn that possibly because they may have been nearer to the top of their seasonal sexual



THE "DIRIGIBLE" POSE

The bird (drawn by F. L. Jaques on a photograph of "court" No. 3) is shown pressing its bill into the top of a slender, broken sapling, while maintaining its position by fluttering its wings

curve, certain males dominated their rivals and in one instance, at least, it was the dominant male that more often succeeded in attracting the female.

When she perched above or at the border of the court, the male made no direct advance toward her, but immediately began to snap and jump to and fro across the court. This evidently was an invitation to the dance. If it was accepted the female took her place opposite the male. She uttered no note and made no sound but jumped when he did and the two thus passed each other over the court. With rhythmic regularity this exciting prenuptial rite was repeated several times before the two birds disappeared together.

Impressed by the male's unfailing responsiveness to the female, I decided to test definitely his reactions to her presence. To this end I sent to the Museum for a mounted female Gould's manakin. It came by air mail; the first manakin ever to fly from New York to Panama!

With this little dummy in my possession I seemed to be possessed of a magic wand controlling the actions of all the males of the species within sight of it. They were obviously aware of its presence as soon as it was visible. If from my observation post I held it where it could be seen, the males of the court on each side at once began to call *pee-yôu* excitedly,



A CIRCUS FEAT

Following the performance shown in the preceding illustration, the bird (drawn by F. L. Jaques on a photograph of "court" No. 3), with bill still pressing the sapling, flutters downward and stands on its head in court

snap in court or hop toward me. They made a similar response when I attached it to a tree forty feet from the nearest court. At this distance it was to me barely visible through the undergrowth. It was, of course, silent, motionless, and lacking in any scent that might conceivably appeal to manakins. But the male's mode of courtship has evidently so highly developed his sense of awareness to the presence of the female, that, aided by sight alone, the dummy was always quickly seen, though to me it seemed but little more conspicuous than would an added leaf to the tree.

Discovery was usually followed by

snapping in court. This invitation to dance bringing no response, the male left court and went to the mounted bird. Placed midway between two courts the dummy brought a similar reaction from both of the owner males, but it was always the dominant male that claimed her. By moving the dummy toward the court of the submissive bird a point was soon found beyond which the dominant individual refused to go. Here was proof of the existence of the mutually recognized territorial boundaries essential to the effective organization of the group.

What I have here related is merely an outline of manakin life. But from this normal "pattern of behavior" there were often departures which were sometimes confusing, at others apparently intelligible. Thus on my last visit to the Laboratory group (March 25, 1932) when the mounted female was placed above court No. 1, bird No. 1 did not appear and the owner of No. 5, after snapping in his own court, came to court No. 1 to address the dummy bird.

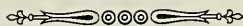
This was an obvious violation of territorial rights, but my records showed that No. 5 had apparently once been a claimant for court No. 1, for which it may still have had a sense of possession.

Again, during my two months' of observation, various incidents came to my attention which helped fill in the picture of manakin life.

The male Gould's manakin is a conspicuous violator of man-made laws

of protective coloration. He is not only more brightly plumaged than most low-ranging birds, but his court-display, day after day, at exactly the same place seems to increase his vulnerability. The female, on the contrary, is exceedingly difficult to see and her visits to court are of short duration and probably infrequent.

With the pattern of their behavior in mind, it is clear that, of the two, the life of the female is of far greater importance than that of the male. On her falls the entire burden of nest-life. On her success in rearing her young depends the continued existence of her kind. But from what I learned of the sexual virility of the males, half their number might perish without any loss to the species. Nevertheless, I marveled how the males, which I saw week after week, managed to escape the dangers to which presumably they are exposed. For example, why could not a cat of some species conceal itself near a court and spring upon the entranced performer? When, therefore, one morning I saw a young puma enter court No. 3, just as the manakin left it, I wondered, for a moment, whether the animal was real or imagined. Mutually astonished, we gazed at each other intently at a distance of sixteen feet, for nearly a minute. Then the puma turned and bounded lightly off through the forest. Sixteen minutes later the manakin returned to court, apparently unaware of the distinguished visitor it had missed and which had missed it.



PHOTOGRAPH BY
JAPANESE ASTRONOMERS
FROM KYOTO
IMPERIAL UNIVERSITY

*Times Wide
World Photos*



TOTAL ECLIPSE
OF SUN, AUGUST
31, 1932. AL-
FRED, MAINE.
EXPOSURE 5
SECONDS

AN ECLIPSE ADVENTURE

The Phenomenon of the Sun's Eclipse of August 31, 1932,
As Observed Above the Clouds, at an
Altitude of 16,000 Feet

BY CLYDE FISHER

Curator of Astronomy, American Museum

A TOTAL eclipse of the sun is without doubt one of the most sublime and awe-inspiring phenomena in the whole realm of nature, and if the path of the moon around the earth were in the same plane as that of the earth's orbit around the sun, an eclipse of the sun would occur at every new moon, and an eclipse of the moon would occur at every full moon. But since the moon's orbit is inclined to the plane of the earth's path, the moon usually passes above or below the sun at new moon, and above or below the earth's shadow at full moon.

We can have an eclipse of the sun or of the moon only when the moon is near one of its nodes, that is, the two points at which the moon's orbit cuts the plane of the earth's orbit,—at these respective phases.

The maximum number of eclipses that can occur in a calendar year is seven, and the minimum two. In the maximum number, two may be of the moon and five of the sun, or three of the moon and four of the sun. In the minimum number both of the two eclipses will be of the sun.

It frequently happens that we have an eclipse of the moon two weeks after a total eclipse of the sun, as was true after both of our recent total eclipses of the sun visible in northeastern United States, as witness the following dates:

January 24, 1925, total eclipse of the sun; February 8, 1925, partial eclipse of the moon.

August 31, 1932, total eclipse of the sun; September 14, 1932, partial eclipse of the moon.



Courtesy Portland Press Herald

THE AËRIAL ECLIPSE PARTY

Left to right: Clyde Fisher, photo-astronomer; Paula Lind, co-pilot and assistant photographer; Leopold Godowsky, pianist and composer and amateur astronomer; Casey Jones, pilot

This second eclipse is made necessary by the fact that the moon is still so close to its node as to be within the eclipse limit.

In both the eclipses of 1925 and 1932, the moon was north of its node before the eclipse, that is, it was moving southward as it crossed the ecliptic. For this reason the path of totality in these eclipses, after striking the earth in high northern latitudes, moved *southward* as well as eastward.

For my first introduction to the airplane in eclipse-observation I am indebted to my friends, Mrs. Opal G. Kunz and the late Dr. George F. Kunz. This was on April 28, 1930, when with Captain John O. Donaldson, World War ace, as pilot, I flew up over the Newark Airport in a partially cloudy sky to an altitude of nearly 20,000 feet, and photographed a partial eclipse of the sun. The success

of this exploit with its attendant thrills furnished the impetus for more aviatational astronomy. For my next exploit I turned to my friend, Chief Long Lance, American Indian pilot, to take me aloft in the 1932 eclipse, and all plans were made for this flight, only to be interrupted by the untimely death in March of this year of Chief Long Lance.

I then approached Casey Jones, veteran aviator, and Miss Paula Lind, one of the younger generation of fliers and a pilot in her own right, and arranged with them to make the flight. I had decided that the ideal location from which to view a total eclipse of the sun is from an airplane at considerable height. In this way one outwits all ordinary clouds, which are the source of disappointment to so many observers.

In the recent eclipse most of the scientific expeditions were disappointed

on account of clouds. Even veteran observers were not more fortunate. Prof. John A. Miller, director of the Sproul Observatory at Swarthmore, met his first failure in eight eclipses. Prof. S. A. Mitchell, director of the Leander McCormick Observatory at the University of Virginia, met his second failure in nine eclipses. Of the younger generation, Mr. Weld Arnold, of the Harvard School of Geographical Exploration, met his first failure in five eclipses.

According to previously made plans, I flew to the Portland, Maine, Airport for the take-off on our eclipse-flight. In the vicinity of Portland, where the proximity to the coast made the weather less certain, the sky was perfect during the entire eclipse. But by noon of the day of the eclipse we could see to the northwest from Portland some substantial and stubborn cumulus clouds. However, we were not alarmed for ourselves, for we were prepared to fly over any clouds at least up to 20,000 feet.

Our party consisted of the following persons: Casey Jones, internationally known pilot; Paula Lind, co-pilot and assistant photographer; Leopold Godowsky, world famous pianist and composer and amateur astronomer; and myself, photo-astronomer.

A little before two o'clock we took off from Portland, flying toward the northwest over Lake Sebago and the chain of

lakes to the northward. Then we swung to the west, flying over Fryeburg, Maine, which we recognized through an opening in the clouds. In climbing we found the clouds to be only 7000 or 8000 feet above the earth, and that they were all at this same level, if we neglect a few wisps of cirrus clouds scattered about which did not in any way interfere with our observation of the eclipse.

Fortunately for our attempt to photograph the on-coming shadow of the moon, this immense blanket of clouds over which we flew for miles was level,—billowy, but all at the same level on top. We climbed on up to an altitude of 16,000 feet, from



Photograph by Cleveland P. Grant

THE PHOTO-ASTRONOMER WITH TELEPHOTO MOTION
PICTURE CAMERA

The camera with which the "diamond-ring" photographs on page 490 were made by Mr. Grant



Photograph by Victor Kahill

THE SEA OF CLOUDS OVER CONWAY, NEW HAMPSHIRE

The expanse of cumulus clouds at an altitude of 7000 or 8000 feet over which the party watched the moon's shadow approach



Photograph by Victor Kahill

FRYEBURG, MAINE, THROUGH AN OPENING IN THE CLOUDS

Photographed from an altitude of 14,200 feet. All of the photographs by Mr. Kahill were made from a neighboring plane piloted by John B. Nichols



Photograph by Victor Kahill

A GREAT BLANKET OF CLOUDS

White at first in the bright sunshine, but becoming tinted with various colors as the sunlight waned, these clouds were a spectacle of superb beauty



Photograph by Victor Kahill

APPROACHING THE SEA OF CLOUDS

At first the plane encountered the clouds in out-lying patches; finally the blanket became continuous, forming a most effective background for the changing light and colors



Photograph by Victor Kahill

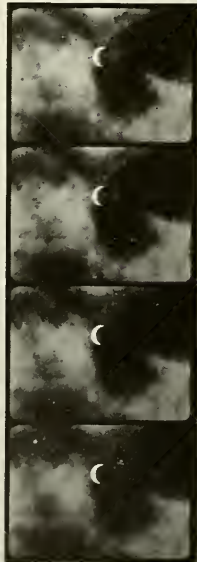
CONTINUOUS EXPANSE OF CLOUDS

More nearly level in the background, toward the northwest. It was over these clouds that the oncoming shadow of the moon was photographed

which height I thought I could see more than one hundred miles to the northwest whence the shadow would come. From our vantage point the White Mountains seemed to be completely covered by these cumulus clouds. Not even the peak of Mt. Washington was to be seen.

The beauty of this sea of clouds,—white at first in the bright sunshine, but becoming tinted with various colors as the sunlight waned—was beyond description.

During totality the bright band of yellow, orange, and pink just above the horizon all around the bowl of the sky was conspicuous, and seemed to lend its colors to the billows of this nebulous sea. The sight of the



PARTIAL PHASES
From motion pictures made at Camp Wigwam, Harrison, Maine, by Cleveland P. Grant

clouds alone, under the varying conditions, would have fully justified our making the airplane expedition.

I made several successful still-photographs of the partial phases of the eclipse with panchromatic plates using the special Eastman filter, which admits about one one-thousandth of the visible light.

Several minutes before totality, Venus, the brightest of the planets, flashed out brilliantly low in the western sky, and during totality Jupiter was seen about five degrees northwest of the sun. But our party did not see Mercury, which was between Jupiter and Venus,—nor did we see Regulus or Spica or any first magnitude star. Our observations, however, were made with

the unaided eye. Binoculars should have revealed Mercury, Regulus, and other first magnitude stars.

The on-rushing shadow of the moon was first seen as a narrow band, on this level sea of clouds, at a distance of probably more than one hundred miles. As it approached it became less distinct, less definite. I began cranking the Akeley motion picture camera as soon as I was sure I could see the shadow, and with the camera pointed at an angle downward toward the clouds, cranked clear through until I observed the first Baily's Bead and the flashing out of the corona. On the Akeley camera I used a very rapid lens, f. 1.9, wide open, with super-sensitive panchromatic film. The focal-plane shutter of the Akeley camera is open about 240 degrees out of the 360, and this makes it unusually efficient. Upon development the motion picture negative seems to be well timed, as expected from this equipment, and a positive print shows just enough diminution of light to indicate the passing of the moon's shadow. This change was so gradual that one raises the question whether the photographs of the moon's shadow, which have been published in the newspapers since the eclipse, had not been "stepped up" in contrast. Possibly the greater altitude would account for the difference.

During the approach of the shadow, Miss Lind

used the Graflex camera with f. 4.5 lens, wide open, using the new Ilford hyper-sensitive panchromatic plates whose speed is H. and D. 4000 to yellow light,—the fastest plates obtainable.

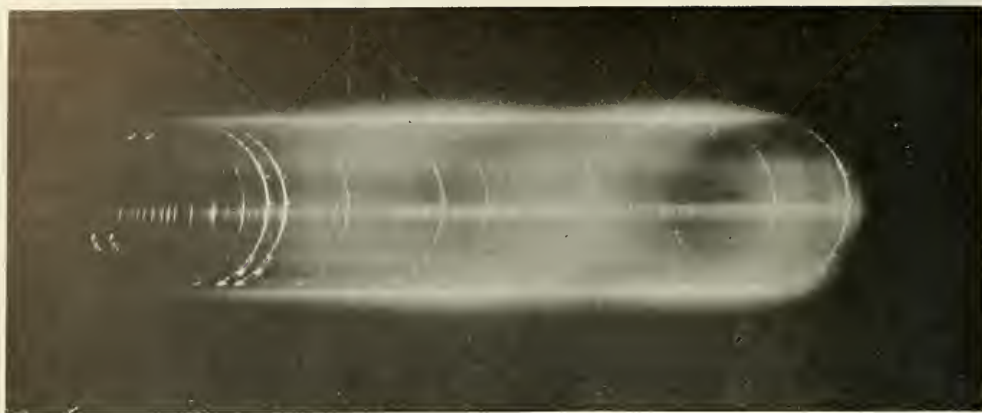
The thing we set out most determined to do was to photograph the on-coming shadow of the moon, since this had never been done before. That we had the opportunity to crank the Akeley camera clear through the phenomenon under ideal conditions is all that we could ask. If one could not photograph the edge of the moon's shadow on a background of white clouds, 8000 or 9000 feet below,



Photograph by Paula Lind

THE APPROACHING SHADOW OF THE MOON ON THE CLOUDS

No definite edge could be seen. In the upper part of the photograph is shown the bright band of yellow, orange, and pink, that extended around the sky just above the horizon



Times Wide World Photos

Photograph by O. Oikawa at Alfred, Maine.

THE FLASH SPECTRUM

During a few seconds at the beginning or end of totality the flash spectrum may be seen or photographed. The bright lines of this spectrum are curved like their source. Much has been learned about the atmosphere of the sun by a study of the flash spectrum

he could not photograph it at all. We photographed the shadow, but in our photographs are unable to see any edge. According to the press, the U. S. Naval Observatory expedition reported: "The moon's shadow had no definite edge. The effect was a gradual darkening of the landscape beneath the plane until the time of totality, and then a gradual brightening after totality." Our observations were in exact accord with these.

I was somewhat prepared for these results by the experiences of Casey Jones and an observer during the total eclipse of 1925, when they flew up from the Curtiss Airport in order to observe and photograph the southern edge of the path of totality as it crossed New York City. At that eclipse much interest had been aroused in testing the accuracy of the astronomers' calculations. Would the shadow reach Seventy-second street, or would it come only to Seventy-seventh street? With a perfectly clear sky and a background of snow on January 24, 1925, Casey Jones and his companion were unable to see any edge to the shadow.

But we had a perfect opportunity to see the eclipse, and to observe a total eclipse of the sun from above a continuous

blanket of clouds, with no earth visible below, is an unforgettable experience.

In the Amateur Astronomers Association there were three other groups which undertook systematic observation. The group at Fabyan, New Hampshire, under direction of Miss Marian Lockwood, secretary of the department of astronomy at the American Museum and secretary of the Amateur Astronomers Association, was disappointed on account of clouds. Mr. Frederick Pierce headed a hiking party for the Amateur Astronomers Association, starting in the White Mountains and tramping to North Conway, New Hampshire, where they hoped to view the eclipse, but as I write he has not yet returned and no report has been received from his group.

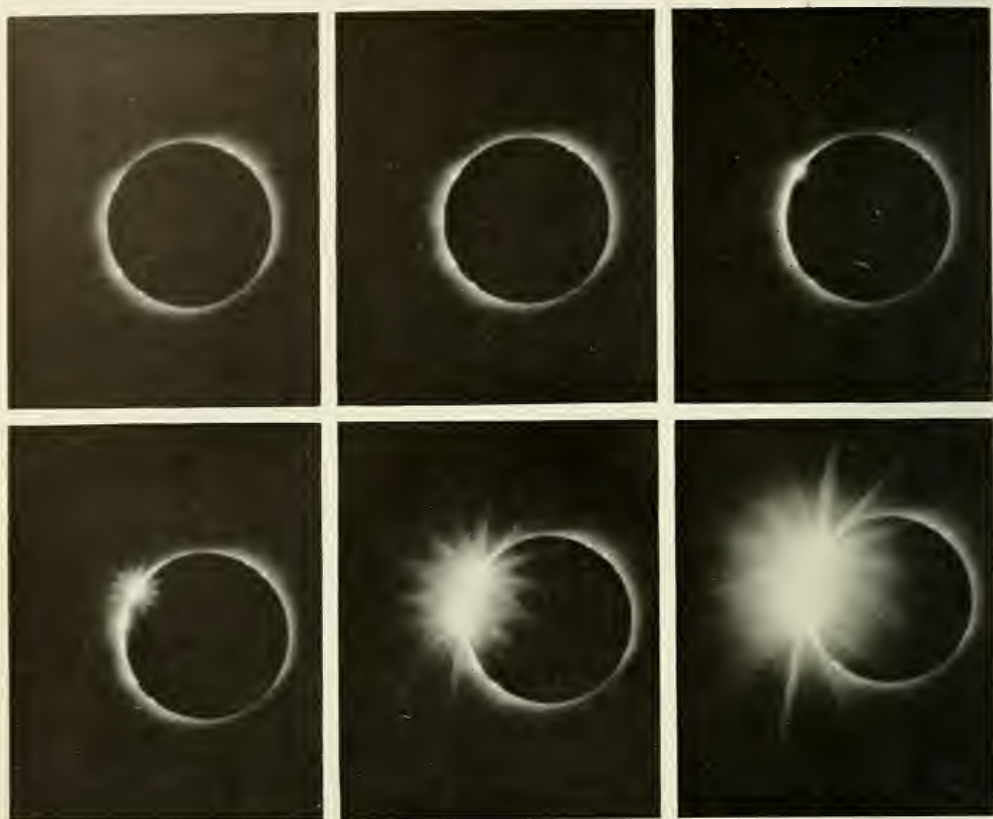
The group under Mr. Leo Mattersdorf, of the Eclipse Committee of the Amateur Astronomers Association, met at Wolfeboro, New Hampshire, and devoted themselves almost entirely to photography, in which they were quite successful with a variety of equipment.

Besides the groups of the Amateur Astronomers Association, the Junior Astronomy Club, which is affiliated with the departments of education and



THE CRESCENT SUN THROUGH THE CLOUDS

[[Partial phase of the eclipse photographed at Camp Wigwam, Harrison, Maine, by Cleveland P. Grant



DEVELOPMENT OF THE "DIAMOND RING"

Six stages in the formation of the Baily's Beads or "diamond-ring" effect, photographed with a telephoto motion picture camera at slow speed by Cleveland P. Grant at Camp Wigwam, Harrison, Maine

astronomy in the American Museum, sent a large and enthusiastic expedition into the field. A group of forty, most of whom were boys and girls of Junior and Senior High School age, made successful observations from North Limington, Maine.

Although from their observation point the sky was largely overcast throughout most of the day, partial phases were observed until about fifteen minutes before totality, when a huge cloud moved over the sun and hung almost motionless, completely hiding the progress of the eclipse. When hope of seeing totality had been abandoned, less than a minute remained; suddenly the cloud lifted, disclosing a marvelously beautiful narrow

crescent. From this point on, the group observed all the spectacular features of a total eclipse.

