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NATURAL HISTORY

THE JOURNAL OF THE
AMERICAN MUSEUM OF NATURAL HISTORY

VOLUME XXXVII

January-May, 1936

TEN ISSUES A YEAR

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

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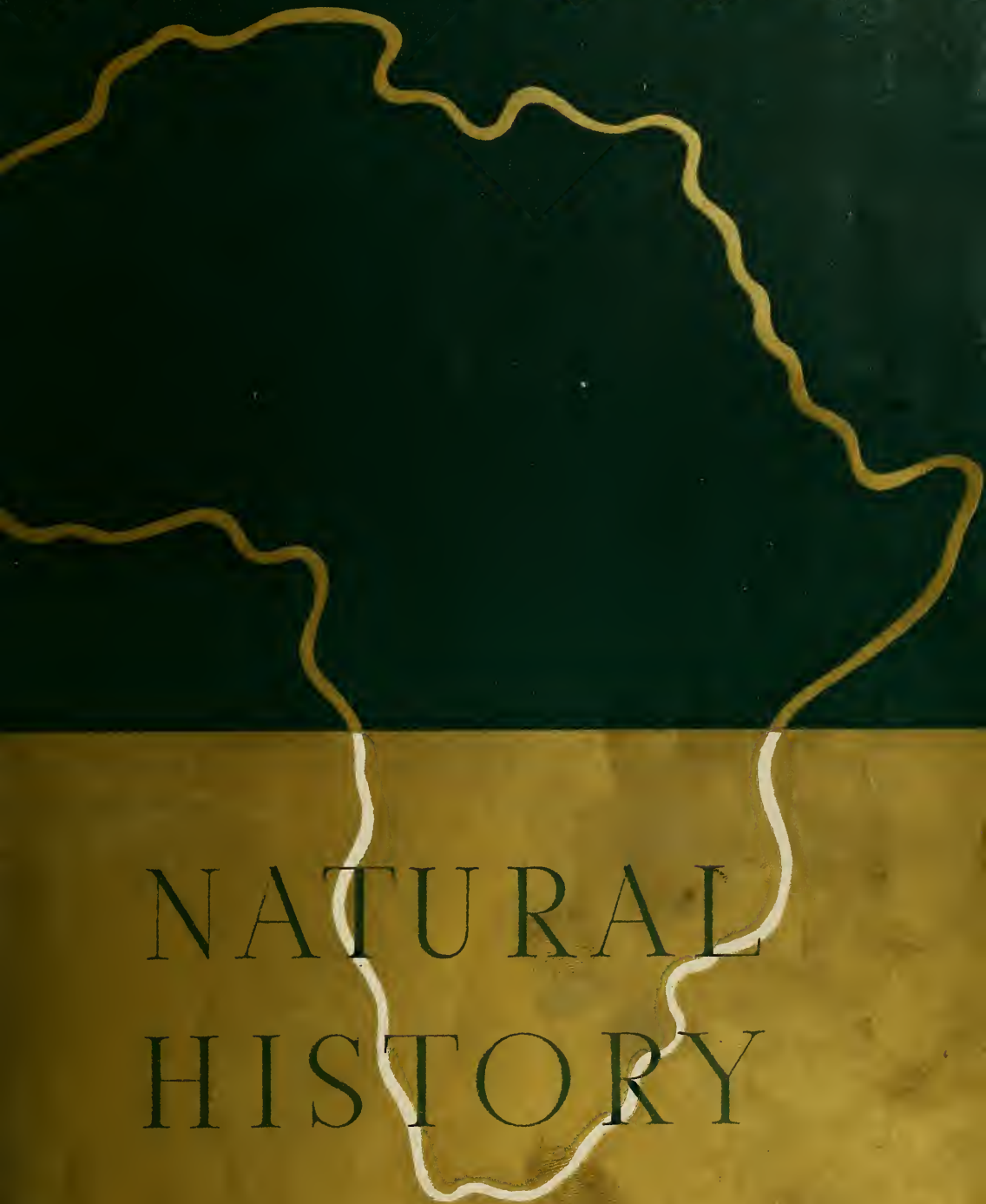
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JOURNAL OF THE AMERICAN MUSEUM OF NATURAL HISTORY

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JANUARY 1936



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No. 2 represents the Bengal Tiger [*Felis tigris*] in the Kheri forest in India. The tigress leads her cubs to the stream to drink and through the reeds and trees appears the lordly male. This represents one of the groups collected for the American Museum by the Vernay-Faunthorpe Expedition.

No. 3 is the Gorilla [*Gorilla savages*]. Here we see the Lake Kivu region of the Belgian Congo with the slope of Mt. Mikena showing in the purple sunset. This great animal was carefully studied by Carl E. Ackley on his many trips to Africa and from this theatre one will glean many interesting facts about a creature that has long been too little known.

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NATURAL HISTORY

The Journal of the American Museum of Natural History

VOLUME XXXVII



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PUBLICATION OFFICE: 246 Meadow Street,
New Haven, Conn.

EDITORIAL: Edward M. Weyer, Jr., Editor;
A. Katherine Berger, Associate Editor; Dorothy
L. Edwards.

Manuscripts should be sent to the Editor, The
American Museum of Natural History, New
York, N. Y.

SUBSCRIPTIONS: NATURAL HISTORY is sent to all
members of the American Museum as one of the
privileges of membership. Membership Super-
viser, Charles J. O'Connor.

ADVERTISING: Tom Davin, Manager of Publica-
tions, The American Museum of Natural History.

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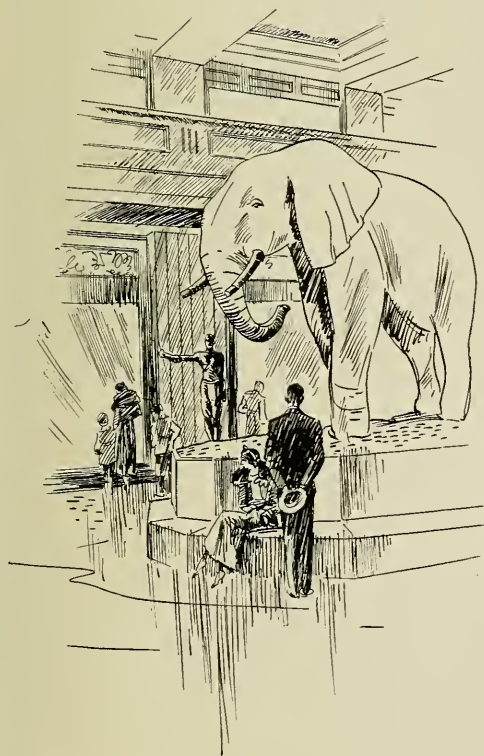
Glimpses Into



The new Akeley Hall of African Mammals opens to public view early in 1936, after years of planning and preparation, although some of the exhibits are still to be provided