Throughout the entire eclipse period, separate groups were seen to be intent upon their particular tasks. Several photographers made complete series of the phases of the eclipse, coronal photos, and they attempted shadow-band pictures. One group with telescopes and also watches corrected by radio and chronometer, timed the contacts; others observed the prominences, measured varying light intensity, recorded temperature changes, noted the action of animals, watched for stars and planets that momentarily appeared, outlined coronal features, and made rapid color notes for painting.

Stationed on a distant mountain, certain members had the unusual experience of seeing miles of country to the northwest darken, as the moon's shadow with prodigious rapidity swept across the landscape.

This expedition of youthful astronomers was directed by Miss Dorothy A. Bennett, assistant curator in education in the American Museum, and adviser to the Junior Astronomy Club; she was assisted by Mr. Hugh S. Rice, scientific associate of the Club, and Mr. Robert Snedigar, assistant in education, both of the American Museum.

Mr. Rice, using high-power Zeiss binoculars, reported the following features: "an unexpectedly 'bright' eclipse, with the sky practically its ordinary blue color, with only Jupiter and Spica visible, an unsymmetrical corona with long equatorial streamers, especially on the east, and well-defined short polar stream-

ers; a number of particularly large rose-pink prominences of surpassing beauty; a narrow reddish ring of chromosphere, part of which appeared just before totality as an apparent extension of the remaining narrow sliver of the sun, and sundry other commonly observed phenomena, such as the shadow-bands, which were particularly elusive where observed, a brilliant "diamond-ring" effect, and the Baily's Beads. Too much extraneous light, mostly from a yellow band above the horizon, defeated our attempt at seeing the shadow cast by the corona itself; the experiment needs a special light-box. The entire party had a view of the eclipse that was absolutely superb."

After an occurrence of this kind, both among those who have been successful and those who have been disappointed, there naturally arises the question: When do we have the next total eclipse of the



Photograph by Victor Kohill

EDGE OF THE BILLOWY SEA OF CLOUDS

Covering many square miles in western Maine and in New Hampshire was this sea of clouds, beautiful above, but the source of disappointment to so many persons beneath

sun? The next total solar eclipse to occur anywhere on the earth will be February 14, 1934, but will be visible only in Borneo, the Celebes, and vicinity.

The next three total eclipses of the sun that occur in the United States,—July 9, 1945, June 30, 1954, and October 2, 1959,—according to Prof. Charles H. Smiley of Brown University, will be visible at or near sunrise in the United States and consequently will not be favorably located in the sky for professional observation. Perhaps the most promising one not too far from New York City will be that of July 20, 1963, the path of totality passing from Alaska across Canada, and, according to Professor Smiley, through Maine. On March 7, 1970, there will be a total eclipse of the sun, the path of totality crossing Mexico and Florida,—a wonderful opportunity, coming at a season when weather conditions are at their best in Florida.

Of all the solar eclipses of the early future, the most attractive seems to be that of June 8, 1937,—only five years hence,—when totality will last about 7 minutes 6 seconds, almost the maximum length possible—according to Professor S. A. Mitchell. The path of totality will cross almost the entire South Pacific Ocean, from Santa Cruz Island, which lies about 1,000 miles to the east and north of Australia, to Peru. According to recent calculations by the U. S. Naval Observatory, however, observations in either Santa Cruz or Peru will be of little value owing to the fact that the eclipse will appear too early in the morning in the former locality and too late in the afternoon in the latter. We are not yet informed whether or not some South Sea island may be well placed for the observation, but if so, the sight will be of unusual interest. Why not, then, plan to go to the South Seas?



IN THE CLOUDS ABOVE THE PINES

Partial phase of the eclipse almost lost in the clouds. Fortunately the clouds parted before totality. Photographed at Camp Wigwam, Harrison, Maine, by Cleveland P. Grant



A Restored Skeleton of *Stegosaurus* in the American Museum

A SPINE-ARMORED SAURIAN OF THE PAST

Stegosaurus, a Creature of the Jurassic Period, Which
Lived About 125,000,000 Years Ago

By BARNUM BROWN

Curator of Fossil Reptiles, American Museum

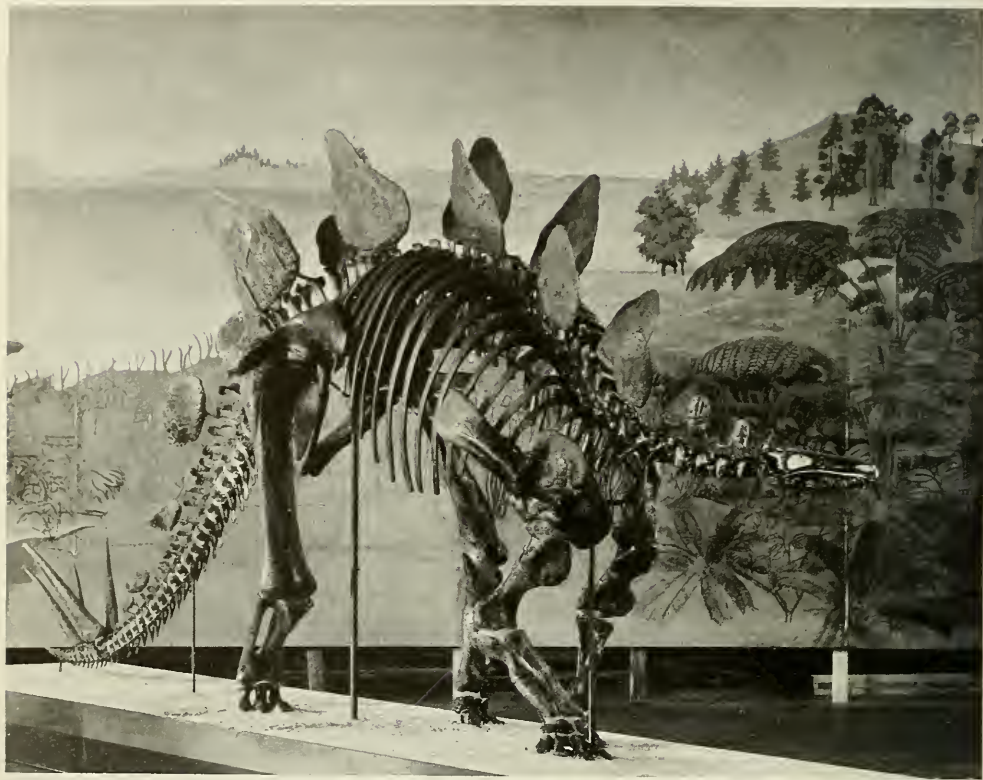
A skeleton of what is probably the most interesting dinosaur of the Jurassic period was mounted at the American Museum during the winter of 1931-32 by Charles J. Lang and exhibited in the Dinosaur Hall in June. A temporary mural background representing its habitat was painted by Auriel Bessamer, showing some of the better known Jurassic plants carefully worked out in detail.—THE EDITORS.

AS we look backward in time through the earth's history, organic remains preserved in the rocks show that each preceding period becomes less and less like the present until in the remote ages the entire cosmic universe was wholly different.

During the Jurassic period which terminated at least 125,000,000 years ago, the animals and plants were quite different from those now living. Rocks of this age found in Wyoming, Colorado, and Utah furnish evidence of tropic conditions at that time, and throughout the

Rocky Mountain region the topography was less rugged with the surface less elevated above sea level. It was a region of lakes and marshes bordered by lush vegetation.

Undoubtedly there were regional peculiarities, but the Jurassic flora was less diversified and less affected by geographical position than that of any past geologic period. Vegetation differed essentially from that of the present day with flowering plants conspicuous by their absence. This is known as the Age of Cycads, for cycadaceous plants repre-



A CREATURE OF THE JURASSIC PERIOD

This amazing beast was one genus of the great family of dinosaurs which 125,000,000 years ago dominated the earth

sent two out of every five species then living. They with the ferns and conifers predominated.

On the hillsides there were coniferous trees resembling our living *Sequoias* and *Ginkgos*; in the lowlands sedges, broad-bladed grasses and large *Equisetales*, related to the living horse-tail rushes, with a great variety of delicate ferns such as *Cheiroleuria* and *Dipteris* and many larger ferns related to *Thyrsopteris*.

The earth at that period was dominated by cold-blooded, air-breathing reptiles—the dinosaurs, whose remains are found in practically all parts of the world. Some of these curious reptiles were no larger than a poodle dog while others were of gigantic size. Great numbers of them must have congregated in favorable

places, for in several localities in Wyoming and Utah the rocks are literally filled with their fossil remains.

There were flesh-eaters and herb-eaters and presumably others that lived on a mixed diet, but little evidence has been preserved of their color or outward appearance. In the succeeding Cretaceous period the skin characters of several genera are known.

Among this host of strange creatures the most curious in appearance was the medium-sized dinosaur—*Stegosaurus* “The Spine-Armored Saurian” named by Prof. O. C. Marsh of Yale in reference to the tall dermal plates that rose above the spinal column, giving the beast its bizarre appearance.

The genus is known from several specimens—a mounted skeleton in the Pea-

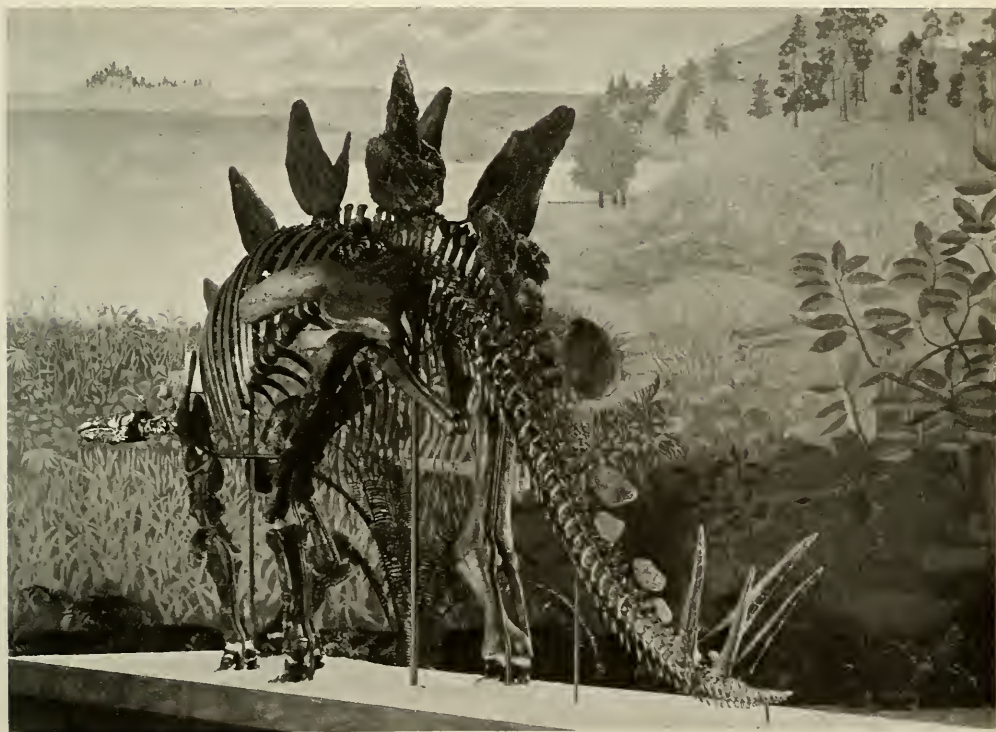
body Museum of Yale University, another in the U. S. National Museum at Washington, besides several incomplete skeletons preserved in the U. S. National Museum and the University of Utah collections.

The present specimen is one of the smaller species—*Stegosaurus stenops*, found by Mr. P. C. Kaisen during the 1901 American Museum expedition in the famous Bone Cabin Quarry near Medicine Bow, Wyoming. A considerable part of it is restored from these other skeletons but this specimen has more complete feet and adds much to our knowledge of the foot structure.

Stegosaurus has many anatomical features that set it apart from contemporary dinosaurs and it now seems doubtful whether any of the flat armored types were descendants of it. The skeleton

measures $23\frac{1}{2}$ feet over the curve of the spinal column and the greatest height of the internal skeleton is 7 feet in the middle of the body. The skull is disproportionately small, and it had tiny teeth and a narrow, bird-like clipping beak; its neck is comparatively short and the tail is long, with extremely long hind legs as compared with the front legs, but the feature that gave it its striking appearance is the double line of huge thin plates that were carried upright in the skin above the backbone, arranged in two alternating rows and terminated in two pairs of sharp spines near the end of the tail. These latter spines were its only means of defense.

The brain of this huge creature weighed only two and one-half ounces, whereas the spinal cord within the sacrum was greatly enlarged and weighed twenty



AGAINST A BACKGROUND OF JURASSIC FLORA

In the Dinosaur Hall at the American Museum the skeleton of *Stegosaurus* has been placed before a setting which depicts the typical vegetation that flourished during the age of dinosaurs

ounces. Many anatomists have conjectured about the significance of this enlargement, but to me it seems probable that it related to the control of the dermal plates and the enervation of the long hind legs.

It is, of course, doubtful whether the nervous ganglia in the sacrum had more than a remote control of the reflex actions, but this thought was the basis of an interesting poem by Bert Leston Taylor which I quote:

THE DINOSAUR

Behold the mighty dinosaur
Famous in prehistoric lore,
Not only for his weight and strength
But for his intellectual length.
You will observe by these remains
The creature had two sets of brains—
One in his head (the usual place),
The other at his spinal base.
Thus he could reason "A priori"
As well as "A posteriori."
No problem bothered him a bit:
He made both head and tail of it.

So wise he was, so wise and solemn
Each thought filled just a spinal column.
If one brain found the pressure strong
It passed a few ideas along;
If something slipped his forward mind
'Twas rescued by the one behind;
And if in error he was caught
He had a saving afterthought,
As he thought twice before he spoke
He had no judgments to revoke;
For he could think without congestion,
Upon both sides of every question.



THE SKULL OF *Stegosaurus* IS DISPROPORTIONATELY SMALL. IT HAD TINY TEETH AND A NARROW, BIRD-LIKE CLIPPING BEAK



The Zoological Museum, Tring

MOVING A MUSEUM

The Story of the Rothschild Collection of Birds, Presented to the
American Museum of Natural History in Memory of
Harry Payne Whitney by His Wife and Children

BY ROBERT CUSHMAN MURPHY

Curator of Oceanic Birds, American Museum

PHOTOGRAPHS BY THE AUTHOR

AMONG naturalists, Tring is a meaning and magic word, albeit most of my guessing friends associate it with something Chinese! A gray little town in Hertfordshire, bordered abruptly by green fields and the beech woods of the Chiltern Hills, it has kept its title, site, and identity since the days of Alfred the Great. Although not without place in the long pageant of English history, it seems probable that nothing occurred to broadcast its quaint name beyond the confines of the Kingdom until, in 1889, the Honorable Lionel Walter Rothschild, now the second Baron Rothschild, founded a private museum of natural history in a corner of his ancestral demesne.

Such was the beginning of a Zoological Museum which rapidly became a Mecca for students of birds, mammals, reptiles,

insects, and other animals brought together from all quarters of the globe. The development of so notable an institution during a single lifetime is a great monument to the zeal and munificence of Lord Rothschild, and to the wisdom with which he chose his collaborators. Construction of the present group of buildings was begun about 1890, Dr. Albert Günther, then head of the department of zoölogy in the British Museum, and other distinguished scientific men contributing their counsel as to the plan and aim of the project. The first unit contained glass cases for the public exhibition of some of the specimens which Lord Rothschild had enthusiastically collected from his early childhood, as well as provision for the storage of material to be used in research. In 1892 Dr. Ernst Hartert was appointed director of the Museum.



ROOFS OF TRING, FROM THE MUSEUM

Narrow footpaths, which are public rights of way, run between the houses in many directions and continue through the green countryside

a post from which he has only recently retired. In 1893 Dr. Karl Jordan, who has succeeded Doctor Hartert as director, became head of the department of insects, which, like that of birds, has grown to be one of the most important centers of activity in taxonomic and biological science.

Thus "Tring," which in the scientific world means the Museum rather than the ancient town, has had a many-sided development, and its accomplishments may be found on the shelves of libraries throughout civilized countries, bound in part within the covers of a journal of quarto size, the *Novitates Zoologicæ*, which Lord Rothschild has published since 1893. From time to time something from the substance of a contribution in the *Novitates* has even filtered out into the newspapers as, for instance, a new discovery relating to fleas! Many a reader has smiled, perchance, at a refer-

ence to the vast Rothschild collection of fleas, obtained from hundreds of species of birds and mammals, often at much expense of time, energy, and funds, but rarely if ever has a press account hinted at the gains to medical science, or to a knowledge of geographical distribution, which have been served by the study of these all but unmentionable creatures. However, of the entomological work at Tring, and of the collections and publications relating to reptiles, mammals, and other vertebrates, it is not my purpose to speak here. A good proportion of Lord Rothschild's interest in natural history has always been devoted to ornithology and, in team work with Doctor Hartert, he has built up during forty years the amazingly rich and useful collection of birds which has finally passed to the American Museum through the generosity and patriotic vision of the family of the late Mr. Harry Payne Whitney.



LORD ROTHSCHILD'S
RESIDENCE AT TRING

Part of the house is said to
have been a royal shooting
lodge, and legends of King
Charles and Nell Gwynn still
cling to it



LORD ROTHSCHILD, PH.D.,
F.R.S.

Photographed in his Museum
study, March, 1932



During the first period of rapid growth, the Tring Museum was enriched by the acquisition of important private collections, particularly such as had been fully studied and reported upon. Buller's New Zealand birds, the Galapagos collection of Baur, and the famous Brehm European birds are examples of many such early purchases. The policy has indeed been maintained up to the present, as witnessed by the recent addition of approximately 45,000 specimens which had formed the basis of Mathews' twelve-volume monograph on the birds of Australia. These facts, together with the speed with which new material from the field has always been studied in Tring, and as promptly reported upon in the *Novitates* or elsewhere, are among the reasons why the collection is so valuable to scholars. It is the most-studied of all bird collections, and a list of those who have pursued researches at Tring would

be in large measure a roster of the foremost ornithologists of our time. The collection may be said to represent the essence of an ornithological library because it is so rich in types and historic examples upon which discussions have been based and important conclusions reached.

Lord Rothschild has always had a particular interest in rare and disappearing organisms, and he has shown keen foresight in acquiring specimens from islands and other regions in which modern changes are likely to bring about extinction. This explains the presence in the Tring Collection of the irreplaceable series of birds from the Galapagos, Hawaii, and other insular universes where, during millions of years, the course of evolution has gone on without extraneous disturbance, and with strange, ingrown results. Equally important among his ideals has been the systematic ex-



LIBRARY OF THE TRING MUSEUM

A quiet retreat, with the odor of scientific sanctity, and filled throughout its three tiers with both new and ancient treasures of zoölogical literature

ploration of ornithologically little known countries. To cite even large numbers of scattered localities to which his representatives have penetrated would, however, be misleading, for above all else Tring has built up a World Collection in the fullest sense. Many thousands of specimens have come, of course, in small lots from as many parts of the earth, and any attempt to analyze the sources of the collection as a whole would be futile. Nevertheless, in order to indicate the scope of a generation of field work, and also to show the relation of Tring to great names among ornithological explorers, I have selected a few of the more important items which combine to give this collection its outstanding distinction. The following list represents some of the major purchases, as well as the fruits of especially significant field work.

The Count Riocour Collection, except the types, which are in the British Museum. (Includes the skin of a great auk.)

The Brehm Collection, chiefly of European birds, comprising 14,000 skins of which 371 are type specimens.

Collections made during the field work of Rothschild and Hartert in the British Isles, Switzerland, the Pyrenees, southeastern Hungary, elsewhere in Europe, and in Algeria.

The Hon. N. C. Rothschild Collection of British birds.

The Sarudny Collection, rich in Russian and Persian birds.



Photograph by Courtesy of Tring Museum

BIRDS OF PARADISE

One of Lord Rothschild's exhibition cases. The unmounted specimens of birds of paradise received by the American Museum comprise the most nearly perfect collection in existence

Collections made by Hartert and Riggenbach in Morocco, and by Hartert and Hilgert in Cyrenaica.

The Meinertzhagen Collections from the Near East and from Africa.

Abyssinian collections made by Oscar Neumann and by Kovacs.

Much of the Emin Pasha Collection of equatorial African birds.

Other African collections made by Schrader, van Someren, Doherty, Grauer (Congo), Anderson (Damaraland), Ansorge (Angola), and Buchanan (East Africa and the Sahara).

The Owston Collection from Japan, central China, Formosa, Hainan, and certain Pacific islands.

The Mathews Collection of Australian birds.