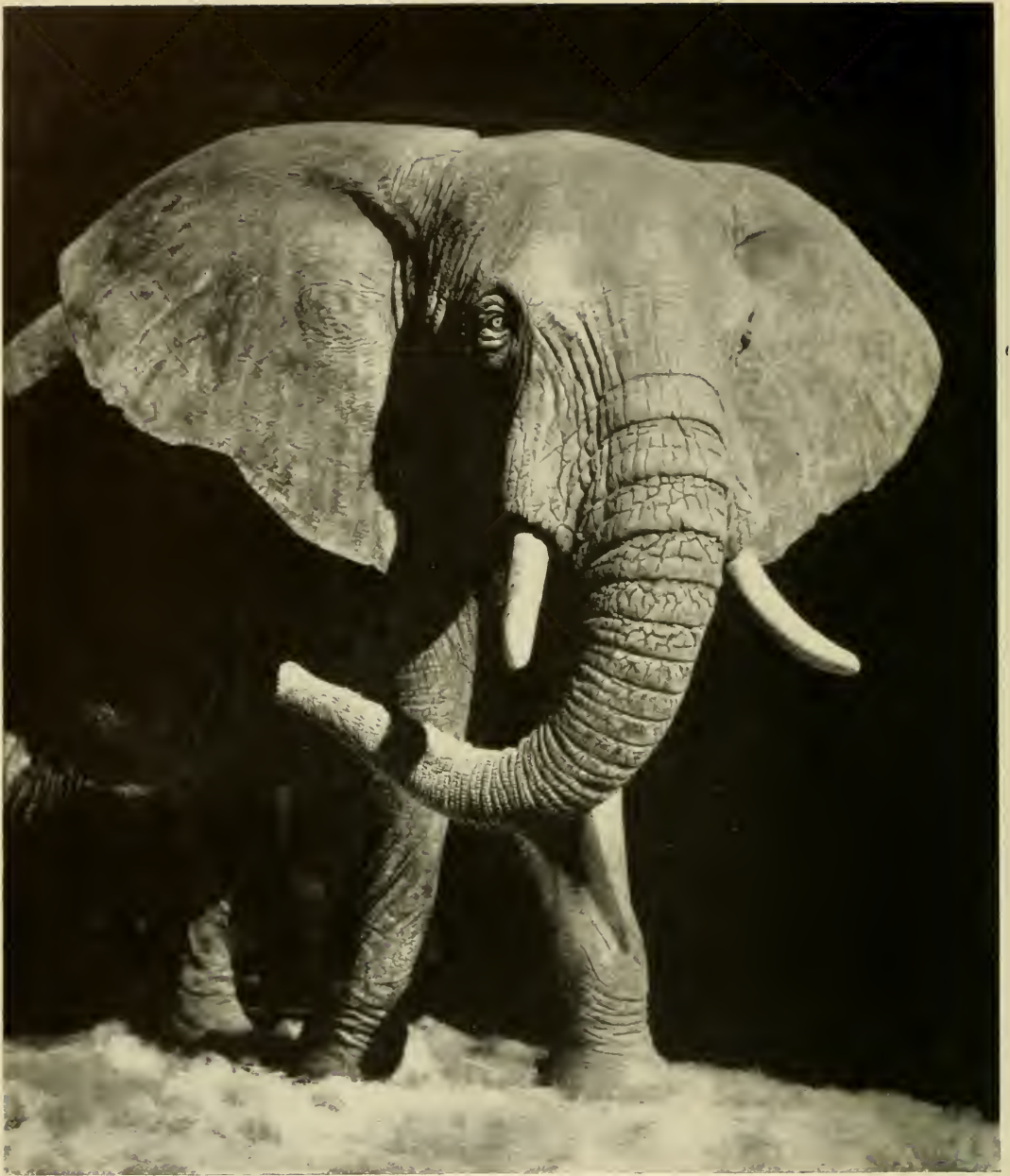


Akeley African Hall



Here are parts of the real Africa recreated in the American Museum as Carl Akeley dreamed. This has been made possible through the generosity of friends, and accomplished by the skill, artistry, and infinite labor of a large staff of workers in the Department of Arts, Preparation, and Installation.

Above is a silhouette of the "Elephant Herd" that dominates the hall, an exhibit unique in museum annals. The three drawings are by Frank Swain



Photograph by Wurts Bros.

THE REAR GUARD

In every herd of elephants at least one animal takes the responsibility of wheeling about at frequent intervals to see that all is well behind. The young male shown above is mounted in this position in the elephant herd which forms the central exhibit in the Akeley Memorial African Hall at the American Museum. It

was collected by John T. McCutcheon in 1910, when he was in the field with Carl Akeley. It was during this expedition that the idea of a great African Hall first germinated in Akeley's mind.

"The Rear Guard" was prepared and mounted by Akeley

Akeley's Dream Comes True

The Akeley Memorial African Hall—a monument to the world's greatest wonderland of wild life

By DANIEL E. POMEROY

AKELEY loved Africa. He knew the primitive Africa, and he saw it being destroyed. It thus became the single purpose of his life to preserve and portray Africa for posterity. He dedicated his life to the task of bringing Africa to America.

Those of us who knew Akeley in the latter years of his life remember chiefly his mounting zeal in the approaching realization of his great dream. He was a man of tremendous nervous energy and with a single tremendous purpose. You had only to see the set of his lean jaw and the fire of inspiration in his eyes to know this.

Though slight in stature, he was wiry and strong, the slight stoop of his shoulders merely increasing the impression of latent vigor. Whether he was in his studio working out some new trick in the displaying of animals or following a jungle trail in quest of specimens, you felt the constant power of his great vision. Yet there was nothing grim about his personality. He had a ready sense of humor and was mellow with kindness and fine sentiment.

His enthusiasm often resembled that of a youngster on vacation, and because of this youthful zest it was easy to visualize his early struggles.

Early ambitions

In the strictest sense of the term, Akeley was a self-made man. As he used to put it, by all the rules of the game he should have been a farmer. But he was always more interested in birds and chipmunks than in crops and

cattle. And he was only sixteen years of age when he announced his life work by having business cards printed stating that he did "artistic taxidermy in all its branches." The portent of this pronouncement lies in the fact that at that time the mounting of animals was in no sense an artistic craft. Akeley saw the possibility of raising taxidermy to an art.

"Stuffing" versus art

Taxidermy before Akeley was scarcely more than a variety of upholstery. The expression "the stuffing of animals" was literally applicable, for the procedure was simply to turn the animal upside down and stuff it with straw, rags, paper, or other rubbish, and to distort the features into as ferocious an expression as possible. Lacking an adequate framework upon which the configuration of the body could be moulded, the specimen frequently bulged or shrank out of all harmony with its original anatomy. Then it would be stood up by itself in a case, without any background. The result was something far removed from nature.

All this offended Akeley's sensitive artistic conscience, even at an early age. Then followed his long years of pioneer work. Gradually he evolved the technique, described elsewhere in this issue of *NATURAL HISTORY*, which has been adopted by museums throughout the world.

In the end, Akeley won renown as a sculptor, an inventor, a naturalist, and an explorer. But these achievements were incidental to his enduring passion for artistic taxidermy and his ultimate purpose through it to create an African Hall.

The first definite seeds of Akeley's dream were planted when he went to Africa for the first time, in 1896.

Akeley's vision

A unique mental and artistic outlook gave a distinctive quality to his impressions. He had long since passed his apprenticeship in the workshops of Ward's Natural Science Establishment, and had devoted eight years in Milwaukee to the development of his own methods. Therefore, when he went to Somaliland with Prof. Daniel G. Elliot, a new world was opened up to him. This taste of the world's greatest wonderland of wild life created visions of unimagined possibilities for his artistry. He saw Africa's magnificent animal forms not as many others have as potential trophies, but as things of beauty to be preserved. Africa would be his vast studio. This awakening came to him almost forty years ago.

"I was so bewitched by the beauty and splendor of Africa," he wrote, "that it seemed to me inconceivable that I would not immediately return."

But nine years were to pass before he was able to go back. It was chiefly in this interval that he perfected the details of his display methods, which were to make possible his dream.

The result of his 1905 expedition was the elephant group, "The Fighting Bulls," in the entrance hall of the Field Museum.

He then wished to elaborate upon his studies on the elephant, which he had found to be the most fascinating of all wild animals, and to create a larger exhibit, requiring a spacious and impressive setting. The proposal he made to the American Museum of Natural History to collect a group was accepted, and in 1909 he again took up the trail, this time on the slopes of Mount Kenya and in Uganda.

A statuesque group of four elephants was planned as the central figure for African Hall. And immediately upon his return he set about mounting them. Subsequent expansion of the plans, however, increased the group to eight animals.

It was on this 1909 expedition that an old bull elephant, tired of being hunted by him, rudely interrupted his activities, as he put it, by using him as a prayer rug. The encounter nearly cost Akeley his life.

Anyone who knows how vigilant Carl Akeley was on the trail will take this incident

as a warning that an emergency can arise in Africa against which the most skillful hunter is well-nigh helpless. When Carl suddenly became aware that the elephant was almost on top of him, he snatched up his gun and of course tried to shove the safety catch forward. It would not budge. He knew he must shoot instantly, and it is a measure of his desperation that he determined to pull the trigger hard enough to fire the gun no matter whether the safety had jammed or not—an altogether impossible feat. Then something happened which dazed him.

Without knowing whether he had shot or not, he suddenly felt a tusk right at his chest.

What he did next was the result of having mentally rehearsed such an emergency many times on the trail. He grabbed the tusk with his left hand, took hold of the other with his right and, swinging in between them, went to the ground on his back.

The elephant drove his tusks into the earth, his curled-up trunk against Akeley's chest. Akeley felt himself being crushed, then lost consciousness. The thing that stunned him was a blow from the elephant's trunk, which broke his nose and tore his cheek open to the teeth. But some obstruction in the soil which the tusks encountered saved Akeley from being crushed to death. The beast left him to charge the terrified native boys, who were his only companions at the time, and then escaped.

A return to life

Akeley lay unconscious for four or five hours. Believing him dead, the natives, in their superstition would not touch him. When consciousness returned to him, although he felt no pain, he could move neither his arms nor his legs, and concluded that his back was broken.

His back was not broken, but his chest had been badly damaged and several of his ribs had penetrated his lungs. He was in bed for three months.

Akeley always said, with his characteristic philosophy, that his invalidism was not a complete loss, for it gave him time to think out his great dream. However, it is likely that those injuries turned the tide against him in 1926 when fatal illness terminated his life, just at the eve of the realization of his dream.

The plan for an African Hall was well

crystallized in his mind when he returned to America in 1911.

On this expedition Akeley had discovered a serious handicap to his work. For the life-like re-creation of wild animals in museum displays, as well as for the study of their habits and actions under various circumstances, motion pictures were an essential adjunct. But no camera had been devised which was fast enough to enable a rough and ready naturalist to record rapidly moving events which were happening unexpectedly in different quarters. Akeley wanted a motion picture camera that you could aim about like a pistol. And so necessary was it to his work that he resolved not to return to Africa until he had produced one.