A FRAGMENT OF THE TRING ROOKERY

A hundred or more pairs of rooks make their nests and indulge in endless conversational hubbub in trees that line the pathways of Tring Park



THE LILY POND

Bordered with dense bamboo and other thicket vegetation, this secluded patch of water, which is not a stone's throw from High Street, Tring, is the haunt of many kinds of birds every day of the year



FALLOW DEER IN TRING PARK

The traditional number of deer in the Rothschild herd is 94, and the excess population is annually reduced. An albino strain has developed, several white animals showing in this scene



A TRING FARM IN FEBRUARY

At the left background one gets a glimpse of the Reservoirs, which are Lord Rothschild's shooting preserves. Here an extraordinary variety of ducks and other water fowl spend the winter

The Sir Walter Buller Collection of New Zealand birds.

Collections made by Forbes and others at the Chatham Islands.

The Whitehead Collection of Philippine birds.

The Stresemann Collection from Molucca.

Collections made by Kuhn, Waterstradt, and Goodfellow at many Indo-Australian islands, by Meek and by the Eichorn and Pratt brothers in the Papuan region, by Bruijn, Mayr, and Shaw-Meyer in New Guinea, and by Doherty and Everett in the Sunda Islands and the Javan district.

The Baron Collection of humming birds and other species from the Peruvian Andes.

Collections from Colombia and Ecuador amassed by Rosenberg.

Collections made by Cherrie in the Orinoco region.

The Venturi Collection from Argentina.

Other South American collections made by Dinelli, Baer, Brittain, Steinbach, Koslowsky, Hartert and Paul Neumann.

The Baur series of Galapagos birds, and later collections from the same archipelago made by Harris, Beck, etc.

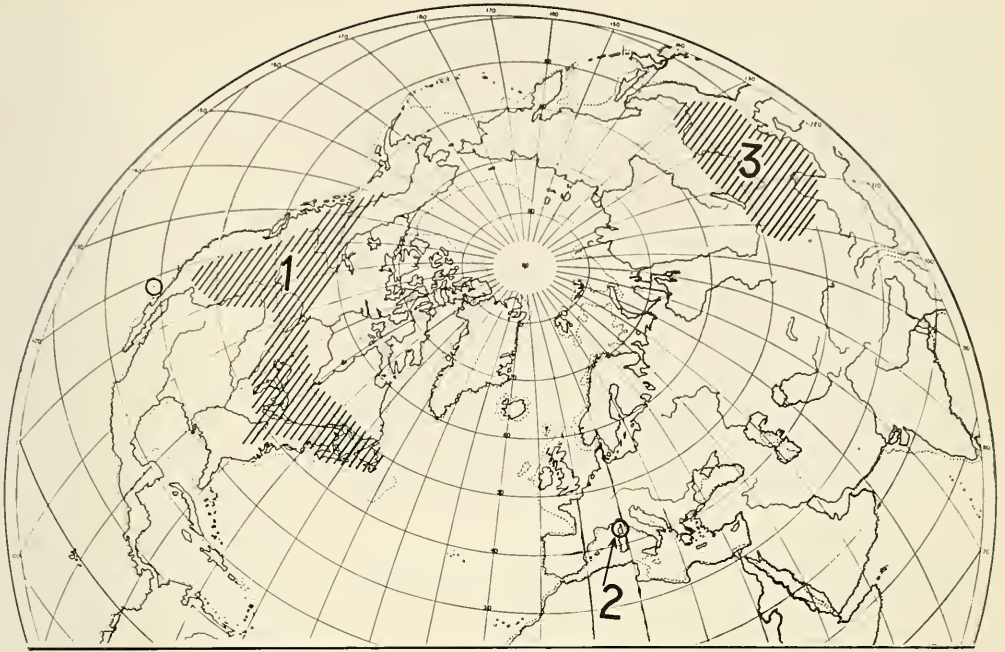
In October, 1931, Lord Rothschild wrote Dr. Leonard C. Sanford, a trustee of the American Museum of Natural History and a patron of its department of ornithology, saying that he had reluctantly determined to offer for sale the greater part of the Tring Collection of Birds. Doctor Sanford then laid the unique opportunity before the friends of the American Museum who became the donors of the gift and, after preliminary negotiations, he and I sailed for England at the end of January, 1932. In London, on February 13, ownership of the great treasure was formally transferred. The agreement called for delivery to the American Museum of all birds belonging to Lord Rothschild with the exception of the mounted collection on exhibition in the halls of his museum, the series of struthious or ostrich-like birds, and a small number of duplicate specimens,



Photograph by Courtesy of Tring Museum

AN EXHIBITION HALL IN THE TRING MUSEUM

Here a selection of mounted specimens, grouped by families and species rather than in geographic arrangement, present a representative picture of the world's mammalian fauna. Many extraordinary rarities are included



THE BREEDING RANGE OF THE RED-BREASTED NUTHATCH

Illustrating discontinuous distribution among three of the races of a single species in the northern circumpolar continents. 1. Our North American form, *Sitta canadensis canadensis*, breeds chiefly in the Canadian zone and upon Guadalupe Island. 2. In Europe, *Sitta canadensis whiteheadi* is confined to the high mountains of Corsica. 3. In Asia, *Sitta canadensis villosa* occurs in Mongolia and north-western China. Both of the Old World races were lacking in the American Museum, but are well represented in the Rothschild Collection

representing various families, which he wished to retain chiefly because the species were not otherwise represented in Great Britain.

Tring in summer was to me an old story, but Tring, or England, in winter, an experience altogether new. The evening of February 6, our first in London, was soft and misty—such an English winter night as calls for widely opened windows long before retiring time. The change from an especially turbulent North Atlantic, the murmur that arose from Piccadilly, and excitement aroused by thought of the combined pleasure and responsibilities of the job before me, tended to put off sound sleep. At any rate I was conscious that Big Ben cadenced through my dreams and that the completely irresponsible lesser clocks of London took many minutes to chirp preludes and echoes.

Next morning Lord Rothschild sent a motor for us, and we sped the thirty-five miles northwestward toward Tring, while every traffic officer waved us along as though we were blocking the road. The fog still made a twilight; hoar-frost silvered the grass and trunks and twigs. Ring-doves seemed stuck to the fields with a chill-morning sluggishness. Gray sheep were also kneeling as if in silent meditation of a bright spot where the sun was hiding; and on the woolly back of one close beside the road an impudent jackdaw was standing, as if to keep his toes warm.

The sun had burned through by the time we entered Tring. At the Museum entrance into the estate it seemed that twenty couple of hounds must be welcoming us, but we presently perceived that all the clamor came from the bubbling throat of one Manchurian crane. As tall as a



AN EMU OF TRING PARK

These Australasian flightless birds, which are not as closely related to the ostrich as they may appear, are among several large species which roam and breed on Lord Rothschild's spacious estate

hitching-post, he stood beneath an ivied tree, and did his best to predict an early spring and as fruitful a breeding season as, I later learned, he and his mate had enjoyed at Tring for many a year. From a field beyond the crane came a muffled bellowing, like far-away thunder. This we traced to emus which, with several rheas, seemed quite at home despite the thin patches of snow. And in the distance the slopes of the deer park rose to wooded hilltops of the Chilterns—all country which I was to know intimately during moments snatched from the exacting task of the next four months.

The prospect within the bird halls of the Tring Museum, which date from the year 1909, was sufficiently appalling. Tiers of covered wooden trays, in alcoved cases, rose to twice a man's height throughout two very large and two smaller rooms, and an overflow of specimens was stored in chests that well filled a spacious basement. The arrangement was mainly one of natural systematic order, modified by the size of the birds of various groups and the corresponding bulk of their containers. No general catalogue had ever

been prepared, and the number of skins of any one form could be determined only by counting them.

The problem, therefore, comprised not only safe packing of the specimens, and safe transport across the ocean, but also a system of listing which would reveal the exact content of the collection, and an arrangement which would assure that the innumerable series, species by species and race by race, might come out of their wrappings in New York in the same

orderly fashion that they were tucked away in Tring. Behind all the packing, indeed, loomed the distant spectre of

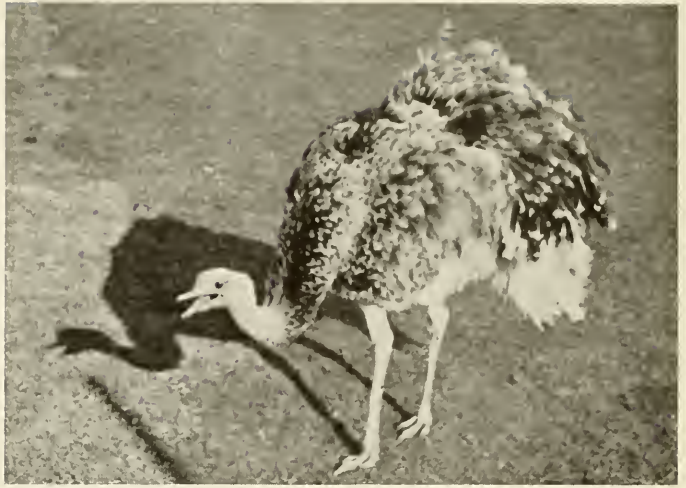


"IS THAT CAMERA EDIBLE?"

Captive emus are exceedingly bold and aggressive. Not only will they take food from the hand, but also, with much bellowing and tilting, they drive off their less robust neighbors, the rheas

unpacking. Any hitch, any unrecorded gap, would lead to hopeless confusion, especially since only one or two specimens in many series of one kind had had the scientific name written upon the field label. A thousand packs of playing cards, turned in a lottery barrel, would be a simple task of reassortment compared with a possible jumble of partly unnamed Old World warblers and thrushes, represented by subspecies extending across Eurasia from Ireland to Japan.

Throughout my stay in Tring, I put up at the jolly Rose and Crown, a hostelry which should surely be forever haunted by



A HYBRID RHEA DISPLAYING

These South American ostrich-like birds erect their posterior plumage until they look more than ever like feather dusters. This individual is one whose ancestors have dwelt for several generations in Tring Park



"COME, AND TRIP IT AS YOU GO"

The rhea's toe is both light and fantastic. He walks with a lighter and more mincing gait than his Australian cousin, and makes up in speed and sprightliness for what he lacks in weight and bluster

ghosts of the ornithological legion which has made it headquarters. It is a typical English inn, situated at the very gates of Lord Rothschild's park, through the winding ways of which I walked several times each day. I cannot say that the quarters were *always* cosy during February and March, for in the English countryside "central heating" is only an American rumor. On winter evenings the Museum was snugger, even though silenter, vaster, and less cheerful, and even though to reach my lonely desk I must needs pass through a long, dim corridor, illuminated mostly by the gleaming glass eyes of bears, gorillas, hyenas, and other beasts mounted in villainous aspects. It was wise to leave the Museum before the chimes of eleven o'clock, for at that hour the street lights of Tring were extinguished, and no forest could be blacker. On belated occasions, of which there were many, I would grope my way until the little lamp at the Rose and Crown, where mine host usually staid up for me, would shine out like a fourth magnitude star peeping into the Pit.

Of the details regarding the supplies,



THE ROSE AND CROWN

Here scores of naturalists of many nations have lived while pursuing their research at the Zoological Museum. The view is from the churchyard, and shows the white cross of the Tring war memorial

insurance, and shipment entailed by the handling of the largest bird collection ever transported from one place to an-



MR. FREDERICK W. YOUNG

The friend and helper of all visitors to the study halls of the Tring Museum is here shown packing specimens for shipment to New York

other, it is not necessary to write. Suffice it to say that with the efficient help of Mr. Young, veteran superintendent of the Tring Museum, and of other members of the force, we set to work to list every specimen of every form, family by family, and to pack them in marked and numbered cartons. The larger birds were wrapped in newspapers, mostly of war-time vintage, and the only lost seconds during weeks of busy days occurred when one or the other of my English helpers was caught and held spellbound by a headline in the *Times* which awakened, perhaps, some burning memory of Flanders. When British sheets gave out, a supply of indecipherable Dutch newspapers, located in the storeroom, served still better to speed up the work. The small birds were packed chiefly between layers of cotton in pasteboard boxes, eight of which fitted within wooden cases with dimensions of 30 by 30 by 60 inches. At the end of four months, when 185 such cases had been filled, we learned that the part of the Tring Collection acquired by the Ameri-

can Museum numbered just under 280,000 specimens.

The list of birds, and the genus index prepared by Mrs. Murphy, who joined me in England at the beginning of April, were typed, as rapidly as they were finished in manuscript, by Miss Thomas, librarian of the Tring Museum. Upon this volume of 740 foolscap pages we pin our hopes for a successful reincarnation of the specimens in the Whitney Wing.

The boxes were shipped from London Docks to New York in six consignments. All reached our hands without dent or dampening, although the destruction by fire of a Cunard pier on the Hudson, shortly after the removal of one lot which contained half the wealth of the Indies, gave us a moment of retrospective trepidation.

The manner in which the Tring material supplements the former bird collection of the American Museum is remarkable. We already had an excellent representation of North and South American birds, of the fauna of forested Africa (i.e., the



TUCKED IN THEIR BERTHS

Study skins of pittas, from the New Guinea region, packed between layers of cotton in cardboard boxes for the long voyage

Congo basin), of Polynesia and certain other island and oceanic areas. The generous interest of Mr. Whitney, in partic-



THE TRING CHURCH

The view is from the Rose and Crown. Chimes from the old tower of Hertfordshire flints mark all rhythms of day and night, and make watches and clocks unessential in Tring



DEPARTURE FOR NEW YORK

Cases containing birds of the Rothschild Collection *en route* for London and a transatlantic steamer

ular, made it possible for us to obtain during his lifetime many thousands of specimens from the South Sea Islands. To house and exhibit these birds he, in conjunction with the City of New York, provided for the construction of the Whitney Wing which, in turn, led to the gift of the Tring Collection. Through the latter acquisition we add the birds of Europe, Asia, and North Africa, those of East and South Africa, the Indo-Malayan and Melanesian districts, Australia and New Zealand, together with a large proportion of extinct species from many localities, not to mention the very valuable hybrids and aberrant forms of numerous families, in which Lord Rothschild has always taken a special interest.

The Tring Collection contains a goodly number of genera not, up to the present, represented in the American Museum; it gives us also a relative wealth of species known only from unique specimens. Types, meaning the particular skins upon which the original description of species or races are based, and which therefore serve as the standard of comparison, number in the neighborhood of three thousand. The total count of genera, as listed in the manuscript catalogue, runs to about twenty-five hundred

but, since Hartert has always given generic names a comprehensive application, the actual representation of genera, as they have been described and used in ornithological literature, is much larger.

To list the rarities would require more space than the meaning would justify. A great auk, two Labrador ducks, and a series of passenger pigeons and Guadalupe caracaras include names familiar to many American readers, though these are far less significant than the world's premier aggregation of birds of paradise, including all but four or five of the known species as well as several extraordinary hybrid forms. No less marvelous are the collections of Hawaiian honey-creepers and Old World sunbirds, and the six thousand American humming birds.

Aside from the rarities, historic specimens, and birds of gorgeous plumage, all of which have a special appeal, the greatest resource that the Tring Collection offers to ornithology in America lies in the satisfying series of entire Old World families and lesser groups. It will now be possible for the American student to examine nearly all the known forms of parrots, pigeons, rails, babblers, and other large families, without crossing the Atlantic. Likewise, it will become peculiarly

illuminating, even to the best informed of our ornithologists, to be able to compare readily their series of familiar North American races with the representative forms of Europe and northern Asia in equally adequate series. Doctor Hartert, author of *Die Vögel der paläarktischen Fauna*—a bible of modern ornithological science—based his comprehensive studies largely upon the Tring Collection, and naturally made sustained efforts to have the birds of this huge field amply represented in the museum to which he gave the best years of his life. It imparts a new meaning to the subjects of evolution and geographical distribution to be able to see upon one laboratory table the evidence that our own very species of nuthatches, horned larks, titmice, finches, etc., occur also in parts of Europe and Asia, in the North African deserts or upon Mediterranean islands. Such facts give an emphatic conception of the oneness of the northern hemisphere. Moreover, when faced with knotty taxonomic problems, we shall far less frequently have to bite our nails and wish that we might be in the British or Berlin Museums in order to examine certain birds from the

Himalayas, or Crete, or Mt. Olympus.

It must not be forgotten that as we in America have gained, so European ornithologists have lost the use of an important tool of their craft. The hospitality and liberality of Tring have become proverbial, and loans of specimens have always been made far more freely than from any national museum in the world. Neither can I forget the friendship of my British colleagues who, while witnessing a deprivation which could hardly fail to fill them with dismay, expressed no criticism of the American Museum or its agent, but, on the contrary, by acts and by spoken and written word did everything possible to make my visit in England memorable and delightful. It is the earnest hope of the American Museum that the effect of the removal of the Rothschild Collection from Europe may be ameliorated in so far as possible. Not only are facilities in preparation for guest-workers in New York but the donors have also provided, for a limited time, a fund in the nature of a fellowship, to be used toward defraying the expenses of duly accredited students from abroad.



The End of the Journey

FROM
NECAXA, PUEBLA



JADE TIGER

A PRE-COLUMBIAN JADE

Artistic Comparisons Which Suggest the Identification of a New
Mexican Civilization

By GEORGE C. VAILLANT

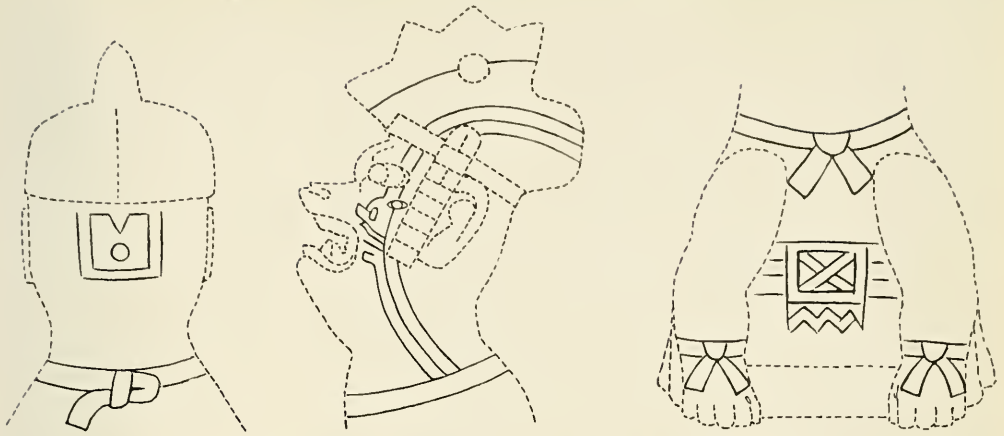
Associate Curator of Mexican Archæology, American Museum

THE little jade tiger or ocelot now among the treasures of the Mexican Hall in the American Museum fulfills two great imaginative requirements, charm and mystery. Although perhaps not beautiful from the point of view of the European æsthetic, its minute grandeur and the consummate excellence of its sculptural technique prove to the most untrained eye that the tiger is a masterpiece of the jade worker's art. To the curious who ponder on its origin and on the identity of its makers there opens through the unmapped jungles of Mexican prehistory a tortuous path toward an unknown destination. There is drama, too, in the details of the jade's discovery, since the rôle Chance plays in archæological discovery is thrust forward so prominently.

The tiger was found in 1909 during the construction of a dam for the great power plant at Necaxa in the mountains of

northeastern Puebla. An American engineer engaged in destroying a mound by hydraulic pressure noticed something shining in the mud sluiced out by the powerful stream. On investigation this object turned out to be the tiger, but the engineer had no time to search further, for the water behind the dam was rising fast. Sixty feet of it now cover the site of the discovery. (See Note on page 557.)

The engineer returned to San Antonio the next year and took the tiger with him. Except for a newspaper article in a San Antonio paper and the comments of those who had seen it, nothing further was known of the jade until 1932, when the owner died and his widow offered it for sale. There was great danger that the piece might fall into private hands and perhaps be lost to archæology, particularly as the specimen was thought to be Chinese. But with generous foresight Mrs. Payne Whitney, Mrs. Charles S.



DESIGNS INCISED ON THE JADE TIGER

The tiger profile is inscribed on either cheek, the shield-shaped design is on the back of the neck, and the third drawing shows the necklace, breast ornament, and wristlets

Payson, and Mr. John Hay Whitney acquired the tiger and presented it to the American Museum, thereby preserving it forever, accessible to layman and student alike.

Although a glance at the photographs or at the specimen itself will show the figure's artistic worth, a brief analytical description will be necessary to show its historical importance.

The tiger, properly speaking ocelot or jaguar, is of sea-green jade and measures

three and one quarter inches high by two inches basal diameter. The jade is of the New World variety, quite distinct from the Asiatic, and the cutting was achieved by the rude abrasives of the pre-Columbian Americans, who had no metal tools suitable for the task. Three holes at the base and one at the top suggest that the tiger was attached vertically to a head-dress or a sceptre, and not suspended as a pendant. The presentation is theological rather than zoölogical for, although the

JADE TIGER,
NECAXA,
PUEBLA

FRONT AND REAR VIEWS. — NOTE THE COMBINATION OF ANIMAL AND HUMAN ELEMENTS, DENOTING POSSIBLY THE REPRESENTATION OF A DIVINITY, PERHAPS TEZCATLIPOCA OR TEPHY-OLLOTLI, THE GOD OF THE MOUNTAINS





VOTIVE AXE OF JADE,
VERA CRUZ

This specimen is perhaps the largest jade from the New World. Note the resemblance between its features and those of the tiger



BEAD, JADEITE, TAYASAL,
PETEN, GUATEMALA

Observe the resemblance between this face and the profile on the cheek of the tiger on page 513. This piece was collected more than fifty years ago by the archæologist Squier





Above

JADE PLAQUE, OCOCINGO, CHIAPAS
From the Squier Collection. A Maya type
is represented here. Exquisite as the speci-
men is, the working of jade is more a south-
ern Mexican art than a Mayan

Right

WIND GOD, JADE
Stuttgart Museum

Truly a masterpiece of the Aztec jade-
worker. Remember that these carvings
were achieved by pecking with stone, and
by abrasives like sand and water used in
connection with a reed or bone drill, or
cord. From Holmes "Masterpieces of
Aboriginal Art," *Art and Archaeology*,
Vol. III, p. 79

posture and the teeth are naturalistic,
the arms and face are humanized, and
such details of adornment are shown as a
sash, headdress, wristlets, and a necklace.
The back of the head, moreover, is divided
by a groove which might be the parting
of the hair, or else may have ceremonial
significance. Faces engraved in profile
on either cheek may represent tattooing,
but other designs inscribed on the chest
indicate perhaps a gorget. On the back
of the figure a small glyph is drawn that





Left
BABY OF
SERPENTINE,
GUERRERO

Observe how the terminal markings on the cheek design resembles the shield inscribed on the neck of the Necaxa jade



Right
BABY-FACE
SCULPTURE,
JADE,
FROM CHIAPAS

Note the identity of the cheek markings of this bead and the Necaxa jade on page 513, as well as their close resemblance to the bead from Tayasal on page 514. After C. Selser, *Auf Allen Wegen*. Page 129

Berlin Museum

although possibly decorative, might also be its name.

If the tiger represents a divinity as all these human attributes suggest, it should be possible to identify it. The grave difficulty obtrudes, however, that although we have considerable data on the nature of the Maya, Zapotec, and Nahua gods, we have no such information for the Vera Cruz region where this object was found. Such great authorities as Madame Zelia Nuttall and Professor Saville incline to place the tiger in Aztec theology as a representation or aspect of the god Tezcatlipoca, the "Flaming Mirror," one of the chief divinities in that



BABY-FACED SCULPTURES, SERPENTINE, FROM OAXACA AND GUERRERO

The contorted mouths are similar to those on the Necaxa tiger

lotli, God of the Mountains, as having sometimes the guise of the tiger or ocelot and at other times the attributes of Tezcatlipoca. Since the Mixtec region borders on central Vera Cruz and since tiger gods are quite often shown in Mixtec codices, such an identification has much to commend it. In the adjacent Zapotec region,

moreover, funerary urns in the shape of tigers are commonly found. However, to assign the name of a divinity to this jade tiger, when we are by no means sure from which of the Mexican civilizations it emanated, can only be defended by the thesis of the homogeneity of Mexican religion, and that thesis is a contro-

versial one. Professor Selser, however, in his commentary on the Codex Fejervary-Mayer, describes the Mixtec god Tepeyol-

versial one. Let us therefore examine the stylistic evidence for the origin of this specimen.

Plastically the tiger belongs to a group of sculptures which all exhibit the same features, a snarling tiger mouth surmounted by a flat pugnose and oblique eyes. Often the back of the head is notched like our specimen. The great jade axe, on exhibition in the Mexican Hall and one of the largest from the New World, is a notable representative of the type. Professor Saville in his paper "Votive Axes from Ancient Mexico" (*Indian Notes*, Vol. VI, No. 3, Museum of the American Indian, Heye Foundation) divides these "tiger-face" sculptures into two classes, votive axes like our great jade, and statues and reliefs like the tiger. The geographical distribution of these carvings centers around southern Vera Cruz, southern Puebla, and northern Oaxaca.

This "tiger-face" class tends to merge with a group of carvings which, although having infantile features, retain the contorted mouth of the tiger sculptures. One of these "baby-faces," a jade bead from Chiapas, makes a definite link, for on its cheeks are inscribed the same designs

as on those of the Necaxa specimen, a "tiger-face" in profile. The "baby-faces" cover the same geographical range as the tiger but in addition several examples emanate from Chiapas and Guerrero. In the excavations carried on by the Museum last winter at Cuernavaca, Morelos, a clay "baby-face" was found under early circum-



PULQUE VASE, JADE
Vienna Museum

An elaborate example of Aztec stone-carving. This plate is from Holmes "Masterpieces of Aboriginal Art," *Art and Archaeology*, Vol. III, p. 74

stances, which might well be a prototype of the two groups just discussed.

So far we have dealt with art styles but now we must consider representations of a



Left
DETAIL FROM
FRESCO OF
BATTLE SCENE
Temple of the Warriors, Chichen Itzá.
Here, perhaps is a cartoon of the race idealized in the previous photograph. (After Morris, Charlott, and Morris, *The Temple of the Warriors*, Pls. 139, 141)

Right
GOLD GORGET.
PAPANTLA,
VERA CRUZ
Museo Nacional,
Mexico

Observe the similarity in position to the Necaxa jade and the resemblance of the features to both the jade and the bearded man. After Peñafiel, *Monumentos del Arte Antico*, Pl. 112





CLAY FIGURINE OF BEARDED MAN,
RIO BALSAS, GUERRERO

The contorted mouth, flat nose, and oblique eyes show close affinity with the jade tiger

racial group, characterized by flat noses, oblique eyes, low foreheads, and often beards. I have described a number of such examples in "A Bearded Mystery" (*NATURAL HISTORY*, Vol. XXXI, No. 3). The relation of this physical type to the "tiger-face" sculpture is dramatically shown by the gold pectoral from Tajin near Papantla in Central Vera Cruz. This place is only two days on horseback from Necaxa, the source of the jade tiger.

When a physical type can be linked to an art style there is strong likelihood that we are dealing with the makers of that style. It sometimes happens that people take as national symbols those animals most resembling them in appearance or psychology, as for example the British and their bull dog. The sculptures listed in the article on bearded men might be taken as internal evidence of their existence, but strengthening this idea are two paintings that show them in contact with other peoples. One of these is the painting on the celebrated Chamá vase where a number of Mayas are shown re-

ceiving a flat-nosed bearded ambassador. The other is one of the murals at the Temple of the Warriors at Chichen Itza, where the Mexican inhabitants of Chichen are shown giving a resounding beating to a group of flat-nosed tribesmen, some of whom have whiskers. Reused stones in Zapotec buildings in Monte Alban depict the flat-nosed type with and without beards, and indicate that before the arrival of the Zapotecs, these people had established themselves there. The area within which bearded figures occur is so much greater than that occupied by the "tiger-face" and "baby-face" sculptures, that it seems possible the bearded flat-nosed people may have been driven back through the rise of the Nahua and Maya tribes in early times and later achieved their artistic evolution in the Vera Cruz-Oaxaca-Puebla region.

However, not all bearded figures have flat noses. A leptorrhine type of bearded figures is shown on sculptures at Santa Lucia Cosumalhuapa in southern Guate-



SCULPTURE IN FINE-GRAINED GRANITE
Dorenberg Collection, presumably from Puebla.
The features and the cleft at the top of the head connect it closely with the Necaxa jade

mala, others appear on stelæ at Seibal and Yaxchilan, and ceremonial vases of lustrous plumbate ware, which was traded from Salvador throughout Guatemala and Mexico, often depict the Old God and the Rain God as bearded. High-nosed bearded figures occur in carvings in the Mexican buildings at Chichen Itza and on some of the Zapotec stelæ at Monte Alban. Perhaps in these cases divinities are represented, for in the Mixtec group of codices, Quetzalcoatl, and Ehecatl, the wind god who often doubles for the former, are shown with beards. Moreover, Tepeyollotli, the God of the Mountains, when not in tiger form, is usually bearded. It is very curious that according to Nahua mythology these gods are associated with the east and south, the directions from the Valley of Mexico where lie the Vera-Cruz-Oaxaca-Puebla area.

Now it sometimes happens that by-gone peoples are transmuted by folk-lore into mythological beings, even as Andrew Lang suggested that the dwarfs and giants



BABY-FACED FIGURE, CLAY, GUALUPITA, CUERNAVACA, MORELOS

Found under conditions of considerable age. It may be the prototype of the stone figures on page 516

of Europe may have had their origin in the wild folk driven back into the mountains with the growth of civilization. Moreover, in Mexico we find the Toltecs, who preceded the Aztecs in the Valley of Mexico, endowed by their successors with almost supernatural skills in the arts. Perhaps in the same way the bearded people were thus considered, and certain of their chieftains or even mayhap their gods were absorbed into the Nahua pantheon.

Supposing that this condition were true, we might examine the list of peoples given in the semi-mythical histories of the Nahua tribes, and by the process of elimination decide which of these is not linked to a defined material civilization. We know the art styles of the Aztec, the Toltec, the Zapotec, perhaps the Totonac, and certainly the Maya. But there is often described in the traditions a highly civilized people called the Olmec, who lived anciently as far north as Tlaxcala, but were later dispersed to southern Vera Cruz, Chiapas, southern Puebla, and eastern Oaxaca. They were famed



HEAD, FINE-GRAINED GRANITE

Probably Vera Cruz. Note the flattish nose and oblique eyes. Is this piece an idealization of a distinct physical type? Compare with page 520

for their work in jade and turquoise, and were credited with being the chief users of rubber in Central America.

The geographical position of these people roughly coincides with the distribution of the "tiger-face" and "baby-face" sculptures and they could have been in contact with Nahua tribes to the north, Zapotec to the west, the central Maya to the southwest, and the Maya and Mexican populations of Yucatan to the southeast. However, no material culture has been assigned to these Olmec.

Thus in view of an art style which is foreign to the defined civilizations, a geographical situation roughly conterminous with the centers of distribution of the art styles, and a historical position which is relatively early, it would seem that the Olmec fulfill very well the requirements for the peculiar art styles we have been discussing. Moreover, Professor Saville in his paper on "Votive Axes" lends his authority to the suggestion.

No formal excavation has been under-

taken in the Olmec area and we know nothing of their beginnings nor of their relations to other cultures. The Olmecs move like shadows across the pages of Mexican history; a few notices that there were such people, a few delineations of a physical type foreign to the racial features of the known peoples like the Maya, and a handful of sculptures out of the known artistic traditions comprise the testimony of their existence. Perhaps investigation in the Olmec area would clarify the much discussed relationship between the Mexicans and the Mayas, or even reveal the origin of the great theocracies that gave Central America its civilization.

The little tiger of jade, therefore, well deserves its place of honor. Its artistic excellence can be seen by comparing it with the more famous jades pictured in this article; its historical implications are sketched in the preceding pages; and its romance lies in the circumstances of its discovery and the mystery surrounding its makers.



RELIEF FROM MONTE ALBAN

Note the delineation of the flat-nosed physical type in another artistic idiom. Bearded examples of this type were uncovered by Professor Caso, re-used in Zapotec buildings at Monte Alban. After Batres, *Exploraciones de Monte Alban*, Pl. V



Exporting Water Buffaloes

PRIMITIVE PLOUGHING WITH WATER BUFFALOES

How the Natives of Central Celebes Domesticate this Great Beast
and Make Use of It in the Cultivation of Rice

By H. C. RAVEN

Associate Curator, Comparative and Human Anatomy, American Museum

The field notes and photographs for this article were made while the author was collecting natural history material in the East Indies for the Smithsonian Institution, Washington, D. C.—THE EDITORS.

THE Indian water buffalo (*Bos bubalis*) of southeastern Asia, which also inhabits many of the East Indian islands, is a huge, ungainly beast whose spread of horn exceeds that of any other existing member of the Bovidae. In many places in the East Indies it is impossible to say whether these animals are truly indigenous or feral, for quite frequently the domesticated ones take to the forests and elude the natives. In a number of localities in Celebes there are both wild and domesticated water buffaloes. There the natives call the water buffalo "benga" but Malays in general call it "kerbau."

In towns and cities of the East Indies

where water buffaloes are used as draught animals like ordinary oxen, they become accustomed to all the various races of mankind. This is not the case, however, in the rural districts where there are no white people, and where, in many instances, the animals are caught wild in the forest and tamed.

Once while hunting birds in the fields near a north Celebes village, I walked on a terrace separating two rice fields. A Malayan native was driving a water buffalo that wore a yoke and pulled a crude plow made of the fork of a tree. The plowman stopped his sleepy looking beast and talked with me and my companions as we stood a few feet down wind.



THE "PERUDJA" UNDER WAY

The field beyond is plowed. All its surface and to the depth of two feet or more is smooth mud free of lumps and grass. The one in the foreground is still lumpy with much grass and water on the surface



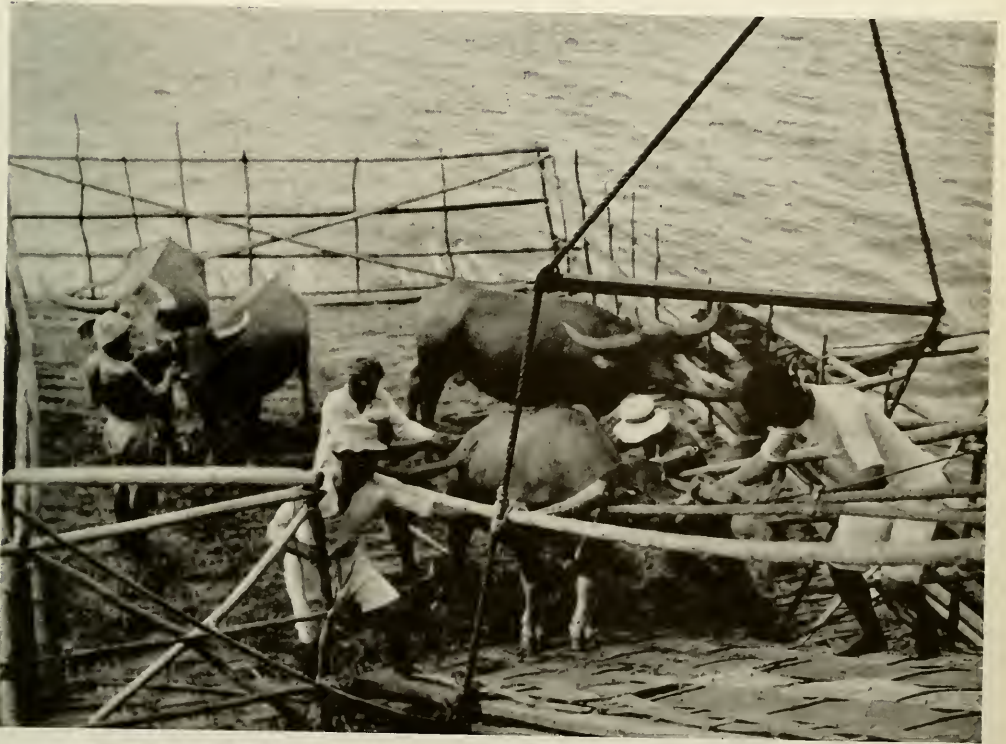
A PRIMITIVE METHOD OF PLOWING

When the fields overgrown with tall grass have been flooded with water, the water buffaloes are driven round and round until the grass and roots are pressed deep beneath the surface



TURNING THE WATER BUFFALOES AT THE CORNER OF THE FIELD

The calf in the foreground was tired out, and when it refused to heed the prodding of the natives, it was allowed to quit the procession



SHIPPING WATER BUFFALOES

They are raised in Soembawa and exported to the much more densely populated island of Java, where they are slaughtered for their meat, or else used as draught animals



TIRED OUT

When the water buffaloes have been tramping round in the soft mud for several hours they get tired and finally lie down and refuse to respond to the prods of the plowmen. Two of the men in the photograph are standing on lumps of mud or roots, but the general depth of the mire may be judged by the wallowing beasts and the men striding about

Then we walked on to the other corner of the field, perhaps seventy yards distant. It did not take long for the wind to carry our scent to the nostrils of the animal. It snorted, wheeled about in the mud, broke its harness, and escaped from its master into the next field, carrying its tail between its legs. There, from a safe distance, it looked in our direction, raised its nose, then lowered and shook its long horns at us. Alternately it walked threateningly toward us and then turned and galloped off toward the forest, repeating this procedure several times before finally disappearing from view. The scent of a white man, which differed from that of my Malay companions to which it was accustomed, had caused its alarm. The natives of course recognized that my scent had excited the beast and with characteristic politeness explained that it was the odor of bath soap common to white men that was strange and alarming to this water buffalo.

Another time I came up beside a

high-banked pool in a stream where some water buffaloes were submerged, except for their nostrils and eyes, as they like to be during the day. Small Malay boys scrambled on their backs and then jumped off into the water as the animals seemed to doze. I stood watching them until the water buffaloes suddenly detected my scent and rushed out of the pool on one side while I made off in the other direction.

Water buffaloes occasionally kill natives and are generally dangerous animals when encountered in the dense forests where they cannot readily be seen. Several times during the day and at night while hunting small animals I found myself threatened by water buffaloes and made a stealthy retreat, as I did not wish to attempt to kill them with a shotgun.

Albino water buffaloes are quite common in this region but are not valued nearly as much by the natives as the normal dark colored ones. It is said that

TAMED WATER
BUFFALOES

When the beasts have been kept about the native houses for some time, they get very tame and allow the children to handle them. It is customary for the children to hold on to the water buffalo's tail to keep from slipping forward when it gallops. This picture also shows an animal with a short tail that may have been cut off as a warning and reprimand to its owner for its having trespassed and eaten in someone's garden. The heavy rattan collar indicates that the animal has been securely tied to a tree or heavy post



the white ones get sore eyes, are weaker, and have poor flesh.

The call or alarm note of a water buffalo at a distance sounds a little like the quack of a duck, not at all like the voice of the domestic cow. Its milk is seldom used by the natives but it is very good and very rich.

On one occasion, when moving camp, I had several pack ponies to carry my equipment. We came to a river in flood. I swam my pony across, but when the natives tried to follow me, their ponies refused to go into the river. I then called to them that I would go on about three miles to the next village, telling them to

take shelter in a village on their side of the river. However, I had not much more than reached my destination when the boys and all the ponies arrived. They explained that they had met a native with a water buffalo, who had fastened the ponies to his animal, and the lumbering, strong-swimming beast had pulled the ponies one by one into the water and towed them across the river.

In Central Celebes the Toradja people keep many water buffaloes in captivity and occasionally add to their herds by the capture of wild ones. This they do with the aid of a pugnacious, and possibly barren, old female water buffalo that will attempt to fight with other water buffaloes, either cows or bulls. When the natives go out to capture the wild animal they equip themselves with long, strong strips of the hides of the water buffalo made like lassos with a noose at one end,

AN ALBINO WATER
BUFFALO

The albinos are quite common in Central Celebes, although they are not valued as highly by the natives as the normal dark-colored animals



A REFRACTORY WATER BUFFALO

The animal that refuses to work and is vicious is controlled by means of a rattan ring fastened in its nose; a heavy collar of rattan, to which long, strong rattans are tied, is placed on its neck, and it is blindfolded with a piece of bark-cloth and led back to the village. Should it balk, the boy carrying a bunch of grass would burn it beneath the animal to make it move

but at the other a grapple or hook of very tough wood. The hunter by rubbing himself against his buffalo acquires some of the animal's odor. He carries his lasso coiled on his arm and crouches beneath the belly of the old female water buffalo as she advances to encounter a wild one. As the two animals come together the man reaches forward and slips the noose on the forefoot of his quarry. Immediately it tries to escape and, as it runs, the grapple catches on a tree and soon the water buffalo has wound and tangled itself with the twenty yards of rawhide until it is tethered short. The natives then approach and apply other lassos. When they have the creature securely fastened, they put a huge rattan collar around its neck and later a ring through its nose. Camping right beside the animal, they let it starve for a time, then hand-feed it, touch it, and handle it, until finally they are able to lead it home. Here they fasten it to a tree or post beside a dwelling where people are passing

in and out and where children are playing about. In a short time the children climb all over the animal and it pays no more attention to them than it would to cattle herons walking on its back and picking insects off its sides.