Engineers and mechanics at first declared Akeley's schemes for his camera to be wild dreams, impractical, impossible ideas of an untrained mind. But after long experimentation he completed a model, which bore no likeness to the conventional apparatus. To those familiar with the old types of camera, the Akeley resembled a machine-gun quite as much as it did a camera. Indeed, it is alleged that when a young lieutenant in the World War was setting up the machine, he was suddenly confronted by seven Germans, who mistook his formidable film apparatus for a new type of Yankee machine gun and threw up their hands in surrender.

Akeley's camera has been used on practically every exploration of consequence and also plays an important part in the production of news reels and in Hollywood. But Akeley had no thought of the commercial value of his invention. He devised it specifically for his task of bringing Africa to America.

The Akeley cement gun

Another invention which he hit upon in his studio work and which found practical applications in industry, was his cement gun. This is a device which enables one to spray liquid cement upon a vertical or inclined surface. Akeley first devised it for the purpose of modeling the manikins which serve as the foundation upon which the skins are mounted. Today the cement gun has a large and important commercial utility in various types of construction. During the war it was valuable in the building of concrete ships.

The World War interrupted Akeley's African program by diverting his abilities to technical problems in the service of the Government, and it was not until 1921 that he was able to return to Africa.

Collecting gorilla

The specific purpose in this expedition into the gorilla country was to collect scientific information about the most important yet least known of the manlike apes and to secure material for a group of these creatures for the Hall. The trip was made with Mr. and Mrs. H. E. Bradley. The locality in which the program of work was carried out was the mountain paradise of Kivu, which Akeley always said was the most beautiful spot in all the world. His favorite scene is reproduced in African Hall as the setting for the superb Gorilla Group. No one can challenge Akeley's opinion of its surpassing beauty or fail to appreciate the rapture he felt as a nature lover exploring in the mountains of Kivu.

Knowing his love of this section, there is additional meaning to us in the fact that it was precisely here that he passed away a few years later at the very peak of his career.

The last five years of Akeley's life were marked by rapid progress toward the creation of African Hall. Yet there were repeated discouragements, which continually threatened to frustrate him.

The creation of the Hall depended upon the achievement of three things. Of these the first, the development of the art of displaying animals in their true settings, had by now been accomplished. The second essential step was to train a body of specialists who could carry out the various processes: collectors, photographers, artists, taxidermists, anatomists, etc. Akeley spent years in developing the talents of men who were to assist him. Louis Jonas, who worked with him during these years has repeatedly spoken to me of Akeley's peculiar faculty for selecting just the man who was fitted for a particular job by ability and temperament.

"Mr. Akeley has a constant supply of surprising ideas," I remember his telling me in his enthusiasm. "His ingenious way of facing each problem as it comes along and working it out, is amazing. One minute you will think he has encountered the impossible obstacle; then

a light comes into his eye and you know that he has changed failure into success."

His personality captivated Jonas, just as it did everybody else, from the moment he met him. The old khaki trousers he wore and the corn-cob pipe he smoked in his studio might have detracted from the bearing of anyone less of a true artist, but we all remember them as part of his beloved personality.

As Jonas has frequently impressed upon me, the encouragement and inspiration that Akeley gave to the rising naturalists of his day was one of his most valuable gifts, and will bring profound consequences for many years to come.

The third essential part in Akeley's plan was the task of convincing the patrons of natural history that his conception was worthy of their support. He had to show them that African Hall, a monument to the passing wild life of Africa, was as truly worthy of their support as any project in marble or on canvas.

A benefactor

This brings us to 1925, for it was then that the great opportunity came to Carl through his acquaintance with George Eastman, of the Kodak Company.

I first knew Eastman through business connections, but it was our mutual interest in the outdoors that drew us together. Eastman enjoyed camping and had made a number of trips into northwestern Canada, Alaska, and elsewhere. He had been interested in my trip to the Sudan in 1914, but the first evidence that his mind was seriously turning toward Africa came one day in the autumn of 1925 when he called me by telephone from Rochester and said: "When are you going to Africa?"

I thought he was joshing. "Any time you say," I answered.

"The best I can do," he said, "is a year from this December."

That was a long time ahead, but I went to Rochester to see Eastman right away. I saw that there was a great opportunity to make an expedition that would count for something in science. I was then a member of the American Museum of Natural History and knew of Carl Akeley's scheme. When I explained it to Eastman, I found him keen as a briar, and he authorized me to get in touch with Akeley.

Akeley always came straight to the point. "If Mr. Eastman is interested in African Hall, I am interested," he said. "If not, I'm not."

I asked Carl what he proposed Mr. Eastman should do.

"You know what my plan involves," he said. "I'd like to see Mr. Eastman give a million dollars."

That was beyond the bounds of possibility and I endeavored to tone Carl down.

"All right," he said. "But let's go right up to see him."

We took the night train.

Carl had been impeded so long by lack of funds that he scarcely dared believe anything would come of this. All that evening in the smoking car he was as excited as a man waiting to hear the verdict of a jury, for African Hall had grown as important to him as life itself. He would remain nervously silent for a long time, puffing on his old corn-cob, and then blurt out: "By heaven, Dan! If Mr. Eastman only can see how important—how necessary this is" Then he would break off. He wouldn't let himself build a great air castle.

But even though I warned him against killing the goose that laid the golden egg, he could not refrain from aiming at a high figure.

George Eastman was then seventy-one years old. He was a heavy man with an unusually pleasant face and a fine, clear complexion. He was modest to the point of shyness.

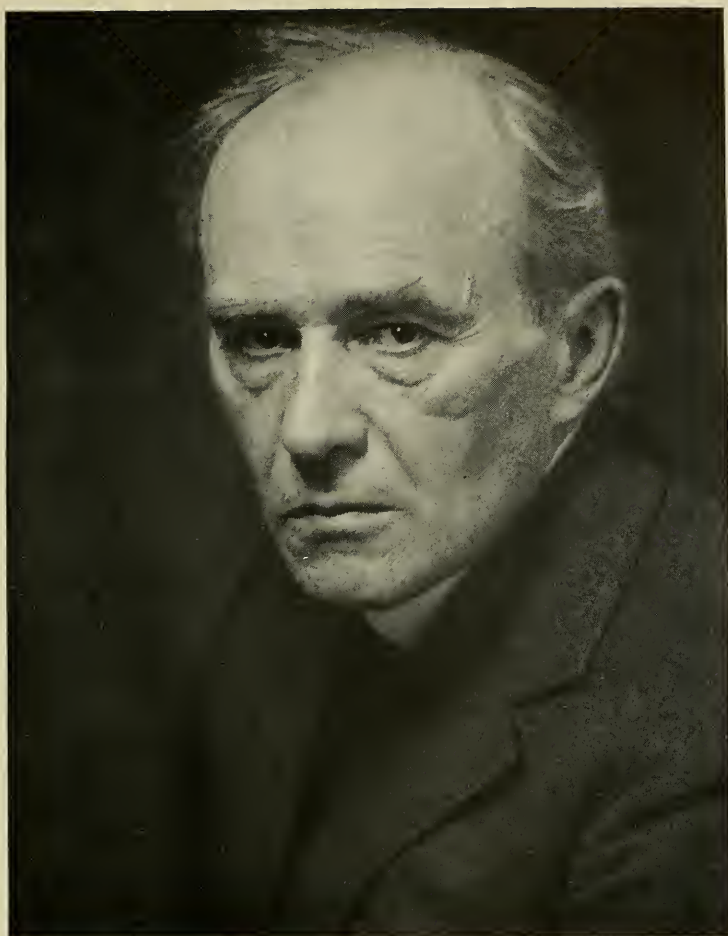
When we talked with him the next day, Akeley painted a word picture of the proposed African Hall, explained that there was no money, and told Eastman that the opportunity was his to create the greatest exhibit in the world. He then asked him point blank for a million dollars.

Eastman said that he could not do that, but that he would give \$100,000 to start the thing.

Carl and I had worked out a budget in which the cost of preparing each regular group would be \$25,000 exclusive of the expense of securing the specimens and accessories, and the cost of the larger corner groups would be \$50,000.

Eastman agreed to stand his share of the expense of an expedition, and his \$100,000 would represent three groups—the water hole group, the buffalo group, and the klipspringer.

I told Eastman how generous and thoughtful he was, and agreed to collect and contribute another group myself, the greater koodoo. I said also that my friend Daniel B. Wentz, of Philadelphia, might make a similar con-



A photograph of Carl E. Akeley taken in 1920 by J. H. McKinley

tribution, which he shortly afterward did. We palavered far into the night over itineraries and preparations.

Carl was jubilant. It was the first real break he had had. When we were alone he said:

"Dan, this is the most wonderful thing that has ever happened. At last I begin to see the realization of my life dream. At last!"

We were all, of course, tremendously excited. The expedition which grew out of that meeting was the Eastman-Pomeroy-Akeley Expedition of 1926-1927.

With an encouraging portion of the African exhibits provided for, Carl threw himself with renewed vigor into the task of completing the plan of the Hall. Having pondered over the lay-out for so many years, he visualized every detail. When we departed for Africa he had the whole scheme worked out.

A sad event occurred a month before we sailed. Daniel Wentz, who had agreed to pro-

vide the lesser koodoo group, passed away. We carried out his intentions, and the group stands as a memorial to him.

One of the final worries that beset Carl was the rapid extermination of certain of the animals he sought. As Henry Fairfield Osborn had expressed it:

"We palæontologists alone realize that in Africa the remnants of all the royal families of the Age of Mammals are making their last stand, that their backs are up against the pitiless wall of what we call civilization."

The quagga had vanished and numerous other forms were on the verge of extinction. Carl realized that in twenty-five years the development of African Hall would be impossible, for the proper specimens would not be available.

On this expedition in 1926 the recent depletion of the wild life was continually borne in upon us. During a two-day trip down the Tana

River, Carl was dismayed to see how different it was from in 1912, when the region was swarming with game. It was now a complete waste.

Having failed to secure any specimens here, Carl wrote to Doctor Sherwood:

"I have not appreciated the absolute necessity of carrying on at the African Hall, if it is ever to be done, as I now do after this painful revelation. *The old conditions, the story of which we want to tell, are now gone, and in another decade the men who knew them will all be gone.*"

Today this crucial situation continues to threaten the success of the remaining groups, and impels us to hasten the gigantic project to as speedy a conclusion as possible. Altogether the Eastman-Pomeroy-Akeley Expedition secured material for ten groups instead of only six as had been planned. And other sponsors have led expeditions and generously provided funds for the preparational work. But we are still confronted with the urgent necessity of securing the support of others who are interested in the world's greatest wonderland of wild life and in this monument to it.

It was this fear of failing irredeemably to secure specimens of the vanishing Africa that drove Carl to such tremendous exertions in 1926.

In the midst of our intensive work in Western Tanganyika he suffered an attack of fever. This prevented him from accompanying me on the quest for the greater koodoo, and he was sorely disappointed. But it was essential that he be taken to the Kenya Nursing Home in Nairobi. In parting, I implored him to guard well his health in convalescence: "Your one aim must be to recover completely. Never mind the time it takes."

I later wired him to have patience, as my own return to America would be indefinitely postponed until we could complete our program of work.

But Akeley was a difficult patient. The King of the Belgians had been eager to send the local Belgian representative, Doctor Dersheid, with Akeley on a survey to establish a game sanctuary in the upper Congo, and Akeley was impatient to get started. On October 14, before he had recovered his strength, the party, including Mrs. Akeley, two members of the Museum staff, and Doctor Dersheid set out. The trip was strenuous.

On November 1 there were many hills to

climb, and the heat and humidity were almost unbearable. Akeley became faint and ill and too weak to walk. He was carried on an improvised hammock about four miles, when a thunderstorm broke and it was necessary to make a temporary camp. The next day Akeley felt better and was able to walk into Rutshuru. Akeley was approaching the country which he loved more than any other in the world, and he seemed to be torn between the desire to rest and the great urge to reach the goal.

After about a week the safari proceeded through cold, wet weather to the Rueru camp. Akeley felt very weak, and passed the thirtieth in bed, reading and sleeping.

We have no way of knowing whether he had any awareness of the end. The end came suddenly on November 17, after two and one-half days of exhaustion following the arrival at Camp Mikenno.

Akeley often had said he wished "to die in the harness," and "to be buried in Africa." He died in the country he loved, and was buried in a tomb of solid volcanic rock on the slopes of Mount Mikenno. In Akeley African Hall you can see this mountain in all its beauty in the background of the Gorilla Group.

It is the sharpest sort of tragedy that Akeley should have been taken just at the peak of his great dream. But there is mitigation in the fact that he knew that the great project to which he had devoted his life was to be carried out.

The group of specialists whom Akeley had trained and who had served him in the field—Harry Rockwell, Raddatz, Leigh, Jansson, and others—would carry on the banner, under the guidance of Dr. James Clark, whose long association with Akeley makes him such an expert director of the project.

The work of the expedition on which Akeley died was ample proof of the practicability and extreme importance of his great plan. Action by the Board of Trustees of the Museum came as a direct result of it, and the construction of the African Building was authorized. Soon afterwards it was decided that the building should be a memorial to Akeley.

Akeley bequeathed to posterity a noble gift, the beauty of original Africa, preserved for generations to come. Akeley African Hall is a monument to the royal families of the animal kingdom, and is the symbol of his genius as the father of modern museum display methods.

The Mountain Gorilla Group

IN the following four pages are shown views of the Gorilla Group in the Akeley Hall of African Mammals, which has particular significance because it displays a species in which the late Carl Akeley was most interested. He was engaged upon an expedition to the very locality shown in the group when his work for the Hall of African Mammals was so abruptly terminated by his death. The group pictures a vista of the Kivu volcanoes from the side of one of them.

Shown in this group is *Gorilla gorilla*, the mountain gorilla, subspecies *beringei*, a race confined to the eastern part of the Belgian Congo in Central Africa. Here it occurs from the upper end of Lake Tanganyika northward to Lake Edward, along forested slopes, and eastward to include the Kivu volcanoes. The mountain gorilla is distinguished from its lowland relative, the West Coast gorilla, principally by cranial characters, thicker and darker pelage, and a slight difference in the proportion of shorter arms and longer legs. It is also stated that the two types of gorillas have different habits, that the mountain animal climbs trees less frequently and is more terrestrial.

In the popular mind the life history of the gorilla is commonly associated with the accounts of the early African explorers, Du Chaillu, for example. The gorilla is portrayed as a savage animal ready to charge the hunter

on slight provocation. He beats his breast with resounding blows, rushes upon the man who would molest the gorilla family, tears the gun from his hands and bends it into bowknots, and then tears the hunter limb from limb. The observations of Carl Akeley did much to dispel illusions of this sort, and after him a number of other naturalists studied, photographed, and lived with the gorilla to the end that a much better understanding is now possible.

The full-grown gorilla is a powerful animal fully capable of many of the feats of strength ascribed to him, and he is dangerous if crowded too far. Under normal conditions the gorilla is not aggressive and tolerates considerable interference before displaying the danger signs of an active resentment. Usually these animals are shy and flee as soon as they are aware of the presence of man. When pursued, the old male may drop behind and stage a demonstration of rage which is pure bluff. Because of the potential danger of coming to close quarters with an angry male gorilla, the bluff is apt to be quite effective. Under these conditions, the gorilla often uses the thick cover and seems reluctant to face man in the open.

Gorillas are social in habit and the customary group is a family or clan composed of one old male, who dominates the band, and several females, subadult males and youngsters. They are vegetarian in diet and roam through the







GIFT OF MESSRS. JULIUS F. STONE,
GEORGE A. STONE, AND FRANZ T.
STONE; MISSES EDNA A. STONE, THEO-
DORA M. STONE, AND NATALIA S. STONE.

ANIMALS by *Carl E. Akeley.*

BACKGROUND by *Wm. R. Leigh.*

FLORA AND FOREGROUND by *Albert E. Butler, assisted by U. Narahara, George E. Petersen, George F. Mason, Joseph M. Guerry; Mrs. Mary L. Jobe Akeley, collaborator.*

DIRECTION, *James L. Clark.*

SCIENTIFIC DIRECTION, *H. E. Anthony.*



heavy forest growth where they find abundant plant life to their liking. One of their favorite food plants is the so-called "wild celery" shown in the foreground of the group. They are not active at night but sleep where night finds them, making nests or shelters on the ground or climbing up into the lower limbs of trees.

It is not likely that gorillas fear any enemy other than man and the leopard. The leopard would hesitate to attack a full-grown gorilla, but would have no difficulty in overpowering a young animal separated from its companions. Fortunately, the gorilla, both mountain and lowland races, is protected by law throughout its entire range, and in the Parc National Albert the mountain gorilla enjoys complete sanctuary.—H. E. ANTHONY





THE LEADER OF THE LION GROUP

This handsome specimen of an adult male lion was the result of great perseverance on the part of the Carlisle-Clark Expedition. Although two males had already been obtained, the party remained in the field an extra week

after all other work was completed until an exceptionally fine animal, such as this one, could be collected.

Large, male lions with good manes are rarely seen in East Africa.

The Lion Group and Its Creation

The beauty of African wild animal life captured and preserved in an American Museum exhibit

By G. LISTER CARLISLE, JR.