When the time comes to prepare to plant rice in Central Celebes, the Toradja women may be seen repairing with earth, sod, etc. the broken walls of ditches that lead from little streams to their fields. Such damages occurred after the previous season's rice crop had been harvested and the fields had been invaded by water buffaloes and horses that fed upon and trampled the stubble and grass and broke down the earthen dikes between fields, also the walls of the irrigation ditches. Now at the beginning of another wet season, grass and weeds stand waist high and the black soil beneath is rather hard. When the dikes between the fields and ditches are repaired, first one and then another of the fields is flooded to a depth of several inches and the water

allowed to stand or flow through a little dam from a higher to a lower field. In this way a whole series of fields may be flooded.

While the women have been attending to the irrigation, the men and boys have built a large pen with posts and poles all fastened together with rattans. A single pen is usually large enough for thirty or forty water buffaloes. When this is completed, they go to the neighboring forest to round up the animals. It takes several days to drive a herd slowly out of the forest and into the pen. There they are watched carefully to guard against their escaping to the forest again. Mornings and evenings they are allowed out of the pen to graze but are always surrounded by men. Each man carries a long bamboo pole with the butt end of which he prods and pokes the clumsy animals to make

them go in the direction he wishes. Should any animal become unduly refractory it is singled out, a rattan is fastened to the hole in its nose, and a heavy collar of rattan is placed on its neck, to which long pieces of rattan are attached. It is then blindfolded with a piece of bark-cloth and led away to be fastened to a post beside a house where it will be meagerly hand-fed until it is quite docile. If, while the animal is being led, it starts to run, the natives hold on to the long rattans fastened about its neck as well as to the one through its nose. If the animal balks they sometimes burn grass under it, which never fails to make it move.

When the flooded fields have soaked for a time and the water buffaloes have become fairly tractable, the plowing begins,—“perudja” as the natives call it.



THE TAMING OF THE WATER BUFFALO

Here he stands for days, fastened to one of the large posts of the house, while children play about him, give him grass and water, touch him, and finally climb on him. He learns first to disregard them and then to respond to their commands. Above the animal, on the side of the house, water buffalo horns are carved in the wood. The head and horns of the water buffalo enter into many of the decorations made by the natives

Early in the morning the men drive the animals out of the pen to the field that is to be plowed. There they graze for a while before the men begin to drive them around and around the soaked field in the tall grass. It does not remain tall long, for the large, cloven hoofs soon make a mire of the fields, at each step pressing the grass down. Laboriously, slowly, round and round they go with more mud and less grass and water to be seen on the surface at each turn. When possible, the men walk on the dikes about the field, but most of them must tramp through the mud beside and behind the animals. The "perudja" or plowing of a field is finished when all the grass has been trodden well beneath the surface. Then the mud is smooth, without lumps, and from two to three feet deep.

As soon as one field is finished the water buffaloes are driven to the next and the process is repeated.

After awhile the larger calves which have been included in the herd lag behind and refuse to respond to the prodding

of the natives; they are then usually dropped out of the procession.

By late afternoon both water buffaloes and men are tired, and the beasts lie down in the mud and refuse to go on until they have rested.

In some districts where the rice fields occupy large flat areas that were once the beds of lakes, surrounded by mountains, several villages may be dotted about, and plowing with herds of water buffaloes will be going on simultaneously at different places. The shiny, wet animals wallowing along with the mud-bespattered brown men striding after them are a very pleasant sight, while their shouts and chanting add to the interest.

Each family looks after the irrigation of its own rice fields. The women plant the seedlings a few days after a field is plowed, and care for the field while the rice is growing. The men of one area band together to do the plowing and the men and women band together again to harvest the rice, which is picked by hand, a head at a time.



THE END OF A WATER BUFFALO

Its owner died, so his friends slaughtered the animal to eat at his funeral. The meat was delicious, seasoned with hot peppers and cooked in joints of green bamboo



World's End!

STOCKING A HOME ZOO

Suggestions on the Derivation of Pleasure
From the Back-door Fauna

By ROBERT T. HATT

Assistant Curator, Department of Mammals, American Museum

ILLUSTRATIONS BY THE AUTHOR EXCEPT WHERE OTHERWISE CREDITED

MOST of us, because of space limitations, cannot maintain private zoölogical parks containing the more magnificent selections from the animal kingdom, yet there are few who could not harbor a white-footed mouse and gain pleasure from watching it. Even though the smaller mammals do not attract our attention as do the larger ones, when they are once observed, interest does not remain in proportion to the size of the animal. However, we in America have not taken enthusiastically to the culture of the micro-mammalia, but in parts of Europe where to aquaria and terraria are given much of the floor space that in this country is assigned to radios, the little fur-bearers have their fanciers and obtain a small share of the appreciation due them.

Now, I shall assume that the reader has a deep interest in the creatures that

are reputed to make ladies scream and put terror in the hearts of elephants. Interest implies curiosity and curiosity deserves satisfaction. Satisfaction, however, does not come so readily through reading as it does through observation, and after invoking the admonition of Huxley to study nature, not books, I may suggest in what manner this study may be made practical.

The desired animal, unless it comes into one's hands by gift, purchase, or seizure, must be obtained by some artifice in the form of a trap. The means will of course be determined by the prey.

Some animals, particularly very young ones, may be run down or removed from the nest. Judgment must be exercised in regard to the age of such victims, for, with most mammals, too early removal from the mother is equivalent to slaughter.



PORCUPINES ARE DOCILE—AFTER THEY KNOW YOU

These animals are easily caught and respond to gentle care. A burlap sack, or a noose, or a barrel is useful in picking one up



TOO YOUNG TO LEAVE HOME

This four-day old skunk would make an attractive pet, but needs the care of its mother for many more days

It is, however, advantageous to take the animal at an early age, for with most species the individual will never be tamed if taken late in life. The time of weaning is, perhaps, the best time for abduction.

Bats are occasionally secured by picking them off their hanging places, or these "flutter-mice" may be secured uninjured by netting them as they fly near their roost or feeding ground. Bats, however, are discontented in captivity, and I would recommend that a beginner or one without a very large cage keep a bat not more than a few days. Feeding them is troublesome and, more often than not, unsuccessful.

Trenches dug into the ground, across runways or other places in which small animals are apt to pass, may be successfully used. This method is especially fitted to the capture of shrews, moles, and mice. Pits must not go long unattended, though, for if the animals are not removed, they will starve, drown in a

rain, escape, or be eaten. When the trench is no longer needed, it should be refilled, for it is a menace to both man and beast.

Probably the most useful of all devices for securing small animals is the live trap. Splendid traps can be made with an old tin can, a mouse trap, and a little wire. I have used the one illustrated on the bottom of page 533 for eleven years, and in all that time I have found no trap that has so consistently made a good catch as has this one. Its bulkiness is somewhat of a disadvantage, but where trapping is not to be done on a large scale, this is no hindrance.

Once, being in need of a suitable device for catching small animals alive, I developed the trap shown at the top of page 532. Details of construction of this model are published and any one interested may consult them. This trap has several advantages over the trap described above.



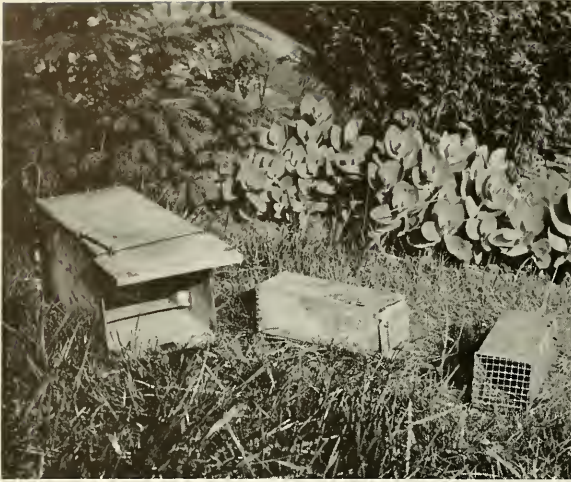
BEAUTIFUL AND ENTERTAINING

Flying squirrels, if taken young, make charming house animals. They are by nature very timid and need gentle treatment lest they be frightened to death



A CONTENTED WOODCHUCK

For the few months of its youth this Adirondack woodchuck lived happily in the house of its captor but in late summer responded to the call of the wild and disappeared



METAL BOX TRAPS

The writer designed these traps to meet exacting field conditions. They are strong and will stand rough usage

of the good points of the trap just described with the added advantage that it is completely collapsible, and thus may be carried in large numbers; it is made in several styles and sizes, including a runway model open at both ends; and, not to be ignored, it may be obtained from its inventor, Prof. Harley B. Sherman, correctly made. That the trap is thoroughly successful is shown by

the list of scientists using it in quantities, and the wide assortment of animals caught in it. One collector in Panama has taken four species of bats in the Sherman trap.

It is strongly constructed and will stand rough usage. It is more compact than any but a folding trap. Being made entirely of metal it is strong and may be easily and completely cleaned. Rodents cannot gnaw out of it. It will not warp and adjustments are unnecessary. The door swinging down from the top operates smoothly and rarely gets out of order. The metal cloth at the end permits the trapper to view the captive without risking its escape. Also bait may be introduced through here. The animal is more apt to enter a screen-end trap than a trap with a closed, dark end, and, of great importance, it is much easier to induce an animal to leave a trap for another receptacle if one can get at it from behind. A positive lock holds the door against all pressure from within. The form of the door avoids injury to the tails of long-tailed animals. Since the roof and walls are solid, the trap protects the catch from showers and, to some extent, winds. The disadvantages of the trap are the relatively high cost of manufacture and the difficulty in repairing breaks which occasionally occur in the trigger. In general this trap is more satisfactory in the larger sizes than in the smaller.

There is a good variety of traps on the market with which one may secure the medium-sized animals, from chipmunks to beavers. Most of these are made especially for muskrat but in most cases

the list of scientists using it in quantities, and the wide assortment of animals caught in it. One collector in Panama has taken four species of bats in the Sherman trap.



GLASS TRAP

A glass jar, a wire, a rubber band, a tin can, and tin shears will make this trap in five minutes

There is one small trap that has most

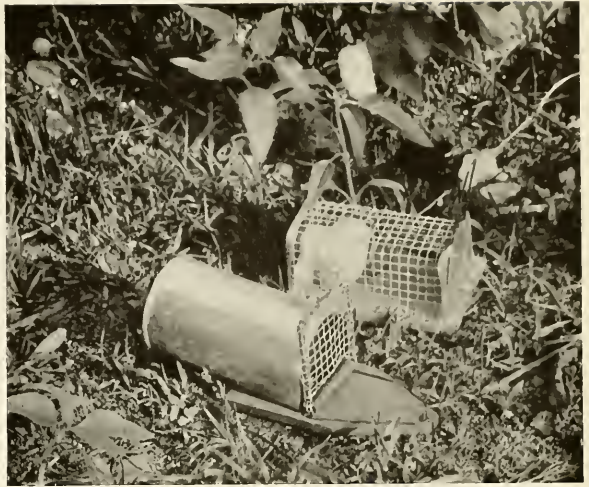
HOMEMADE AND FACTORY MADE

For outdoor trapping the homemade can trap is preferred, as it offers greater protection and occasions less injury

they are equally suited to other species

Old-fashioned wooden box traps are easily made by anyone capable of using a saw and hammer. These traps are, of course, bulky and heavy, and unless they are metal-lined will not hold any ambitious rodent. Also, many animals are suspicious of these traps. They are best for rabbits, beaver, and for cats.

Where should one trap? That will of course depend on what is wanted. Special animals require special technique. Assuming, however, that the beginner would like to see what chance brings, the live traps may be set out in varied situations. If sets are made in upland fields, the traps should be put along the fences or near any small burrows. If traps are set in the woods, the bases of big trees or fallen



logs are good sites. Small mammals are on their guard and in the woods usually travel near logs, or from one tree base to another. If trapping is done in a meadow, it will pay to look for runways and put traps in or alongside of them. By frequent trapping one soon comes to know the common small mammals and where they are likely to be found.

Baits should be varied for a varied catch. Corn meal, rolled oats, peanut butter, banana, bacon, raisins, apples all attract mammals. Mixtures of various of these may be used with success. Cheese may sometimes lead to a catch but it does not enjoy great popularity among the country mice. It is useless to use as bait anything which the animal can easily get outside the trap. Traps must be rebaited and reset every day, for insects clean up most baits, and traps have a way of sticking after exposure.

Some cotton batting or dry grass should always be placed in a live trap. Animals die quickly from exposure in the confined quarters of a trap, even in warm weather.

Unloading a trap is not always quickly accomplished, but I have found that animals leave a trap more readily if undisturbed than if an attempt is made to frighten or shake them out. It is often practical to transfer animals directly from



THE SET

A trap made of a coffee can, a mousetrap spring wire, and a board. Simple and efficient



CAUTION

Opossums are interesting for their reptile-like mental traits, but one never finds them truly friendly

trap to cage. With some traps and some cages, however, the animal must first be transferred to a bag and carried from the one to the other. If the animal is small and long retention is not necessary, a paper bag will do. It is preferable, however, to use a cloth bag of ample proportions. If the animal is as large as a squirrel, one must wear gloves or be prepared to make a blood sacrifice.

Should the reader be faced with the necessity of shipping animals, he may profit by the unfortunate results of a few of my early trials. In the first place most animals must be shipped in individual compartments. Animals which live peacefully together in nature or even in a quiet cage occasionally turn mortal enemies during a voyage, and it is not uncommon to find only a single individual surviving in a box in which several were shipped, even in such cases where the species is by habit vegetarian. Not only must the animals be protected from each

other, but also from the well meaning or thoughtless attention of the express men. It is best to screen one side of the cage and put a burlap cover over this screening. Nail, screw, or lock the case, and if the animals are small and not to be in passage more than four days, label plainly that they are not to be watered. An express company employee in New York's Grand Central Station once opened a case of mine which was tightly nailed and labelled "Do not feed or water." His intention was to water the animals, but the four ground squirrels that had come safely from Colorado escaped and probably did not live long in the new environment.

All mammals, with the exception of a few from desert regions, do need moisture, of course, but in passage the smaller species can get this from their food. For most animals that one is likely to have, an apple is good for this purpose, but a heavy apple rolling around a shipping cage is

A FOLDING TRAP

These traps are made in several types and sizes. When folded, they take very little room

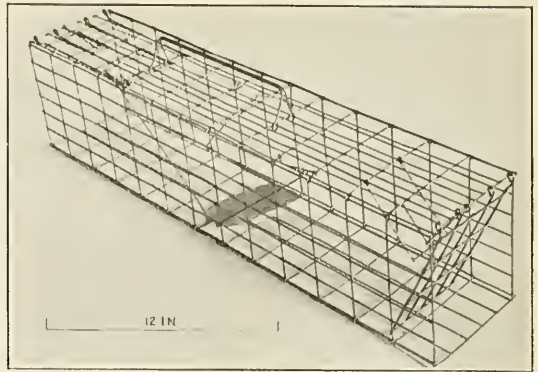
Courtesy American Humane Association

destructive, and for this reason such fruit should be cut in quarters. Other good moist foods such as carrots, lettuce, and similar vegetables that have been found acceptable previous to shipment may be used.

Too much food should not be put in the traveling cage as it is more apt to spoil than to be eaten. It is necessary to determine how much the captives do eat per day, determine the number of days en route, and put a little less than the estimated amount in, for animals do not eat heavily while under the strain of travel.

It is best for a mammal en voyage to have a shipping cage with two compartments, one for the nest, one for feeding. The two may be separated by a good partition that will not allow passage of much food into the nest.

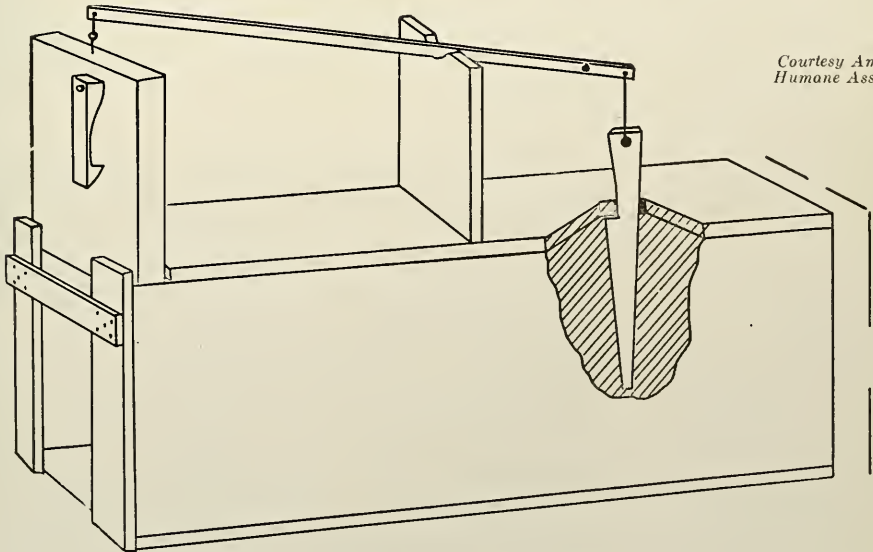
Rodents gnaw out of wooden boxes and, to avoid this, cages need to be lined with



screening or hardware cloth. Smooth metal is less satisfactory as it gives an animal little to cling to.

Both temporary and permanent cages should be equipped with sliding doors. These allow ready adjustment of the size of the opening and minimize the opportunity for escape at the time one is moving the animal, cleaning the cage, or putting food in.

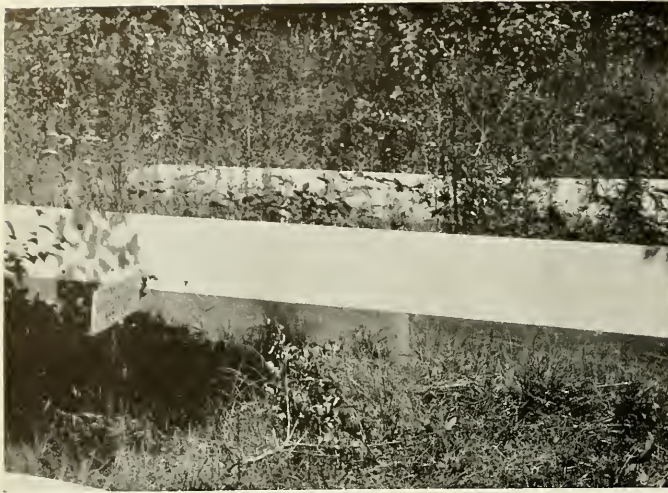
For short journeys or temporary housing I have found well constructed wooden shipping boxes of any sort satisfactory. A smaller box with a small opening may be wired inside for a nest. The front should



Courtesy American Humane Association

THE WOODEN BOX TRAP

An improved box trap, well suited for capturing medium-sized animals and easily made at home



MOUSE PASTURE

In a natural enclosure mice are reasonably contented and are easily watched. The tree in the foreground was felled by hungry meadow mice

after filling, or one may equip an inverted bottle with a bored cork in which a nozzled glass drinking tube is inserted.

Cages of many sorts may be purchased. Pet shops usually carry wire cages for white mice, for squirrels, and for monkeys, but none of those

be covered with screening and, for shipment, part of this recovered with a portion of the original box lid. A door can be made in an end, back, or top. In many boxes one finds a strip of board in the top or back that may be loosened and converted into a sliding door.

The ultimate cage for housing the animal will be determined by one's desires and space. Ample size, complete protection from weather and draughts, and cleanliness are paramount. For most animals earth or sand should be on the bottom of the cage and a puddle of water must be available for swimmers. Many rodents foul their drinking water very quickly. One may change the water frequently or adopt some sort of drinking fountain in which the contents are kept clean automatically. Such a device may be made by constricting the open end of a glass test tube and inverting this in the cage

which I have seen may be recommended for small mammals in general. Laboratory supply companies can furnish metal cages suitable for white mice and others for white rats, but these cages are not made for animals that appreciate exercise, and since they do not have glass sides or front, the animals are not easily watched. Usually the animal keeper will need to make his own cage or have it made for him.

Aquaria are not good mammal cages because they are not readily cleaned. However, a large aquarium with thick glass sides, when filled with loose earth, is a satisfactory place in which to keep the burrowing species such as moles.



TRANSFERRING THE CATCH

The animal is allowed to move through the opened trap door into a canvas bag, and is then carried to its cage



A HAND-FED BAT

Bats usually sulk in captivity and often starve, but occasionally will feed well on flies and beef

It is not the purpose of this paper to give explicit instructions on the construction of cages, as conditions determining caging are subject to too great variation. The making of laboratory cages is detailed in several papers, reference to which may be found in the list on this page.

Permanent cages for active animals should always contain revolving wheels. These afford the animals ample exercise and keep them contented and in good health.

Wheels may be vertical or tilted just off the horizontal. It is easy to underestimate the use to which these are

put. Squirrels particularly require very strong wheels and soon wear out any poorly made contrivance. Mice exercise well on a circular table fastened on to an

axle tilted just off the vertical. This may be made from ply board and a large spool, or fastened to a roller-skate wheel.