MUSEUM expeditions are apt to come into being as the result of the fortuitous meeting of men who have made some branch of natural history their life work and amateurs in natural history. Their interests and activities have made careful observation in the wilds second nature to both and, also, one of the pleasures of living. The Carlisle-Clark African Expedition started in this way from a meeting with Carl Akeley in the American Museum shortly before he left for Africa and his beloved gorilla sanctuary, where he died.

At this meeting it was evident that we held similar views on the high value of museum natural history exhibits in the cause of conservation, or appreciation of wild life and interest in its preservation. Later came happy meetings with Professor Osborn and a fuller knowledge of the needs of the American Museum and of the ambitious plans for the Akeley African Hall which is intended to bring something of great Africa, and its interest, to New York.

A plan materializes

The plans at once appealed to Mrs. Carlisle and to me. We had been in the English Sudan during the previous year and were anxious to return to Africa to experience again the thrill of living in unspoiled country. Thus the expedition which has resulted in the Lion Group was launched. This love of the world as it was in the beginning is deeply ingrained in many of us, and those who have experienced years of life in some one of the few untouched areas count the memory as very precious. There comes as a natural sequence the wish to aid in

one of the most important causes of our times, that of the preservation of nature's interest for future generations.

A "conservation" expedition

When the expedition first took form in our minds, much thought was given to the question of whether killing and conserving could be made logically to mix and it was decided that our expedition should be run on a non-killing basis in so far as it was possible and, at the same time, meet the Museum's requirements for group material.

This plan was carried out, and none of us did any unnecessary killing. In fact, Mrs. Carlisle and I did no killing at all.

The outfitting of an expedition is a special field wherein only experience is of value, and we were fortunate in that much of this sort of experience centers in the American Museum. The many expeditions sent out in the past have reduced the problem of outfitting to an exact procedure based on accumulated knowledge—and this knowledge is not one of the least assets of the Museum. My associate in the expedition, Mr. James L. Clark, assistant director of the Museum, carried most of this load and later in Africa gave a lesson in efficient field work which those who accompany him on other expeditions will likewise experience.

Our strong desire was that the Lion Group should embody all excellence that art and craft could give, and, now that the group is completed, we feel our objective has been attained.

By various ways we all reached Nairobi and there met our white hunter or guide, Al Klein, who had been in Africa for twenty years. Klein has been, literally, "in at the death" of no less

than a thousand lions, but this is not to infer that Klein, personally, shot that number. As a matter of fact he is opposed to unnecessary killing. Al is not very large physically, and, when we first met, I wondered how all of those lions could have missed him. Later I understood. No lion has yet been quick enough to get to him first, and his deep, commanding voice is a defense in itself. Al is a very delightful companion indeed, witty, and a collector. As a boy, brought up at Haverstraw on the Hudson, he collected birds' eggs. Later his search for bigger and better eggs led him to the dry wastes of southern Africa where a boom in ostrich farming provided a profitable market for the wild ostrich eggs. From there he worked his way to East Africa where with the passing of the years, he has founded a particularly happy home, has become one of the noted East African guides, and he is certainly a raconteur of parts.

Two weeks of hard work awaited us at Nairobi before the equipment was thoroughly gone over and packed in five light motor trucks under a system that permitted of access to at least a part of our equipment without disarranging all of the rest. These were fascinating weeks as the East African plateau has a good climate, and a future, and in consequence has drawn to it many ambitious English who are rapidly building a white man's country astride of the Equator. The natives, instead of being pushed back as the land is occupied, are given large native reserves wherein they live peacefully and without fear of attack from the predatory Masai. The treatment of the natives in East Africa and in the Sudan is wise, just, and definite, and well may England be proud of her Oxford and Cambridge administrators.

The "D.C.'s"

Meeting and knowing the English District Commissioners, or D.C.'s, as they are called in the Sudan and East Africa, is a major pleasure. Their lives are full of vivid experiences, many of which turn on personal courage and confidence in their own ability to settle tribal disputes fairly and quickly without resort to force. As a necessity they must know the native language, and the native customs which serve as native laws, and their aim is to render verdicts in their local courts in accordance with tribal ways. Strong attachment and loyalty generally characterize these natives in their

relations with their British leaders. England rules her East African Colonies with marked consideration for the happiness and material welfare of her native subjects. Many white colonists in Kenya even think that too much consideration is given them but, be that as it may, the result is that England is enabled to rule her East African Colonies with a mere handful of white troops. What the future may hold, however, is obscure, as the outcome of the present Abyssinian situation may profoundly influence English interests in East Africa and the Sudan, and there are even wider possibilities.

Game commissioners

The game commissioners of East Africa are splendid men, often retired army officers, and their control of hunting is very much more effective than any hunting control known to us in America. In East Africa the game laws are obeyed, or retribution is swift and adequate. On his return from safari many a hunter has been surprised at the "news value" given by the game commissioner to certain supposedly unknown incidents that occurred out in the Blue. There must be an "underground telegraph" or a "grapevine system" supplying red-hot information from the field, as the game commissioners know all that happens on an expedition, apparently, as soon as it happens.

The East African plateau is interesting country, with its several high dominating mountains, its hills and grassy plains, its Rift Valley and high escarpments. We crossed the Rift Valley soon after leaving Nairobi, and it is, perhaps, the most outstanding geological feature in Africa. Imagine, if you will, the Highland area of the Hudson without a river flowing in the trough and, after adding length, ten miles to the width, and two thousand feet to the height, the comparison will reasonably apply to the valley at the point where we crossed it. But the genesis of the two valleys is so different. The Hudson Valley was eroded by water, bit by bit, while the Rift Valley was formed by the subsidence of the block between two roughly parallel faults, and the amazing fact is that the Great Rift Valley systems extend from Northern Palestine to southern Africa and embrace several of the larger lakes such as the very deep Lake Tanganyika. Lake Baikal in Siberia is another long, deep lake, formed in this unusual manner. It was really thrilling even trying to understand the geology of the area as we

descended the steep eastern escarpment where, incidentally, grow the world's largest cedar trees. Game or no game, and there is generally some in sight, travel in East Africa is full of incident and food for thought.

We were traveling southerly from Nairobi in Kenya toward the plains area in Northern Tanganyika where there is the last great concentration of animal life likely to be found anywhere in the world. This was Carl Akeley's opinion, and the more I think of it, the happier I am that we did so little to disturb that wild animal zoo which, fortunately, has now been made into a closely guarded game refuge.

Reaching the lion country

Our guide, Al Klein, was heading for a little grassy swale on the side of a certain wooded hill overlooking the plains—now pictured as the background in the Lion Group—and he was quite keen about getting there privately. Al is noted for his good judgment in the selection of hunting country, but he does not believe in advertising. Our desire was to reach the site of the proposed base camp in such a manner as to prevent others from following our trail. This important maneuver added three days to our journey, but it was worth it!

We were then in real lion country—and alone—and thereafter we saw from two to twenty lions daily, some duplicates no doubt, as there was plenty of game in the area and no need for the lion to travel far in search of food.

As soon as our base camp was established in the center of the best lion country on earth, we began our inspection of the local lions and hunted tirelessly for individuals suitable for the proposed group. Our group was to be real in every way, an artistic and truthful reproduction of an East African scene, and the amount of work involved in the consummation of such a project is little realized by the casual visitor to the museum. Groups may be made from a hunter's imperfectly cured skins and his recollections of the surrounding country; but the Akeley Hall is different. Using the Lion Group as an illustration, we have there an exact and artistic reproduction of East African lions and of the hills and grassland where they live and hunt. At times single lions are encountered but generally more. In fact, on one occasion I saw sixteen together, but in this part of East Africa they usually live in small family groups similar

to the one represented in the Akeley Hall. The modeling is based on intensive study of the animal, on a scale model of the group made in the field (an unusual refinement), on detail measurements, and on plaster casts of the lions taken after the skins had been removed. Even the skeletons were preserved in order that they might be used in the modeling process in the American Museum.

Getting skins out of Africa in perfect condition for mounting requires knowledge and equipment and ours were delivered at the Museum in hermetically sealed poison-gas tanks in as perfect condition, I dare say, as any ever brought in. I am especially proud of this phase of the field work.

Successful lion groups are very difficult of accomplishment owing to the facility which the animal has of expressing his feelings and, after seeing my first hundred lions, I realized that the success of the group would depend on the ability of the sculptor. We have all seen poorly mounted lions in museums, but ours were to be different, and they are different—thanks to the ability of Mr. Clark.

The foreground of the group is as real as the animals, and most of the accessories in the group were actually brought from Africa. The fine background painted by Mr. W. R. Leigh is so true to the actual African scene which it reproduces that it refreshes my memory picture even to the small details. He made some twenty delightful oil paintings in Africa and from them the finished background was evolved. Few museum expeditions take artists into the field, and this is to be regretted, as their field "sketches" are necessary in the painting of a true reproduction of a wilderness scene.

Rich fields for the artist

Some expeditions to Africa have as their object hunting, others collecting, others photography, but few go to Africa merely to paint the vanishing wild-life in its native setting. This is rather strange when one considers how few good paintings exist of the old game herds once so numerous on our western plains. Today even the work of poor painters who lived in our early West is treasured in museums, while little effort is being made to preserve the present Africa game scene on canvas. Such pictures will be invaluable when time has destroyed the motion picture film. I can im-

agine nothing happier than a return to Africa with Mr. Leigh in order that he might make a series of game paintings; he is a talented animal painter as well as landscape artist. I am only sorry Mr. Leigh was unable to paint in that baboon fight we saw in the original setting. It was a family fight and noisy as usual, and there must have been forty in it.

Extra effort rewarded

The selection of the particular lions desired for the group was Mr. Clark's special province and he, therefore, did the collecting. The largest lion in the group is the young male behind the tree, and he was taken on the plea of some Masai tribesmen who reported that this particular lion had killed one of their steers during the previous night. The big-maned male was a find at the very end of our safari, when an extra week was allotted to an intensive search for a better specimen than we had so far collected.

Lions differ somewhat in characteristics as their habitats vary. From the Cornwallis Harris illustrations made before 1840 it would appear that the Cape lion, now extinct, grew a more luxuriant mane than the East African, and the Abyssinian lion, I believe, although smaller in body, also has a fine mane. The East African lion has a fair mane, and the group contains the best specimen encountered during three months in the field—with the possible exception of one that was too quick for us.

One cannot live in East Africa without acquiring a deep interest in the lion and his long rule over the country, and yet he lives dangerously. At times he is injured in killing; two of the lions we killed carried evidence of such injury and were not used in the group.

We came on one of these lions unexpectedly as he was lying by a water hole in a beautiful grove surrounded by a great troupe of barking zebras—all maligning him terribly. The zebras were making a wild woodland protest to the well understood determination of the lion to kill a zebra before he would permit the rest of the herd to touch a drop of the precious water. After enjoying the strange and noisy scene for a while, we decided that the lion was better than any we had, so he was shot, but it was afterward discovered that he was unable to make a kill owing to injuries and, in fact,

he was partly paralyzed in the rear. Presumably he had been injured in killing one of the larger animals able to put up some defense against his usually deadly method of attack.

If the quarry is small it may be struck down by a stroke of the lion's paw—and I have seen this done in the killing of a reed buck. However, where capture depends on the speed and weight of the lion, the animal attacked should have strength and size sufficient to hold up the lion long enough to break his fall. Zebras are often killed by lions, and the size and strength of the zebra, as well as his meat, may just meet the lion's requirements.

This September morning here in Connecticut I looked out of my breakfast-room window and saw seven wild deer. Two of these were undersized and in poor condition and I doubted whether they would get through the coming winter. In Africa it is different. There the lions and leopards pick off the laggards, the weak, and so aid in preserving the health of the herd. As I saw them on the Serrangetti plains they fairly radiated vitality, and few die of old age.

Those African evenings around a big fire, as notice to the lions as well as for warmth, were grand affairs. Delightful tales of Africa were continually punctuated with wild noises. The late afternoon peace of East Africa is made vocal by the cooing of the wild pigeon, but after his all pervading song has apparently lulled the wild things to sleep, then the killing begins. Later one listens to the grunts and deep-throated roar of the lion, to the curious cough of the leopard, perhaps prowling in the blackness just beyond the circle of light, and to the weird yell of the hyena—all telling of the content which follows the satiation of their wild hunger.

The venture proved absorbingly interesting. The carrying out of an American Museum Mission is a rare pleasure and, I may add, a privilege, and you, reader, may also desire to aid in this interesting work. There are still important groups to be procured for the Akeley Hall.

I would like to add that hunting and collecting are different, and it will be well to do one or the other, but not both. Also, it will be but fair for you to arrange for the completion of your work at the Museum, after you have had the fun of the field expedition.



(Above) A lion group in the making. The animals obtained in Africa being brought to an appearance of life in the preparation department of the American Museum. A picture of the finished group will be found on page 40.

(Below) A group of lions as they are most frequently seen in east Africa. They tend to group themselves into families except for the old males which usually roam about by themselves.



Photograph by
Martin Johnson



Mr. William H. Leigh at work in the field on color sketches to be used later for the background of the Lion Group. His gun-bearer,

and protector if necessary, is just behind him, but out of the picture. An artist cannot concentrate on his work and safety at the same time.



The Carlisle-Clark Expedition preparing to leave Nairobi. Systematic packing is very necessary as the unexpected generally happens during field work in Africa



Mr. Leigh at work on the lion group background in the African Hall at the American Museum. Few visitors, when viewing the fin-

ished work, will realize the amount of thought, effort, and skill that has gone into the making of the backgrounds



The end of three days' hard work. Some real road building was necessary when the heavily laden expedition auto trucks became stuck in a dried water-course



(Above) African travel made really interesting by an unexpected rain at the beginning of the dry season. This river was flooded to a disconcerting height, considering the fact that it was necessary for the expedition trucks to cross

through it en route to the Serengetti Plains. (Below) The Carlisle-Clark African Expedition returning to Nairobi after a three-month's collecting trip in the most interesting game country left to the modern world.



Some African Hall Chronicles

A saga of the collecting expeditions behind the groups

ALTHOUGH the visitor to the Akeley Hall of African Mammals may well be impressed with the meticulous artistry of the habitat groups, there is a story behind each group that represents as great a task as the making and assembling of the groups themselves.

These chronicles are the sagas of the expeditions that spent adventurous and arduous weeks in securing the fine specimens which represent African fauna and flora at its typical and best.

The foundation laid

The foundation for African Hall was actually laid when the Eastman-Pomeroy-Akeley Expedition set out for Africa. It was on this great safari, led by Carl Akeley himself, and supported most nobly by Messrs. Eastman and Pomeroy, that the main groups were obtained. The animals of the Plains Group and the great Water Hole Group were selected and hunted, as well as the greater and lesser koodoos, the klipspringer, the impressive buffalo, the wild dog, bongo, and impalla.

Much has been written on this famous expedition in the books of Mary Jobe Akeley, and the reader of this issue of NATURAL HISTORY will find it described in the articles of Daniel Pomeroy and Martin Johnson.

Mr. G. Lister Carlisle has also written for this issue a typical account of one of the African Hall expeditions so full of adventure and scientific interest. To avoid a natural repetition and to place before the reader in as concise form as possible the accounts of the several expeditions which contributed to this great monument to African wild life, the following excerpts from field records are given to show some of the dramas behind each group.

When the O'Donnell-Clark Expedition set out in January, 1931, to obtain the specimens of the giant eland of Southern Sudan, they realized that they were setting themselves a task similar to "looking for a needle in a haystack." Lesser eland were to be found over Southern Africa; but the giant eland, a great, shy, handsome animal, was to be found only in two small and widely separated districts. Since the Sudan range was more accessible, the expedition, consisting of Dr. James L. Clark, C. Oliver O'Donnell, W. T. Hunt, John W. Hope, Dudley Blakely, and Jack Robertson assembled at Khartoum in February of that year to outfit their expedition. From there they sailed up the Nile 860 miles to Shambe, a little river station, from which outpost they were to set out for the back country in search of the elusive giant eland.

"Deserving your eland"

Little or no information about this giant antelope could be found in Khartoum or farther south than the Sudan since few people, even among the local officials, had hunted it.

They were told in Khartoum, "If you get your eland, you will have very well deserved them." With this scant information and with hints as to their whereabouts picked up by Doctor Clark some years before, the hunters proceeded one hundred miles westward from Shambe to Rumbeck. There they were advised to go another fifty miles farther west to a spot known as "York House." This regal name was applied not to a mansion or stately outpost, but a simple grass hut by a water hole where the Duke and Duchess of York, on a previous visit, had established this camp to try for lions.

There the O'Donnell-Clark Group by good

luck jumped the only herd in the country, on their first day. Their good fortune, however, was only of eight hours' duration for, after trekking the herd for that period of time, not a single chance of a shot presented itself and the herd moved on into the wilderness.

The heat was so extreme and the conditions of living were so bad there that the expedition set out the next morning for Amadi Post where they again reassembled and proceeded sixteen miles out to one of the rest-camps which was assigned to them by District Commissioner Cann of Amadi. Several days of hunting disclosed nothing but a few old tracks of a herd that had long since passed that way. As Doctor Clark wrote in *NATURAL HISTORY*, November, 1931: "After seeing this eland country, I began to realize the great part luck would play in our success, even though we hunted hard and conscientiously. The first thing was to locate the eland; second, to see them first; and third, to see enough of them to pick the desired specimen."

A limited privilege

The expedition possessed licenses to shoot only two eland. At least four would be needed for the group and the extra two were subject to a fee or "export duty" of five hundred dollars a head. With a misplaced shot costing five hundred dollars, their difficulties became intensified.