An excellent way to keep small animals where space is available is to construct outdoors an enclosure in which conditions are natural except for the confining fence. The fence surround-

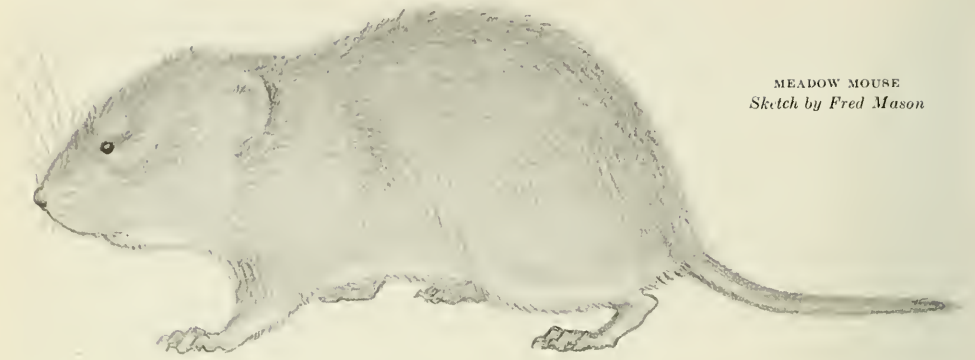
ing them must, of course, be escape proof. An enclosure which I once used for meadow mice was limited by a fence of

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MEADOW MOUSE
Sketch by Fred Mason

galvanized fly screening extending eight inches vertically above ground, eight inches underground, and had an eight-inch under-turn at the bottom. Sewn to the upper edge of the screening and extending vertically above it was a twelve-inch sheet of galvanized iron. This was a very effective barrier to the mice. Some species would need one less troublesome to construct, others one somewhat more so.

Of subsequent care of the animals I can advise little in the space available except the general advice that all living creatures for whose well-being one assumes responsibility must be given a personal, though routine care. The animal's original environment should be simulated as much as

possible, at least to the extent that swimming animals have water, digging animals have earth, sand dwellers be given sand, and nocturnal animals be untroubled by strong lights. Food must be suited to the animal's normal diet and should be diversified. Gnawing animals will need something on which to chew, for their teeth are subject to serious malocclusion when not worn away equally with growth. If the animals are to be made truly tame one must be very gentle with them and avoid excess handling at first, and always refrain from loud noises and sudden moves. The Golden Rule intelligently applied is the key to good care. Patience will reap a rich reward.



Sketch by Fred Mason



Photograph by Frank M. Chapman

View from the National Museum in Rio de Janeiro

WILD LIFE IN BRAZIL

A Pageant of the Fauna That Is Sheltered in the Forests and on the
Prairies of the Largest Country in South America

By BERTHA LUTZ

The National Museum at Rio de Janeiro

LIFE teems more richly in Brazil!" exclaimed Gonçalves Dias, the greatest nature poet of Brazil, in his "Song of Exile." Thus he gave expression to a longing prompted by a remembrance of the intense life in his native land, a life with myriad manifestations, a life of infinite variety and exuberance, a life in striking contrast to the relative poverty of more temperate climes. And Gonçalves Dias was not the only one who felt thus, for no traveler, naturalist, or trained observer who has journeyed through our country and studied the fauna and flora has failed to be deeply impressed by the wealth of wild life in Brazil.

Yet naturalists themselves emphasize another fact which at first glance appears to be directly contradictory. When one starts on a journey full of eager anticipation, cutting his way through the jungle and crossing the sun-baked prairies, a

great surprise ^{is in store.} awaits him, for ^{to} contrary to all predictions, he does not encounter an interesting mammal at every step; the trees are not jeweled with gorgeous flocks of birds; jaguars do not bar the way; and hissing, poisonous snakes do not spring up at every step.

Where is life hidden? Are animals really so scarce in Brazil? Is the much-vaunted fauna a fiction of romance? No, indeed! The animals are there, but to find them it is necessary to know how, when, and where to look. This poverty of animal life is only apparent, and, paradoxical as it may seem, it is really a result of the richness of our fauna, for the species are so numerous and varied that animals are obliged to resort to every sort of a device to guarantee their existence and perpetuation. They are forced to look for surroundings which favor them; to adapt themselves to circumstances; to choose a safe habitat;



Photograph Courtesy of N. Y.
Zoological Park

A CREATURE OF THE DARKNESS

One of the several species of armadillo to be found in Brazil. It is a modern representative of a group which was large and flourishing in mid-Tertiary times

to conform not only to their own instincts, but also to those of the organisms which prey upon them and on which they feed; and, finally, to adjust themselves to the physiographic conditions of the regions in which they live. While plants are chained to the soil and must perforce remain in evidence, defending themselves in ways which nature has provided for them, animals have various means of escaping observation.

Twilight or night life is one of the simplest. To be sure there is no lack of species which go their way in broad daylight, but there is a larger percentage which becomes active only at the close of day. These are either nocturnal, or creatures of the dusk.

Nocturnal wild life in-

THE TAPIR

The tapir is the largest and heaviest of the South American mammals, and is widely distributed throughout Brazil. It prefers a habitat along rivers and watercourses. Tapirs occur today only in Central and South America and in the Malay peninsula

cludes the most varied groups. Among the monkeys there is the night monkey, a tiny animal which sleeps the whole day. Bats, of which there are about a hundred Brazilian species,

also spend the day tucked away with their wings folded, head downward, suspended by the feet. They are active during the twilight and throughout the night. Many of them live on insects and fruits, though some are blood-sucking. Many of the Carnivora are nocturnal. In addition to the spotted jaguar and the different wild cats, there is the raccoon, the *guaxinim* or "bare-hand" (*Procyon cancrivorus*), and a very interesting little animal named kinkajou (*Potos flavus*), which is yellow in color and about the size of a cat. The tayra (*Tayra barbara*) and the ferret-like *Grison vittata* also



Photograph Courtesy of N. Y.
Zoological Park

sally forth at night in search of birds and small mammals. Among Brazilian rodents there exist various wild rats which are scarcely ever encountered during the day. The *gambás* and *quicas* (opossums) the female of which shelters her young in a marsupial pouch, also go about at night and are frequently accused of creating great havoc in hen roosts. Armadillos, likewise, are creatures of the darkness.

Nocturnal birds include owls and nightjars, or *bacuaraós*. These have a curious habit of sitting on the road, their eyes shining in the headlights of automobiles, and, when about to be crushed, leaping up with silently moving wings. Some birds become vocal when the day is done, the *paracura*, for example, which raises its voice to speed the dying light.

A great number of reptiles are nocturnal. Among these, lizards, alligators, and some poisonous snakes may be mentioned. Amphibians are no exception to this rule. In the little towns of the state of São Paulo large groups of great toads are frequently seen sitting solemnly at the foot of lamp-posts at night, waiting for the insects attracted by the lights. The toads are easily caught as they move away very slowly, and that only when a shadow covers them. Many tree-frogs and some other species of frogs are also nocturnal. Some of them, although tiny, have strong voices and contribute a large and varied volume of sound to the chorus intoned night after night. Artificial light exercises a veritable fascination over these batrachians.

Probably the insects form the largest nocturnal group of all. Many species of fireflies glow here and there in the night.



Photograph by H. E. Anthony

A NIGHT WANDERER

The kinkajou is often called by the misleading name of "honey-bear." It is not a bear but is closely related to our raccoon, and looks very much like an animated Teddy bear

Among the Hymenoptera, the termites emerge at twilight with the first hot weather, and dance their ephemeral way into the houses and along the lamp-posts of the streets. Mosquitoes bite treacherously in the darkness or half-light, sometimes transmitting yellow fever, malaria, and other diseases.

Among the animals considered nocturnal, some appear in the afternoon, at nightfall, or just at break of day. This is true of the great rodents, like the "water pig" (*Hydrochoerus capibara*). Although it shows itself openly in the daytime in solitary haunts, it comes forth only at night in those regions where it is hunted.



Photograph Courtesy of N. Y. Zoological Park
CAPUCHIN MONKEY

One of the several species to be found in Brazil. This group of primates was so named because of the fancied resemblance between the cowl of the monk and the erect fringe of hair about the face of the animal

With the break of day all these inhabitants of the shadows withdraw to apparent lifelessness.

Other creatures, however, display themselves openly, like the great blue butterflies that are encountered in the mountains of Rio de Janeiro, but most of them are more cautious and have various methods of passing unperceived. Mimicry is one of the most common. Many species have a distinct resemblance to inanimate objects or plants. A number of tree-frogs, for example, have the faculty of changing color, or, at least, of varying it within certain limits. *Phyllomedusa* can be either green or chocolate-colored on the back. The "stick insect"

assumes the perfect likeness of a dead branch. Various species of grasshoppers, praying mantis, or *louva-deus*, and butterflies have wings that resemble either green or partly withered leaves. Other insects, moths, and wood bugs look like the bark of a tree covered with lichens. For instance, *Thysania agripina*, the largest of the moths, has a wing spread so great that when it alights on a small tree, it is often found sitting crosswise with one pair of wings upward and the other downward. There are many beetles which look like berries. The Arachnidæ, or spiders, are sometimes the color of the petals of the flowers, where they conceal themselves in the corollas and await their victims. Immobility helps greatly as well as the simulation of death. But since we are speaking of mimicry, it is well to mention

the fact that some animals go to the other extreme, ostentatiously displaying bright colors and carrying their audacity to the extent of imitating other species feared for their defensive mechanisms or their ruthlessness. For instance, the false corals imitate the true coral snake, and profit thereby. There is also a frog marked like the coral snake. The underside of the wings of the great *Caligo eurylochus*, or owl butterfly, are an excellent imitation of the eyes of an owl. Another less well-known case is that of a dipteran which resembles a hornet so closely that it can be distinguished only by the fact that it has two wings and that it lacks the characteristic odor.

(43-200-222) that is

The influence of geography and adaptation to environment is most apparent in Brazil: both the rain forest which extends along the coast of the Amazon Basin and other hydrogeographic systems, and the region of open campos or prairies have their own faunas adapted to special existing conditions.

There are in the forest animals which live on the ground like the wild pig and the deer, but the greater number seek the trees. All of the monkeys are arboreal, and most of them have prehensile tails that constitute, as it were, a fifth limb, which aids progress along the tops of trees. Many of the Carnivora climb trees. Arboreal raccoons have already been mentioned as well as the *guarinim*, which is found in the coast region in swampy places and in the neighborhood of the great rivers. The coati, (*Nasua socialis*), climbs trees in search of fruits and eggs. The marsupials, *gambás*, and

quicas, also live in the trees, with the exception of the water *quica*. But without doubt the most interesting arboreal mammals are the sloths, which belong to the order of Edentata. They are descendants of the gigantic fossil forms that have been discovered in the cave of Maquiné and on the pampas. There are four kinds of sloth, which fully justify their name by their indolent habits. They live exclusively on the leaves and sprouts of the *imbuia* or *Cecropia*, the silvery, digitated leaves of which stand out from all other trees in our woods. The sloth remains immovable during long periods, fastening itself to a branch by its claws, and going to sleep with its body hanging underneath the branch and with its head tucked away between its forelimbs. Its gray fur protects it as it resembles the bark of the tree. There is a tiny moth which lives on the skin of this animal. To the same order belong two species of ant-



Photograph Courtesy of N. Y. Zoological Park

A FOREST DWELLER

The giant anteater is one of the most peculiar as well as the most typical of the Brazilian mammals. It is one of the last survivors of a group of cumbersome, slow-moving creatures which were common in Tertiary times. It walks upon the sides of its forefeet because the long claws interfere with the normal position



Photograph by H. E. Anthony

THE ROAD THAT LINKS RIO AND PETROPOLIS

Vegetation is prolific, and heavy forest clothes the slopes of the low hills. The conspicuous light foliage of the cecropia tree is noticeable as scattered whitish spots



BRAZILIAN FOREST

A glimpse into the luxuriant sub-tropical forest at Theresopolis

Photograph by Frank M. Chapman





Photograph by Frank M. Chapman

ON THE ROAD FROM SANTOS TO SAO PAULO

This wild and mountainous country harbors an abundance of interesting fauna

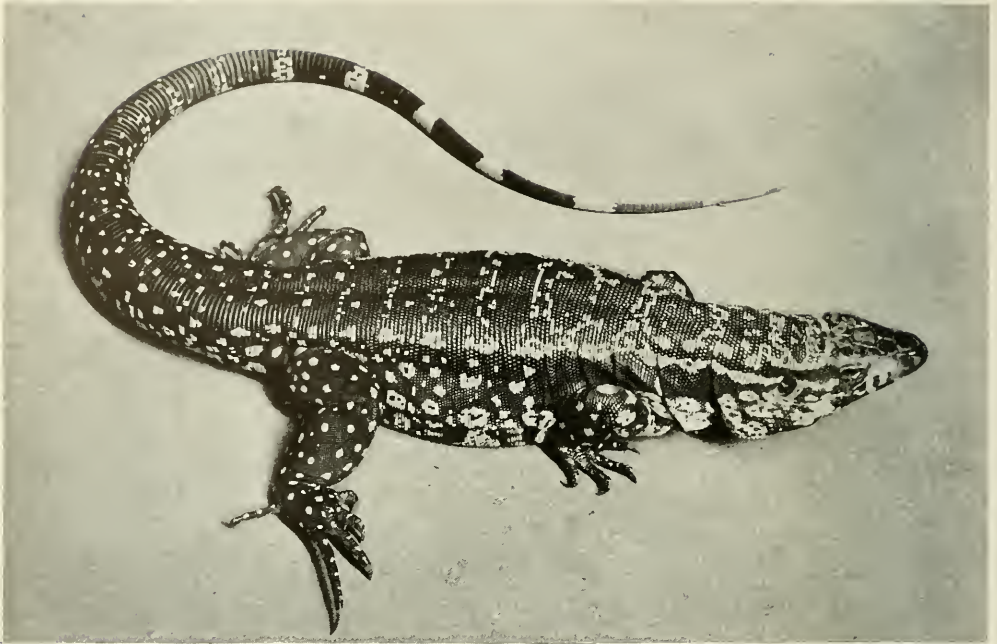


LIKE A GIGANTIC GREENHOUSE

Heavy tropical forest along the road to Petropolis. An abundant rainfall and favorable temperature are conducive to a growth of vegetation such as northerners never see outside of a greenhouse

Photograph by H. E. Anthony





Photograph Courtesy of N. Y. Zoological Park

A BRAZILIAN MARAUDER

Tupinambis nigropunctatus is one of the largest lizards in South America. It is a relentless foe to the smaller denizens of the jungle and has been known to make frequent raids on the chicken yard

eaters; *tamanduá-mirim*, the little ant-eater with the smooth tail; and the *tamanduá-y*, which is scarcely a hand long. The *tamanduá-mirim* climbs trees, and the *tamanduá-y* is exclusively arboreal. It lives in the Amazon basin and, like the giant anteater, *tamanduá bandeira*, eats ants and termites. Not even the reptiles despise arboreal habitats. Some lizards and snakes go in search of nestlings and tree-frogs that live in the bromeliads and other epiphytic plants. Tree-frogs afford one of the most interesting adaptations to life in trees, their spatulate digits with adhesive discs helping them to climb almost anywhere. The species which live among the leaves are frequently of a green color. Not only the adults, but even tadpoles, are found in the trees, for some batrachians spawn in the bromeliads that contain water at the base of the leaves, and the development of the larvæ takes place there. *Mygale*, a great spider, is an arboreal hunter that feeds upon nestlings.

In the eternal search for a safe habitat, many animals go to the other extreme and burrow in the ground. Foremost among these is the armadillo. Its body is covered by a shell composed of a variable number of movable plates arranged in transverse bands on the body. The snout is elongated and the paws end in strong claws which enable it to dig real galleries underground. It lives on insects and worms. There are various species of which the largest is the *Tatú canastra* which is about a yard long. Some reptiles are found under the soil as, for example, the *Amphisbaena*, known in Brazil as "the two-headed snake." It looks like a great worm and is entirely inoffensive. There are some frogs that live almost buried like the horned *Ceratophrys cornuta* which generally leaves only a part of the head outside its burrow. Others, such as *Odontophrynus* and *Cyclorhamphus*, burrow in the earth and are most difficult to find in spite of the noise

they make. On rainy days a great snail (*Bulimus ovatus*) crawls above ground, but on other occasions it loves to conceal itself in the soil, where it lays large eggs with hard shells like those of a dove. There is also a veritable giant of the genus *Glossoscolex* among the earthworms of Brazil.

A large region of Brazil consists of campos, or prairies. There the vegetation is low and conditions are very different from those existing in the rain forest. Except for the dense thickets found along the watercourses, few hiding places exist, for trees are very scarce. Consequently the animals of the prairies are obliged to adopt other tactics, and since they find it impossible to remain unseen, many take to flight. They become swift, their senses acute, and at the first warning given them by their hearing or sight, they are off. On the campos wanders the Brazilian wolf (*Chrysocyon jubatus*) which resembles an over-grown, long-legged

red fox. True to environment, it is a timid and fugitive animal that is rarely seen, and its existence is unknown to many Brazilians. On the prairies the giant anteater (*Myrmecophaga jubata*) has its home. It has no teeth, while its tongue has grown long and slender and is furrowed by a groove. It lives entirely on ants. With its powerful claws it tears apart the nests of the termites, and then collects the inmates with its tongue. In speed, this animal is an exception to the rule, for it cannot run swiftly nor does it need to, for it can defend itself with its powerful claws. In his book on the Amazon, Bates describes a fight between a giant anteater and a dog, relating that the *tamanduá* succeeded in killing the dog by holding it firmly with its claws and squeezing it to death.

Several snakes live in the prairie region, among them the terrible rattlesnake. The other groups of animals are more scarce. There are locusts and some Lepidoptera,



Photograph Courtesy of N. Y. Zoological Park

THE DAGGER-TOOTHED FROG

Few frogs ever use their teeth as weapons but *Ceratophrys dorsata* buries itself in the forest floor and is said to attack not only small animals which serve as prey, but also people who try to molest it



Photograph by H. E. Anthony

A BAT OF THE GENUS *CHILONYCTERIS*

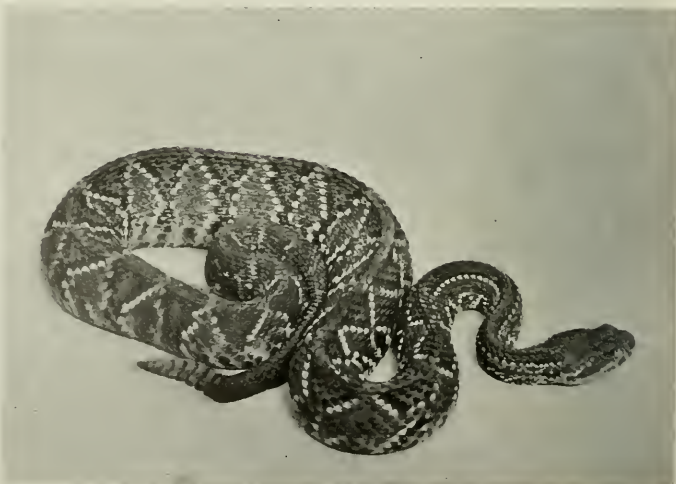
One of the many to be found in Brazil. The variety existing there includes bats that eat insects or fruit, catch fish, or suck blood

but those insects that depend on the presence of running water are not seen. Termites are very common, and their great houses are a part of the landscape. Often-times the termites shelter intruders, such as scorpions and snakes, and many of these ingrates do not hesitate to devour their hosts.

While the soil harbors numerous animals, there are many more in the water, whether in the marshes, or in swift and turbulent rapids. Creeks, rivers, bogs, and

arissu BRAZILIAN RATTLESNAKE
Despite its warning rattle, *Crotalus terrificus*, the only species of rattler in Brazil, is one of the most feared of the poisonous snakes

Photograph Courtesy of N. Y.
Zoological Park



lakes down to the little puddles in dirt roads, and the water accumulated in the bases of the leaf tube of the Bromelias and the internodes of the bamboos all have their fauna. The great watercourses of Brazil teem with numerous species of fish such as the giant *Arapaima gigas*. The indigenous name of this fish is *pirarucú*, a name derived from "pira," fish, and "rucú," red, and assigned on account of the scales which are bordered with red. This enormous species which inhabits the Amazon, is hunted by the Indians with bow and arrow or with the harpoon. Its flesh is utilized in the same manner as that of the codfish. Another fish, interesting because of its ferocity, is the piranha, of which several species exist in the great river systems of Brazil. It is universally feared, and with reason. The fish gather in schools and do not hesitate to attack even the larger beasts. Men and animals with open wounds run especial danger, for blood seems to excite the ferocity of this fish. Bathing places and river crossings are made perilous by this carnivorous pest. It is easily caught with hook and line owing to the indiscriminate precipitation with which it falls on the bait.