In this country thickly but evenly covered with small trees and bush, no long vistas could be found—about seventy-five yards was the length one could see on the average. A switch of a tail, the movement of a single ear suddenly come upon was all that could guide them. The eland never stop to feed. The herd travels zig-zaggedly only to reach for leaves or to break down with their horns the small trees which bear their food.

After three days in such difficult country, the bearer spotted a herd of eland during one of their trips, but before they had time to sight an individual animal, the herd had their scent and were off. The next day and the day after they hunted in different directions and devoted what time they could to the collecting and preserving of accessories while O'Donnell hunted by himself for three days. Two weeks had now gone by, and still no eland. Then one day fresh tracks were seen of a single animal. Carefully they trailed him but always he eluded them in the heavy grass and thick underbrush.

A second track was found and as they stopped to examine it their guide sighted the herd—or what they hoped might be the herd. About 150 yards to their left there was part of an eland visible through a spot in some thick bush. Doctor Clark dramatically tells of its capture.

A dramatic capture

"Here we were—clean in the open, with hardly a blade of grass to shield us. How we had gone this far without being detected and how the shikari picked up this tiny spot is one of those breaks in hunting that can't be explained and which we call 'luck.'

"I looked through my glasses, but all I could see was a single spot of tan. I could not distinguish just what part of the animal it was, but I was sure it was an eland. Then to the right my eye caught the swish of a tail. This gave me his general position, and looking at the other side of the spot, I saw the tip of a horn. Everything else was a wall of leaves.

"Apparently he was facing left and almost broadside. Fortunately the same leaves that shielded him also shielded us from his view.

"Although I searched the bush for others, not a sign could I find and I turned again to study his position. At last I had an eland before me, but was it what I wanted? I suspected I saw the tip of the other horn, and slowly edged my body sidewise to locate the head, if possible. I saw a big ear swing into view and from its position figured he must be looking our way, yet I could see no part of the face and not until this ear changed its position did I dare to move. When the ear swung back, a tip of horn came into view and from this I finally put together the puzzle of his head.

"The patch we saw was part of his shoulder and from what I saw of the tip of the horn I figured it was undoubtedly a bull, but was too small for the group. At one time I decided to let him go and to try for a bigger one. Then I began to reflect upon the days I had trod the ground with never the sight of one, and here was my first chance, the only shot I had had presented in all the fifteen days of hunting. Finally I said to myself, 'Don't be a fool. Here's a bull eland, and you may never see another. Take him!'

"I could see the point of the elbow and a bit of the brisket and from these I judged the position of the heart. Cautiously I changed my glasses for my gun and slowly brought myself

to a sitting position. Now I was ready to shoot.

"With my mark spotted more by the bushes than by the now indistinct body, I took aim, but I was inwardly too excited, and the front sight would not settle down to quiet. I began shaking like a leaf. I was getting buckfever. I dared not risk the shot, so I took the gun from my shoulder.

"It was with supreme effort that I recollected my scattered nerves and calmed myself to steadiness. Then, holding my breath, I began to squeeze the trigger as I held the gun with braced elbows on my knees. It finally went off and at the report I saw the animal jump and a pair of heels fly into the air. Somehow I was confident, but rushed ahead to follow through.

"When I neared the spot, I saw through the bush my eland lying motionless and, to my great surprise, there stood two more fine bulls but a few yards away. Startled by the ring of the shot and their comrade's fall, they stood and watched me. Hurriedly I looked them over. I had by sheer luck drawn the best."

The task not ended

The camp was a happy, buoyant place that evening. Although another full week was wasted going and coming from other eland grounds farther west, without sight of another herd, the hunters toiled on. They were to sail from Shambe on April first and the days had sped by until it was now March 29. They had hunted a total of 220 miles on foot and had not seen another herd from which they might hope to get an eland cow for the group. Food was about gone, for things had been timed to wind up on this day. On the morning of the 29th the gray, dull light and recent rains made ideal hunting weather. For two hours they skirted the country about their camp where they had gotten their first bull. Suddenly they sighted a herd coming straight toward them, but again their problem presented itself. But one shot was possible and that would have to be a cow. Just a few steps in front of the hunters one such animal raised her head. A slight turn to the left and she presented her shoulder just as Doctor Clark pulled the trigger. She was so close that with one lunge she could have pinned him to the ground. As the shot rang out confusion reigned and eland broke in all directions. The cow

wheeled, but another shot brought her down for good.

The O'Donnell-Clark expedition had found their "needle in the haystack."

The sable antelope

The magnificent Sable Antelope Group was obtained by the Vernay-Angola Expedition.

Although they were obliged to hunt these animals during the dry month of August, when tracking was most difficult, Mr. Vernay succeeded through persistence in shooting the splendid specimens that are now in African Hall. After three days' reconnaissance in the sable country, Messrs. Vernay, Lang, and Boulton made their camp on the Teti River not far from the salt pans near Chisongue.

"I had with me young Alan Chapman who was born in Angola," wrote Mr. Vernay in *NATURAL HISTORY* in November, 1927, upon his return from Angola.

"It was for his grandfather that the Chapman zebra was named. Our plan of attack was that Alan should go north and I south, he go west and I east, or whatever arrangement might be best so that we should cover the whole country as much as possible. The first day out I was rewarded by getting two cows, one old cow and one young cow who had had one calf. The next day a calf was the bag.

"Two days after that Alan obtained a young bull with 39-inch horns. And time went on—and our anxiety increased as we now had only three days left; I decided to send Alan to camp on the Tunda River, which was about fifteen kilometers away, as only a few days before I had seen tracks of a large bull which I thought he might possibly find. In the meanwhile I covered another part of the country. The understanding was that he was not to return until nine o'clock of the morning we had to break up camp. This would allow him a few hours after daybreak to make a final hunt before reporting.

"I had no news from Alan, and finally had only one day left. After having made a fairly thorough inspection of the country, I considered it almost useless to go out the last day—the natives' feet were in bad condition and we were all tired—but finally I decided that we would make one last attempt and make a big detour around a feeding ground where I had seen a large bull at dawn a few days previously.

"I started out at a quarter to five with Sakafuta, an Ombundu native, and one other. At a quarter past seven I saw to the left, about 150 yards in the bush, a magnificent bull sable walking majestically through the bush, returning from the feeding ground. Sakafuta and the other native had not seen him, as they were looking in the other direction. However, at a signal, they immediately went down on the ground and disappeared in the grass, which was up to our waists. The bull in the meanwhile disappeared behind a large dead tree which had fallen. It was an anxious moment, wondering whether he would keep on or possibly turn away into the bush, which would mean that I should have to move and he probably would see me. However, he fortunately came out from behind the tree and was shot. In this way a magnificent specimen was obtained, which complemented the group of the sable antelope."

A foretaste of what the American correspondents are experiencing in Abyssinia was obtained by Morris and Sydney Legendre, Gertrude Sanford, and T. Donald Carter when they set out to secure specimens of the Abyssinian nyala—"The Queen of Sheba's Antelope"—in 1929.

Camping out in southern Abyssinia provided plenty of thrills and the elusive nyala. Mr. Carter and Sydney Legendre each secured a bull and Sanford secured two does. As they describe the shooting of the first big bull, "He was

sighted a little after sunrise, and was followed all day, yet, although he was always kept in sight, he was never close enough for a shot. At sunset he seemed to disappear altogether. Suddenly, just as the party was about to return to camp defeated, he appeared silhouetted against the sky. The range was rather long and the light practically gone, but as it was their last chance, they decided to shoot. The first shot, a lucky one, dropped him in his tracks.

"In one day Mr. Carter had six animals to skin out and care for. The natives helping him were practically useless. Doing very little, they nevertheless managed to do it carelessly, so that he was forced to go over everything they touched. Often he worked a day and night without stopping, and it is due to his untiring efforts and skill that we were able to bring back to the Museum the skin of every animal we shot."

Mary L. Jobe Akeley

The chronicles of African Hall would not be complete without mention of the earnest participation of Mrs. Mary L. Jobe Akeley and her constant enthusiasm which has brought substantial support to the project. The reader is referred to Mrs. Akeley's books for further information, and to volumes XXV, XXVII, XXIX, XXX, and XXXI of *NATURAL HISTORY* which carry other stories of African Hall expeditions.



A Pre-View of Eight Groups in the Akeley Hall of African Mammals

The following photographs were selected to give some idea of African mammal life as it will be displayed upon the opening of the new hall to the public early in 1936.

Although the hall will not be completed at that time, enough of the large and spectacular exhibits will have been finished to warrant admitting the public. All of these completed groups are to be found on the second floor of the African Hall, but progress on the third floor, or balcony, justifies the prediction that some of those habitat groups as well will soon be available to the visitor.

The photographer in his selection of the details to be pictured and in the use of special illumination has achieved results which speak for themselves, but it is impossible to do full justice to the beauty of the groups through the medium of photography, and the visitor should find these transplanted portions of Africa exceeding any expectations aroused by the photographs.