The electric eel (*Gymnotus electricus*), which possesses an apparatus for generat-

ing electricity, repels its assailants by means of a strong electric shock. An amusing legend popular in northern Brazil has it that when hungry, the electric eel causes coconuts to fall by submitting the palm tree to repeated shocks. But of all the Brazilian fish, the most interesting is the *Lepidosiren paradoxa*, which is a lungfish. It has both gills and a respiratory apparatus designed to breathe air. When in the river, *Lepidosiren* breathes by means of the gills, but during the season of low water it remains hidden in the stagnant pools of the marshes and breathes by means of the lung. This is one of the transition forms actually existing which gives strong evidence in support of the theory of evolution.

Tortoises have various Brazilian representatives, among them the great turtle of the Amazon, *Emys amazonica*, the largest fresh-water species. It is highly valued both for its flesh and its eggs, and therefore it is much sought after. The eggs are buried in the sand and so skillfully covered that in order to find them the inhabitants of that region are accustomed to probe the sand bars with sticks until certain looseness of the sand indicates a nest. Man annually destroys enormous numbers of turtle eggs, and the



Photograph Courtesy of N. Y. Zoological Park

A COATI MUNDI

By his banded tail you may know him as a member of the exclusively American raccoon tribe. He is inquisitive, active, and interesting

young that do hatch out are hunted by snakes and many other animals. Travelers down a river in Brazil may unknowingly encounter caymans for these creatures are almost always in the water, often with the point of the snout and the eyes

at the surface; in turbid water or on the muddy margin, they merge into the dark background and escape observation. Near the large rivers, too, the explorer may have the doubtful pleasure of encountering the anaconda, or sucury.

DINNER TIME

Armadillos are apt to be solitary and it is only as young animals that several will be seen together as in this picture

Photograph Courtesy of N. Y. Zoological Park



Under favorable conditions several interesting mammals can be seen in the vicinity of the rivers. The most characteristic is the tapir (*Tapirus americanus*), the largest animal of the Brazilian fauna. Bogs difficult of access serve as refuge for several species like the marsh deer (*Odocoileus paludosus*). Numerous mollusks live both in stagnant and in running water.

It is not necessary to travel far to see the fauna of the mountains. It is enough to climb the winding roads that lead upward tier upon tier from Rio de Janeiro. Before long from afar one is greeted by the merry music of waterfalls, the pure crystalline waters of which cut through the dense curtain of vegetation. The life which unfolds here is life in formation: the aquatic larvæ studied with loving care by Fritz Müller and, more recently, by Adolpho Lutz. Attached to the leaves on banks bathed by the water or enveloped in foam or gelatinous tissue are found the eggs of frogs. On the wet rocks wriggle tadpoles the dark mottled color of which blends perfectly with the background. In the clumps of plants covered by running water are found the slipper-like cocoons of the black-flies, or *borrachudos*. Hidden under the stones in rude habita-

tions formed by little sticks, by leaves, or pebbles grouped together, the larvæ of caddis flies, Trichoptera, abound. Certain species construct sheaths of a mosaic of pebbles and grains of sand soldered by a cement secreted by the larvæ. These are most artistic. *Marilia* builds them in the form of a horn, and *Helicopsyche* in the shape of a snail-shell. One species constructs its house of pebbles, weaves a net in the form of a funnel with the larger opening in the direction of the current before its door and remains inside its dwelling awaiting the arrival of some delicious morsel swept by the waters into its nest.

Clinging to the stones where the water dashes most violently live the larvæ of Blepharoceridæ, a little family of flies. They are rough-looking fellows and hold tightly to the smooth surfaces. They are found only on the points where the water is intensely agitated; when removed from such surroundings and placed in calmer waters, they perish almost immediately.

The bird life and ocean life of Brazil also are of great interest to the naturalist, but they are of such variety and abundance that it is impossible to include them in so brief an outline of the fauna of this colorful portion of South America.



Photograph by Frank M. Chapman

Coast near Santos, from the road to São Paulo



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

EXPEDITIONS

CENTRAL ASIATIC EXPEDITION.—Dr. Roy Chapman Andrews returned to the American Museum on September 27, after spending the summer in Peking. He went to China to close permanently the headquarters of the Central Asiatic Expedition and to make arrangements with the officials of the new State of Manchukuo for future work. The obstructive tactics of the National Commission for the Preservation of Antiquities, particularly the Peking branch, toward foreign scientific work in China made necessary the drastic step of abandoning work with China as a base.

Since 1928, when the Nationalists obtained control of a large part of China, foreign scientists have been so hampered in their work by the Preservation Commission that it is no longer worth while to attempt to carry on scientific field work. Americans are not the only ones who have suffered. Dr. Sven Hedin and his great expedition were detained in Peking for months while negotiations with what was then the Cultural Society were being carried on. Sir Aurel Stein, the famous British archæologist, was driven out of Chinese Turkestan by the activities of this same society after his passports had been granted by the Nanking Government. The French Citroën Expedition was required to submit to many months of negotiations and accept a Chinese co-leader and ten Chinese passengers, two of whom almost wrecked the expedition, before they were allowed to proceed.

The Committee has succeeded in making it virtually impossible for foreigners to carry on modern scientific field work either in China or in those regions which must be entered or left from China. The Chinese quite obviously wish to stop all foreign expeditions. Their attitude toward scientific work is only a part of the intense anti-foreign feeling which has arisen since

1928, and which is being systematically fostered in most of the native educational institutions throughout China.

It was hoped by the Museum authorities that a more liberal attitude would be found in the new State of Manchukuo. Happily, this was the case, and Doctor Andrews was most cordially received by the officials of the new government at Mukden and Chang-chun. He was assured that when conditions are reasonably peaceful in Manchuria, the expedition will be welcomed. In the present state of war, it would invite certain disaster to attempt an expedition.

An excellent account of the distressing conditions under which the foreign explorer has to work in China is given by the veteran naturalist, A. C. Sowerby, editor of *The China Journal*, August, pp. 73-74. It is quoted below:

"Exploration in China: Exploration is becoming increasingly more difficult in China. . . . But the greatest difficulty that now has to be encountered by the intending explorer in China is to get the necessary permission of the Nanking Government, which now imposes such conditions on exploration in the country as to make it hardly worth the trouble. It is not that the Central Government is hostile to would-be explorers so much as suspicious of them, and extremely jealous lest they might take something of value, intrinsic or scientific, out of the country.

"This is a great pity, for never before was there such keen interest manifest in Western countries in what the interior of this great country holds, while all branches of scientific research on the part of both Chinese and foreign investigators are being held up by the lack of the knowledge that foreign explorers, backed financially by wealthy institutions in their own countries, are willing and eager to go after, provided they can secure something tangible in the way of specimens for their pains.

"One of the chief fears entertained by the Chinese authorities seems to be that foreign explorers will rob the country of its valuable archaeological relics; and we can well understand and sympathize with the desire to keep such things in the country. But the ironical part of the whole business is that, while a *bona fide* archaeologist is hampered and hindered in his investigations, the interior of the country is being scoured by antique dealers and cleared of all kinds of valuable relics, which are shipped out of the country without any interference on the part of the officials.

"We are not suggesting that these dealers are doing anything dishonest or contrary to the law in this. All the stuff they export passes through the Customs and duty is paid on it. But, if a scientific explorer were to ask permission of the Government authorities to export similar material, he would unquestionably be denied, and, more than likely, his material would be confiscated, or he would be forced to hand it over to some cultural institution.

"The same applies to the foreign biological collector and explorer. He is forbidden to send any specimens of birds whatsoever out of the country; yet there is a flourishing export trade in bird feathers of all kinds. He has to get special permission to send specimens of mammals and other branches of animal life out of the country, and must supply the National Research Institution of Nanking with duplicates of those he is allowed to send abroad; yet any merchant can export thousands of skins of the very same animals without let or hindrance.

"The zoologist, presumably, is placed under restrictions in order to preserve China's native fauna, and the archaeologist is prohibited from sending out antiques in order to preserve China's ancient relics; yet in both lines there is an unhampered and brisk export trade. Surely something should be done to rectify this anomalous state of affairs.

"We do not blame the Chinese for taking an interest in what their country contains, but we suggest that it is entirely against the country's best interests to hamper the efforts of those willing at great cost to carry out scientific research work in the interior, even if it does entail the sending out of the country of a few specimens.

"Banditry, of course, is an evil that, under existing conditions, it is difficult to eliminate, and it may not always be possible to make soldiers and petty officials behave as they should towards foreign explorers travelling in the interior; but at least the Government authori-

ties could welcome and encourage those who are willing to help in the scientific exploration of the country, which it so badly needs, instead of, as at present, making things so difficult for them as to put such exploration work out of the question.

"Exploration in China, which a few years ago was being pushed in all branches with such vigour, has practically ceased, and it is doubtful if it will ever be revived on anything but the smallest scale so long as the present system of regulating the actions of explorers is maintained. And, viewed from any angle, this is not good for China."

SOUTH AMERICAN ARCHAEOLOGICAL EXPEDITION.—On October 17 Wendell C. Bennett, assistant curator in the department of anthropology of the American Museum, returned to New York from an eight months' expedition to Peru and Bolivia. Arriving in Peru in April, he with his companion, John Phillips, devoted the first month to a trip around the southeast of Lake Titicaca,—Achacachi, Timusi, Chuma, Italaqui, Escoma, and Carabuco. On this trip some forty sites of late Inca ruins were located and briefly described. The most complete ruins were mapped and photographed, the others merely noted.

Following this, the party obtained permission, through the aid of Minister Feely, to take aerial photographs of Tiahuanaco. These photographs were taken from government war planes and the results were excellent. Next Doctor Bennett and Mr. Phillips went to Cochabamba, where they were especially interested in the mounds which contained pottery of distinct Tiahuanaco type. During June and July test pits were made at Tiahuanaca. These pits were distributed about the ruins more for study than for collection purposes, and were excavated in half-meter levels, and all finds classified as such. From this material Doctor Bennett hopes to continue studies in stratification as well as classification of pottery. In this regard Pit No. 5 was the most interesting, as it revealed a stratified depth of 4.5 meters. Several pits showed underground canals and suggested that the irrigation and drainage system was quite complex. By far the most notable pit was No. 7, in front of the temple of Calasasaya, in a small temple said to be the oldest in Tiahuanaco. Here was encountered a gigantic monolith beautifully carved in the form of a human figure and decorated with interesting and rare drawings. The length was 7.3 meters and the width and thickness each 1 meter. The weight of the red sandstone figure was roughly eighteen tons. It is a typical Tiahuanacoean monolithic statue, though much larger than any yet known. Two smaller carved stone figures,

two stone heads, and a large stone wheel or ceremonial grindstone were found beside the big statue in the same pit.

In La Paz the expedition obtained permission to export the complete Tiahuanacoan collection as a study loan for one year.

Leaving Bolivia, the party visited Cuzco and Lima. Mr. Phillips then returned to New York while Doctor Bennett went on, at the request of Dr. Rafael Requena, secretary to General Juan Vicente Gomez, president of Venezuela, to examine the collections and archaeological work around Lake Tacarigua, where he excavated a test trench through one of the mounds at "La Mata." The collection obtained from this exploration is now being shipped to the American Museum.

A fuller account of Doctor Bennett's work will appear in an article in an early issue of *NATURAL HISTORY*.

JOSEPH RAK

JOSEPH RAK, outstanding collector of extinct mammals of the Late Tertiary of North America and honorary member of the American Museum of Natural History, died in California on August 17, 1932. Mr. Rak was born in 1874 in the town of Miskovice, near Kutná Hora, Bohemia. He came to New York from Prague in the late '90s and moved to California in 1903. While in New York he was a frequent visitor at the Museum. Working in the California Sierras for fifteen years as prospector and miner, Rak gained the training of eye and hand which was to aid him in future investigations of sedimentary strata.

Rak joined the writer in the early winter of 1917 in the exploration of certain Quaternary deposits of Riverside County, California, that resulted in the discovery of Uppermost Pliocene deposits in the vicinity of Mt. Eden. The Eden fauna, as developed by Rak subsequent to the war, affords the best representation of that period. Similarly the rich and hitherto unapproached collections of Late Miocene and Lower Pliocene mammals, which Rak collected from the Barstow, California, deposits during the winters of 1923-30, and Santa Fé marls, New Mexico, in the fall of 1924 and summers of 1925-30, afford for the first time a definite basis for fundamental revisions of the major mammalian groups of the later Tertiary. Rak's reports on remote California, Arizona, and Texas localities always attested to a keenness of eye for productive strata and an ability to quickly size up the possibilities of a new area. The soundness of his judgment in quarrying was accompanied by deftness of technique in dynamiting over-burden

and in the taking up of fragile remains. Heretofore supposedly barren underlying layers of the Barstow sequence yielded to him complete skeletons. These particular Barstow beds are best exposed in Rak Canyon and now bear his name. From one stratum in the uppermost Barstow division he secured numerous dentitions of *Hemicyon* Lartet, until then unreported from America, and of some thirty individuals of a new genus of wolf, *Arakodon*.

The past February, enthused by the news of a fossil bone prospect in the old Eden area, Rak abandoned the bed to which he had been confined for many months by a tubercular infection. Once more he journeyed back to the well known cañons and there with characteristic care developed the prospect and took up the 1580 pounds of matrix, mandible and partial skull and skeleton of a unique specimen of all but the unknown mastodon genus, *Rhynchotherium*. It was his last trophy.—CHILDS FRICK.

ASTRONOMY

ON November 2, Dr. Jan Schilt, head of the department of astronomy at Columbia University, addressed the Amateur Astronomers Association at the American Museum on "Determining the First Star Distance," and on November 16, Miss Jean Conklin discussed "The Cosmic Ray Controversy."

The following lectures have been arranged for December and January:

December 7.—Mr. James C. Hickey, science editor of the *New York Sun*, will speak on "Man's Debt to the Stars."

December 21.—Mr. David B. Pickering, internationally-known amateur astronomer, will talk on "When the Astronomical World Comes to Town; Personalities of the International Astronomical Union."

January 4.—Dr. John A. Kingsbury, member of the Executive Council of the Amateur Astronomers Association and director of the Milbank Memorial Fund, will describe "A Visit to a Strange Planet."

January 18.—Dr. Palmer Graham, professor of mathematics at New York University, will discuss "Comets."

THE Amateur Astronomers Association has also organized three small classes in astronomy to be held during the current year and open to members of the Association only. Mr. Charles A. Federer, Jr., is conducting both an elementary and a more advanced class, to be held on Tuesday and Monday nights, respectively, and Mr. Paul Shogren continues with his class in elementary and general astronomy on alter-

nate Wednesday nights. For information concerning these groups and the general Association activities write or telephone Miss Lockwood, secretary, Amateur Astronomers Association, American Museum of Natural History.

THE officials of the Association are happy to announce that arrangements have been made with Station WOR to resume the series of radio talks on astronomical subjects given under the supervision of the society on Saturday afternoons. The topics and time for these radio addresses will be announced through the regular radio programs.

DURING the summer Dr. Clyde Fisher, curator of the department of astronomy and president of the Amateur Astronomers Association, made a trip to the Southwest in order to study Meteor Crater and to visit the large astronomical observatories in that part of the country. From Winslow, Arizona, he flew by plane to Meteor Crater, twenty miles to the westward, and photographed this unique formation from a two-thousand foot altitude. Doctor Fisher was convinced by his examination that the only adequate explanation of the cause of the crater is the impact on the earth's surface of a giant meteorite. The crater is four-fifths of a mile in diameter and nearly six hundred feet deep, and closely resembles the craters on the moon, although it is the only one of its kind known on the earth. After photographing it from the air, Doctor Fisher made studies from the ground, photographing it from the rim and from the bottom. Doctor Fisher also visited Lowell Observatory in Flagstaff, Arizona, where he examined the discovery plate of the planet Pluto, and looked through the big telescope with which Professor Percival Lowell made his famous studies of Mars. He also visited Mt. Wilson Observatory in Pasadena, the home of the largest telescope in the world.

BIRDS

OUTRAM BANGS, curator of ornithology in the Museum of Comparative Zoology, with which he had been connected for thirty-two years, died at his home in Wareham, Massachusetts, on September 22, 1932, in his seventieth year.

His publications cover in time a period of fifty years and relate to the birds of the greater part of the earth. The combined result of careful studies and sound judgment, they reflect the character of the man himself and form a notable contribution to our knowledge of the relationships and distribution of birds.

While Bangs's achievements gained for him the respect and esteem of his fellow-workers, his personality won their affection. Generous, fair-minded, cordially helpful, he filled a unique place in the fellowship of ornithologists.

COLLECTING WILD BIRD SONGS.—Not all field expeditions need necessarily be in far off climes. Thus Albert R. Brand, associate in ornithology at the American Museum, spent most of the spring and summer months this year collecting songs of native wild birds. New York and adjacent states sufficed as hunting territory. In a small Ford truck equipped with a "movie-tone" sound recording camera, amplifiers, and microphones, the sound recorders sought quiet woodland stretches wherein to stalk their game. Microphones were set up in the open, cables run out from the truck, and the sound vibrations of the singing birds were photographed on sensitized film. In all, the songs and calls of about ninety species of our common birds were thus secured. Many of these recordings were made no farther away than Westchester County, Lake Hopatcong, New Jersey, and Bear Mountain Park. A number of recordings were taken in and around Ithaca, New York, with the department of ornithology of Cornell University co-operating.

After the film has been developed it can be heard by playing it through an ordinary sound motion picture machine. Later it is transferred to wax discs, and from these phonograph records are stamped. In this manner the first collection of the actual songs of wild birds is being amassed.

HISTORY OF THE EARTH

VARVE CLAY INVESTIGATION.—With the aid of a field fund supplied by Mr. Childs Frick, Dr. Chester A. Reeds resumed his investigation of the varved clay deposits in the vicinity of New York during the month of September. During this time he was assisted in the field by Messrs. S. C. Happ and B. Zellner and in the laboratory by Mr. P. B. Hill.

While some attention was given to the previously studied deposits in the Hackensack and Hudson River valleys, most of the time was confined to the securing of sections taken from borings in the glacial Lake Passaic deposits south of Morristown, New Jersey, where sediments seventy feet in thickness have been encountered in well records. With the aid of specially devised apparatus, consecutive samples, each 20 inches in length, were taken from various holes to a depth of 32 feet. These samples show numerous bands, which alternate in color—a

lighter band for the summer deposition and a darker one for the winter season. The problem is to secure as complete a section as possible and then count the number of bands represented, allowing one light and one dark band for each year. The total number of bands represented for this locality is of scientific interest in that when this record is finally secured, it will indicate how many consecutive summers and winters, or years, the ice of the last glaciation stood at its terminal moraine at Morristown and Summit, New Jersey.

A HOME-MAKING BAT

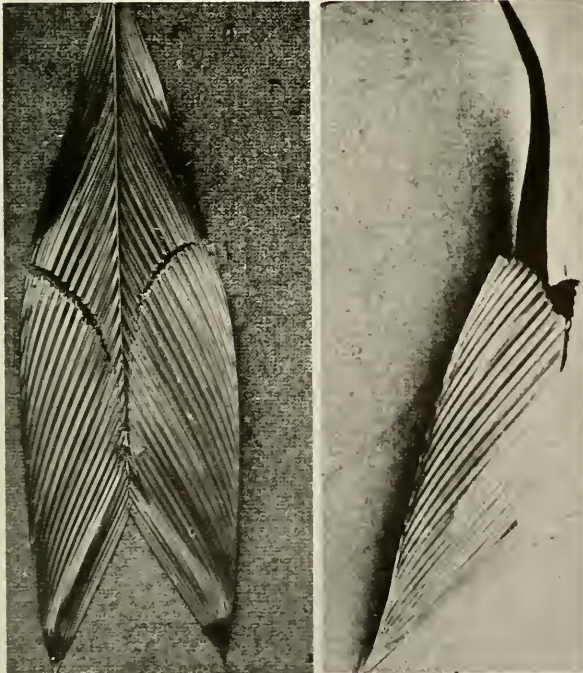
THE following interesting note on bats has been contributed by Dr. Frank M. Chapman:

"On the morning of January 9, 1932, near Station No. 6 on the Shannon Trail, Barro Colorado Island, C. Z., I frightened a bat from an overhanging palm leaf. Examination showed that both vanes of the leaf whence the bat flew were cut diagonally to the midrib of the leaf, so that their terminal portions drooped downward to form a tentlike shelter. In the same palm I discovered a second leaf similarly treated beneath which, at the apex of the "tent," a single bat was hanging. In a neighboring palm of the same species a third bat was found whose home re-



A BAT-INHABITED PALM

Showing leaves at right and left cut by the bats to form the tentlike shelter within which they roost



LEAF OF PALM

(*Geonoma decurrens* Wendl.)

Left: Showing the cuts made by Watson's bat at each side of the midrib
Right: Showing manner in which the apical portions after being cut by Watson's bat hang downward to form a tentlike shelter

sembled those of the first two. The palm, identified by Dr. Liberty H. Bailey from my photographs as *Geonoma decurrens* Wendl., is locally common on Barro Colorado. At intervals during the remainder of the winter I examined many individuals but without finding additional bat-inhabited leaves. This bat, which, with Mr. George G. Goodwin's assistance, I have identified as *Artibeus watsoni* Thomas, is apparently, therefore, not common on the island.

The manner and direction in which the leaves are cut indicate that this work is performed by the bat's teeth with the object of providing a retreat in which to pass the day. The accompanying photographs tell their own story."

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Since the preceding note was placed in type Doctor Chapman writes that he has seen a paper by Dr. Thomas Barbour (*Quart. Rev. Biol.*, Sept., 1932, pp. 307-312) proving conclusively that another species of bat (*Uroderma bilobatum*) in the Canal Zone, creates a roosting shelter for itself by cutting the leaves of a palm (*Prichardea pacifica*) in



GENERAL VIEW OF THE MESA OF NECAXA

The administration buildings are located on the mesa. In the background stretches the trackless wilderness of the Sierra de Puebla

a manner essentially similar to that employed by *Artibeus watsoni* as just described.

MAMMALS

SMALL MAMMALS FROM NEW HAMPSHIRE.—Mr. Deane Mather, volunteer assistant in the department of mammals, spent some months during the past summer collecting small mammals at Mt. Washington, New Hampshire. The specimens, which he has turned over to the American Museum, include two topotypes and two species new to the Museum's collections.

GEORGE GOODWIN, assistant curator in the department of mammals, has obtained fifty live white-footed mice in Cedarhurst, Long Island. These are to be shipped to Prof. Emil Brumpt, head of the department of parasitology of the University of Paris, who will use them in experimental work.

MINERALS

THE "ROUND TABLE" TALK.—One of the difficult problems in the extension education service now being carried on by Dr. H. P. Whitlock in the halls of the department of minerals and gems at the American Museum, is the hand-

ling of groups of from fifteen to thirty persons. Units of less than fifteen can easily be addressed while assembled in front of a five-foot-long case, and so moved on from case to case, and groups numbering more than thirty are best handled in one of the School Service Building assembly rooms. For the medium-sized group, however, i.e., from fifteen to thirty, the department has adopted the method of using the central table in the Morgan Hall as a point from which to address informally the group which is seated on the stone bench facing the table and on chairs surrounding it on three sides. Hand specimens can be circulated and photographic enlargements and charts may be set upright on the table, the former with back supports like those attached to photographic frames.

Topics of too general a nature to be handled by a "tour of the cases" can be successfully presented in this way. For example, Doctor Whitlock has within the past year spoken to medium-sized groups on "Elementary Crystallography," "Distribution of the World's Metals," "Diamond Polishing," "The Common Minerals," and "How Atoms Build."

LIVING INVERTEBRATES

A NEW SERIES OF ROTIFER MODELS, illustrating the comparative anatomy of six typical species of rotifers, has just been installed in the Darwin Hall of the American Museum. The rotifers are extremely variable in shape and external characters throughout the various species comprising the group. Much of the internal anatomy is typically the same, but with certain characteristic and striking peculiarities typical of each species. This series is intended to illustrate these points by showing through the transparent models the internal organs with corresponding sets of structures colored similarly throughout the series.

The models are the skillful work of Mr. Herman O. Mueller, and the data, materials, and critical supervision are due to the coöperation of research associate Frank J. Myers of Ventnor, New Jersey, who is an acknowledged authority on rotifers.

SCIENCE OF MAN

WHERE THE JADE TIGER WAS DISCOVERED.—

Below and on page 556 are pictures of the great power plant at Necaxa, Puebla, during the

construction of which the jade tiger described on pp. 512-520 of this issue was discovered. These photographs were furnished through the courtesy of Mr. W. H. Fraser, general manager of the Compañía Mexicana de Luz y Fuerza Motriz, which maintains the plant to supply light and power for Mexico and for the railroad connecting the capital with the coast. A high tension line carries the power over the hundred miles separating Mexico City from Necaxa.

The great plateau of which the Valley of Mexico is part rises almost vertically from the coast plain of Vera Cruz. Rivers having their source in these mountains consequently drop with tremendous force before they reach the flat jungle region. The mesa of Necaxa, thrust out like a buttress midway between the plain and the peaks of the highland, afforded a means of harnessing this power. Engineers constructed a dam on the edge of this mesa, impounding the Necaxa River. The water was then conducted through great pipes which passed through tunnels to the bottom of a gorge 740 feet below. In this manner tremendous force was generated to run the turbines situated there. Later a second



NECAXA FROM THE AIR

Note the dam, the locks, and the ravine where the power houses are situated

river, the Tenango, was dammed, and its water connected with the Necaxa plant, so that however much the use of electricity may increase in Mexico, there is an adequate means for its production.

The scene at Necaxa is one of violent contrasts. The camp situated on the mesa is in a temperate climate, but the power houses in the gorge are in the hot country. The living quarters of the workmen and engineers are as modern as the machinery, but in the surrounding hills live Indians who retain their native dress and language. There is a constant stream of Indian foot traffic between the low country and the plateau; but the power plant maintains its communication by means of a narrow gauge railroad, connecting with a branch of the National lines. Necaxa is barely accessible by motor car in the dry season, so that for much of the year the railroad and foot paths represent without intermediary phase the two extremes of transport. Until recently communication with the low country was on foot or on horseback, but now a pipe line paralleled by a road just passable by motor, after a spell of dry weather, has been put through from the Tuxpan oil fields to Mexico City.

To achieve in so desolate a spot a project of such advantage to the people of Mexico is one of the great engineering feats of our era and a monument to British initiative. It is indeed most fortunate that this vast undertaking should have produced, as the merest of by-products, our small jade tiger.

Of the Olmecs whom we thought to be the makers of the tiger, very little is known. Perhaps the fullest account of them is given by Fray Bernardino de Sahagun (1499-1590) in his *Historia de la Cosas de Nueva Espana*, Book X, Chapter XXIX, pp. 136-137 of Volume III of the Bustamente Edition of 1830. "Paragraph Tenth: of the Olmecas, Uixtoti, and Mixtecas: Those who are thus named live toward the sunrise, and they call them also Tenime, because they speak a barbarous language; and they say that they are Toltecs which means workers in all the important crafts and cunning in everything, and that they are descendants of the Toltecs as has been mentioned above; and they are powerful because their lands are very rich, fertile, and abundant in that every kind of sustenance is given in profusion. Growing there are much cocoa and the flower or kind of aromatic called *teunacaztli*. There also grows there *ulli* (rubber) which is the black gum of a tree which is called *olli*, and the flower they call *iploxuchitl* and all the other flowers which are very valuable. Here also

is found the source of the birds which produce very rich plumage, and parrots great and small and the bird which they call *quetzaltototl* (quetzal or trogon). Also there are taken from there very valuable stones of *chalchihuites* (jade) and turquoise, and here also are found much gold and silver.

"The land is certainly most fertile, so that the ancients call it Tlalocan which means land of riches or earthly paradise..

"Their dress was in diverse styles: some wore blankets, others garments like small coats, others breech clouts with which they covered their nakedness. Their women are great weavers very neat in working cloth, and rightly so for they are of such a good rich land. They wear as charms wide bracelets and anklets of gold, strings of stone beads on their wrists, and jewels of these and of gold at the neck. They also wear sandals like the men, but those of the latter are finer. They also use sandals made of rubber.

"It was said of these people because they were rich and because nothing necessary was lacking to them that they were the sons of Quetzalcoatl, because the ancients believed that he who was prosperous, rich and fortunate was the intimate and friend of the said Quetzalcoatl.

"They used neither more nor less than the following: bows, arrows, and wide knives to defend themselves from the savage beasts which they saw in the mountains.

"There are many of these people who are Nahuas or Mexicans."—G. C. V.

VERTEBRATE PALÆONTOLOGY

PRESIDENT OSBORN VISITS NEBRASKA STATE MUSEUM.—The splendid collection of fossils which Dr. E. H. Barbour and his students have brought together in Morrill Hall at the Nebraska State Museum at Lincoln, was the subject of research, by no less than four curators of the American Museum during the past summer. Childs Frick was especially interested in the fossil bones of horses and the ancient carnivores of Nebraska; Barnum Brown paused for a visit while on his way to the Rocky Mountains in Wyoming, where he was planning to search for dinosaur remains; and more recently President Henry Fairfield Osborn made a two-days' visit to the museum in company with Dr. Walter Granger. After a tour of the fossil corridors, President Osborn settled down to the task which had brought him to Morrill Hall viz. the study of the fine fossil elephant from Brown County, Nebraska. Quite a little of the elephant material in Morrill Hall will have an important place in President Osborn's Monograph on the Proboscidea and every effort was made by the staff of the Museum to facili-

tate his work during his short sojourn there.

When resuming the weekly Nebraska State Museum broadcast talks from Morrill Hall in September, Mr. J. G. Collins, the assistant curator of its department of geology, devoted a large part of the talk to President Osborn's visit, and referred to him as follows:

"You are doubtless familiar with his name, it has long been a household word in the scientific world, and not only among students but among the educated public, for Doctor Osborn is one of those rare and priceless men in a generation who are able not only to gain great knowledge by their intensive studies but to tell the public in understandable language what it is all about, and while he has written no end of books and pamphlets for the consumption of his scientific brethren, he has also written several most fascinating volumes for his lay brethren."

SCARRITT PATAGONIAN EXPEDITION.—Work is advancing rapidly on the results of the Scarritt Patagonian Expedition. As previously reported in *NATURAL HISTORY*, the chief purpose of the expedition was to collect and study the fossil remains of the oldest mammals of South America, and a large collection was brought back from Patagonia last year. Work on the preparation and restoration of these fossils is now nearing completion, although some of the more striking and complete specimens have not yet been prepared.

The scientific results of the expedition will be presented in a series of preliminary papers, followed by a complete memoir of the whole subject. Seven preliminary papers have already been published, three more will appear almost immediately, and several others are in press or nearly complete. Work on the memoir is also progressing steadily.

Among the results already published are some of unusual interest. It has, for instance, been shown that even the earliest mammals of South America were subject to disease, and two specimens showing severe rheumatism of the backbone were discovered. For many years there has been debate as to whether dinosaurs survived longer in South America than elsewhere, and the debate seems to be ended by the results of this work, which are opposed to the reality of such survival. Another preliminary note points out that armadillos are a very ancient group, and refers to a remarkable new specimen with enamel on the permanent teeth, never before known in any of the armadillos or their allies. Naming and description of the many hitherto unknown species discovered by the expedition has also begun in recent publications.

A paper still in press will describe a new fossil snake of enormous size, undoubtedly well over thirty feet in length when alive. It is related to modern boas and pythons, but like most gigantic extinct animals probably was not the direct ancestor of its modern relatives.

In the preparation of the material, it was a pleasant surprise to find that one of the specimens, still in the rock when collected, turned out to be the skull of a very rare mammal, *Trigonostylops*, hitherto known chiefly from a few isolated teeth. The skull is one of the most extraordinary ever discovered and shows that this animal was only very distantly related to any others known.

—G. G. S.

BROADCASTING BY THE AMERICAN MUSEUM

THROUGH the courtesy of the Columbia Broadcasting System the American Museum has instituted a radio broadcasting period on a coast to coast network over Station WABC each Thursday afternoon from 2:15 to 2:30, from October 27 until May, 1933. Members of the scientific staff are giving these talks on behalf of the Museum.

In October three talks were given over WJZ through the courtesy of the National Broadcasting Company. The first, over a coast to coast network, on October 9, was by Clyde Fisher, whose subject was "Eclipse Adventures." On October 23, Roy Chapman Andrews over an international network spoke on "Explorations in the Gobi." On October 30, James L. Clark talked on "Hunting the Giant Eland in the Sudan."

A series of talks will also be broadcast over Station WNYC by members of the department of education in biweekly periods, on Thursday evenings from 8:15 to 8:30.

AMERICAN MUSEUM LIBRARY

With the publication of the eleventh and twelfth volumes, Rex Brasher's stupendous work on the *Birds and Trees of North America* has been brought to a close. The Library is most fortunate in having the complete series through the generosity of Mrs. Wheeler H. Page.

✓ *Illustrations of Japanese Aquatic Plants and Animals* is a collection of beautiful plates reproduced with the care and artistry which are characteristic of the Japanese. The explanations are in Japanese and English. The second and final volume, just received, came as a gift from the publishers, the Fisheries Society of Japan, who were also the donors of Volume I.

The Birds of Minnesota by Dr. Thomas S. Roberts, an exhaustive two-volume work,

superbly illustrated, has been received on exchange from the University of Minnesota. It forms a most important addition to American ornithological literature and will be of endless value to the Library.

As an exchange from Fisk University, the Library has had the good fortune to acquire a copy of Mrs. Fanny R. Bandelier's translation of Fray Bernardino de Sahagun's *A History of Ancient Mexico*. This translation from the Spanish version of Carlos Maria de Bustamante now makes available in the English language the writings of that earliest great historian in the New World, who is today also recognized as the first true ethnologist.

Two other works of unusual appeal to the eye are the second volume of *Ars Americana*, entitled "L'Ancienne Civilization des Barreaux du Nord-Ouest Argentin," by Salvador Debenedetti, and *L'Art Précolombien*, by Adolphe Basler and Ernest Brummer. Both are quartos, magnificently illustrated, partly in color, and depict primitive South American art, especially the work in stone and pottery.

NEW PUBLICATIONS

A Contribution to the Paleobotany of the Eocene of Texas. (Bulletin Agricolt. and Mechan. College of Texas. 1931. Vol. 2, No. 5.)

LEAVES of long ago! Autumn—and broad leaves fluttering down! What an immense quantity of leaves falls each year,—in forests, in valleys, on mountain-sides. And yet, when the winter's rain and wind have done their work, they are all gone—gone like the snows of yesterday.

But not quite all. Here and there some stray, lucky leaf escapes this sad fate. Perchance it falls into a lake or into the shallow sea, and so comes to rest on the soft, velvety sediment at the bottom; there it stretches its weary little limbs—wary from battling with cruel winds and hard rocks—and sleeps on and on—almost endlessly—until at last it is transmuted into a fossil leaf.

These thoughts flitted through my mind as I turned the pages of a large, quarto monograph on the fossil plants, mostly leaves, of Texas. It is by Prof. O. M. Ball, and is entitled, rather modestly, *A Contribution to the Paleobotany of the Eocene of Texas*.

In this work Doctor Ball summarizes years of study of the paleobotany of Texas. In the Eocene age, many millions of years ago, the primeval forests of Texas possessed many kinds of trees, among them some that differed only specifically from trees around us today. Their fossil leaves, pictured in the numerous plates in the memoir, will have a familiar look to anyone accustomed to observe trees and their leaves. There were in those forests hickory trees and walnut trees, fig trees and catalpas, and a great many other trees and shrubs not so generally familiar.

By the aid of these leaves we can see in our mind's eye the great forests of tall, stately trees covering vast stretches of land in Texas, in that dimly remote time we call Eocene. These forests were not confined to Texas. Professor Ball gives tables showing the range of many of these ancient trees of Texas, at that time, through other states of the South.

Many of the species in this memoir were previously named and described by Prof. E. W. Berry, the noted paleobotanist of Johns Hopkins. But Professor Ball here correlates and synthesizes these earlier studies with his own investigations extending over years, and gives a complete summary of the Texan Eocene flora.

One page, at the end of the memoir, should prove of great interest to entomologists. Despite years of intensive collecting, and although multitudes of leaves were obtained, only two fossil relics were found of all the abounding insect life that hovered and flitted through those ancient forests—a wing of a dragon fly, and a wing of an ant. What a commentary on the "imperfection of the geological record."

—L. HUSAKOF.

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total membership 11,428.

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GEORGE N. PINDAR, Chairman

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BLAZING THE TRAIL

ROY CHAPMAN ANDREWS, who has only recently returned from China, has written for the January-February number of *NATURAL HISTORY* a fascinating article on certain of the inhabitants of the Gobi Desert. For some reason the lowly ass has long been thought of by lordly humans as being the very apotheosis of stupidity. Yet, as is so often the case, we have been far from right, and the wild ass of the Gobi Desert is anything but what popular prejudice might imagine it to be. Fleet enough to test the speed even of the Central Asiatic Expedition's motor cars, and capable enough to glean a satisfactory living in a land so nearly devoid of grass and water as to be one of the world's greatest deserts, this animal, with his enemies and associates, proves to be remarkably interesting when seen through Doctor Andrews' eyes.

CORTEZ in Mexico fills more than a few pages of early American history, but his efficiency as a conqueror was more than equalled by his ability as a destroyer. The result is that archaeologists have had an enormous task in piecing together the broken fragments of a once great civilization and of learning enough of the details of the life and art and industry of the Aztecs and their neighbors to make the matter reasonably clear to present-day readers.

Dr. George C. Vaillant, who has worked for years among the ruins of old Mexico, has written an article on the Valley of Mexico as that land was just before the coming of the Spaniards. The article will appear in the next number of *NATURAL HISTORY*, and will describe the temples and palaces, the places of sacrifice, the manners and customs of this fascinatingly beautiful, if somewhat bloody region.

ALFRED M. BAILEY, director of the Chicago Academy of Sciences, has a marvelous facility in photographing birds, and we are

fortunately able to obtain from him occasional articles telling of his activities in this very pleasant and appealing labor. In the next number of *NATURAL HISTORY* he will tell of his experiences in photographing the avocet, and of imposing on the willingness of a female avocet in getting her to hatch a clutch of hens' eggs in place of her own.

MONT PELÉE is a West Indian Vesuvius quiet enough at times but retaining within its vast depths the fires that occasionally burst forth. For the next number of this magazine, Dr. C. A. Reeds has written an article dealing with this volcano and its most recent eruption, as well as with Mr. Frank A. Perret and this volcanologist's new museum. Here upon the foundation of a villa destroyed by an eruption, the new museum stands, while with this as a laboratory, studies of the great volcano's moods and activities are made. The article is to be illustrated by Mr. Perret's remarkable photographs.

AN article on insect contrasts has been contributed to *NATURAL HISTORY* by Paul Griswold Howes, of the Bruce Museum, Greenwich, Connecticut. This will appear in the January-

February number, and will be illustrated by some of Mr. Howes' highly unusual photographs of wasps and wasps' nests.

M. G. H. H. TATE of the American Museum's department of mammalogy, who has lead several highly successful expeditions to various parts of South America, has written an article for the next number on his experiences among the mountains of Bolivia.

LACK of space prevents the listing of other articles that we shall publish in the coming number. We believe, however, that they will all prove to be thoroughly entertaining.

SCULPTURES FROM ANGKOR

THE examples of Khmer sculpture reproduced with fidelity by Mr. Arthur A. Jansson, staff artist, for the cover of this issue of *NATURAL HISTORY* are representative specimens of Cambodian art. The head is based on an original exhibited in the Albert Sarraut Museum of Khmer Art at Pnom Penh. Sculptured heads such as this one are frequently found broken off from the body which represented a seated Buddha, a dominant diety in the Khmer pantheon. There is no attempt at portraiture here. The artist has sought rather to achieve a type, peculiarly appropriate to the characteristics of the divinity.

The relief depicting the dancing figures is still in place at Angkor. In spite of its antiquity these dancing girls have a contemporaneity bestowed upon them by virtue of the preservation in the modern dances of these ancient and traditional postures.

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SIXTY-ONE 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.

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This magazine, published bi-monthly by the American Museum, is sent to all classes of members as one of their privileges.

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Series of illustrated lectures held on alternate Thursday evenings in the autumn and spring of the year are open only to members of the class of \$10 annually or higher 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 have been constantly in the field for years, gathering information in many odd corners of the world. During 1931 twenty-three expeditions visited many distant portions of the globe. In 1932, however, owing to the limitations of funds, expeditions will necessarily have to be eliminated except as they are financed by gifts. In this work of exploration, consequently, the American Museum especially needs the generous help of its many friends in order to further the scientific work of the institution. Contributions to this phase of the work of the Museum are of more than usual value, and the Museum will be glad to discuss any angle of its delayed program of exploration with anyone interested in aiding this work financially.

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 108,000 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 coöperating 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 augment greatly the Museum's work, not only in New York City public schools, but also throughout the United States. More than 27,945,076 contacts were made with boys and girls in the schools of Greater New York alone, and educational institutions in more than thirty-three states took advantage of the Museum's free film service during 1931. 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.