*All of the groups in the Akeley Memorial African Hall
have been assembled under the direction of Dr. James L.
Clark, and the scientific direction of Dr. H. E. Anthony.*

*Text by H. E. Anthony
Photographs by Wurts Brothers*



ANIMALS by John W. Hope.

BACKGROUND by C. C. Rosenkranz.

FLORA AND FOREGROUND by Albert E. Butler, assisted by George F. Mason and Joseph M. Guerry

The Giant Sable

sentinel for the herd will be a young bull. It is said that formerly, in South Africa, the sable traveled in bands of as many as fifty or sixty animals, but today the sable of Angola may be found only in much smaller groups. Usually there is but one large, mature bull with a herd of cows and young animals, although the sexes will be about equally divided. Half-grown bulls with much smaller horns will be tolerated by the herd bull.

The giant sable prefers brushy plains, lightly forested stretches, or low, hilly districts. It does not wander far from areas of at least scrub vegetation and is not found out on the open stretches of the great Kalahari Desert. It comes regularly to water and is least active during the heat of the day.

At the time Mr. Arthur Vernay collected the specimens shown in this group, August, 1925, the giant sable was already becoming scarce. Mr. Vernay experienced no great difficulty in getting the cows, calf, and young bull, but could not locate a big male, one with horns more than fifty inches in length. By the fortune of the chase, the big bull was secured on the last day of hunting before Mr. Vernay had to leave Angola. Luckily for the Hall, this individual had truly magnificent horns. Although not a record, a head as large as this is an achievement for recent years. The dwindling numbers of giant sable, the fact that they are limited in their range, and that hunters are eagerly seeking the big heads, all operate against the production of horns as large as those of former times.

THE giant sable (*Egocerus niger varians*) with its fine, upstanding carriage, its impressive, curving horns, and its appearance of alert awareness is one of the most spectacular of all the antelopes. The members of the genus *Egocerus* (sable and roan antelopes) stand relatively high at the shoulder and have the appearance of being up on their toes and ready to go.

This physical appearance of vigor and watchfulness is well supplemented by sharp senses, the power of vision being especially keen, and by a disposition unusually aggressive for an antelope. The sable is one of the very few antelopes that will, when wounded, charge man.

The sable antelope shown in the group, the giant subspecies, sometimes called Varian's sable or the Angola sable, is to be found only in Portuguese West Africa, in Angola. Other races of the sable antelope occur from the Transvaal and Rhodesia north to Tanganyika and Kenya. Unfortunately, the giant sable has been so reduced in numbers that it is not far from extermination. Habitually, the sable antelope runs in small herds, although an occasional old bull may be observed traveling by himself. Such individuals usually are extremely wary. Captain Gilbert Blaine, an authority on Angola, states that he has not noted the giant sable occurring as a solitary old bull, but has found two young bulls, probably driven out of the herd, traveling together, very shy and watchful. According to his experience, the



The cross-hatching indicates the site of the Group



The Gemsbok

THE gemsbok (*Oryx gazella*), sometimes anglicized to gemsbuck, is the largest of the genus *Oryx*, the group of antelopes carrying long, slightly curved horns. All of the *Oryx* are handsome mammals with compact bodies, businesslike horns, and rather showy markings; and at the top of the list stands the gemsbok.

This antelope shows a preference for desert areas and is at home in southwestern Africa from the Kalahari Desert to the northern limits of the Cape Province. Because of its specialization for a desert environment, its ability to obtain the water it needs from the vegetation upon which it feeds, more particularly a variety of wild melon, and the inhospitable character of these desert regions for human occupation, the gemsbok has not, until recently, suffered unduly from persecution by man, and still exists in numbers over much of its range. The advent of the motor truck, carrying a water supply, has brought a menace to the mammal life of the Kalahari, and the gemsbok has already begun to suffer from this attack upon its natural sanctuary.

With the gemsbok, as with other *Oryx*, the horns of the female are longer although not as heavy as those of the male. A maximum length of four feet along the curve is recorded for this antelope. The spearlike nature of these horns makes them formidable weapons and the gemsbok is an aggressive believer in their use. When wounded, it does not hesitate to charge the hunter; it is said that it successfully combats

the lion; and during the rutting season the males fight savagely with one another.

In common with other plains types, the gemsbok has very sharp vision but seemingly places most reliance upon its sense of smell. These antelopes do not travel in large bands but rather as solitaries and groups up to six or eight in number. A bull may have two cows as consorts and, with the young animals and immature bulls, the family group may hold together to reach this figure. The solitary gemsbok are apt to be old bulls which, because they have no companions to do a sentinel turn, must be continually on the alert themselves and are accordingly difficult to approach.

Despite a general lack of water on the Kalahari and the fact that it is truly a great desert, there are considerable stretches of scrub vegetation and occasional "pans" where water may be found at certain seasons of the year. The mammal life of the Kalahari comes to these "pans" for water when it is available, but the observations of men who know the region indicate that the gemsbok wanders at will and need not base its choice of range upon the presence of water.

The name suggested by the early Dutch settlers for this sharp-horned antelope gemsbok, is rather peculiar when one considers its original meaning. The Dutch called the chamois a "gems" and the English equivalent of "bok" is buck, so "gemsbok" means a buck chamois; but there is very little about the African species suggestive of the small antelope of the Alps.



The cross-hatching indicates the site of the Group



ANIMALS by John W. Hope.

BACKGROUND by C. C. Rosenkranz and Dudley M. Blakely.

FLORA AND FOREGROUND by Albert E. Butler, assisted by Dudley M. Blakely.

The Mountain Nyala

preservation of the species, it is not convenient for the average hunting party to make the long and difficult trip up to a timber line so removed from railroad or motor transport. Accordingly, few white hunters seek the Queen of Sheba's antelope.

During the hours of high sun the animals are in the forest or thickets and then wander out into open patches late in the afternoon. Here they feed, browsing on heather principally, although grazing occasionally upon grasses, until sunrise of the next day. Mountain mists sweep the slopes at times and serve to protect the nyala from the vision of the hunter without handicapping the antelope to any great extent, because the latter rely upon a keen sense of smell. It is said that when out in the open, they are noticeably more shy and wary than when among the trees, and if pressed too closely, they may climb above the heather into the barren, open terrain of the mountain-tops where they have a decided advantage over any pursuer. Lions do not occur in the region where the mountain nyala lives, and the leopard is not common there; hence these antelopes have little to fear from any creature other than man.

This antelope is related to the nyala (or inyala) of southeastern Africa, a handsomely marked representative of the bushbuck family. The similarity of names is confusing, but the inyala has smaller horns and lives along river banks in the lowlands. Still another name for this southern nyala is Angas' bushbuck.

THE mountain nyala or mountain bushbuck (*Tragelaphus buxtoni*) is found only in the mountainous corner of Africa occupied by Abyssinia and even here it is restricted principally to a small area centered about the Arusi district. It is, as its name suggests, a bushbuck that has come up from lower elevations, adapted itself to a high altitude environment, roughly 9000 to 14,000 feet, and has retained the same type of twisting horn. It is, however, much larger than its lowland relatives, carries much heavier horns, and is a much more impressive animal. One of its names, the Queen of Sheba's antelope, indicates its importance among the game mammals of Abyssinia.

This antelope feeds on the high mountain slopes and rolling uplands where the dominant vegetation is giant heather. It is also found in the forest which lies along the slopes before the zone of heather is reached. In this forest the bamboos are a prominent feature. This is a region of temperate characteristics in that nights are cool, often with the thermometer dropping to the freezing point, and precipitation is sufficient to encourage green vegetation. At midday the sun may become quite hot, thus causing the daily range of temperature to cover a wide swing.

The mountain nyala occurs singly or in small bands up to six or eight in number. Apparently the total number of this species is not very great, for the animals are local in distribution and restricted rather closely to a specialized environment. Fortunately for the



The cross-hatching indicates the site of the Group



ANIMALS by Robert H. Rockwell.

BACKGROUND by Wm. R. Leigh.

FLORA AND FOREGROUND by Albert E. Butler, assisted by George E. Petersen and Robert W. Kane.

BIRDS by Raymond B. Potter.

The Greater Koodoo

down the great spiral horns and into the ear. This species may be seen in small bands or as solitary individuals. It does not group into larger herds as do some of the plains antelopes, and usually the females greatly outnumber the males. The old bulls with the finest heads are relatively scarce, and because more molested by the hunter, are more secretive and more difficult to observe.

It is not likely that the greater koodoo often falls a prey to enemies other than man. Its habitat preference keeps it out of regions where lions abound, but the leopard lives on some of the rocky slopes in the koodoo range, and against this cat the young koodoo and the hornless females must be on their guard. Not infrequently greater koodoo may be noted in areas where the natives run their herds of goats and sheep. If the number of these domestic animals is not so great as to take all the feed, the koodoo remain in the region, moving out of the way when a shepherd and his flock passes, but not disturbed or alarmed to the same extent as would be our North American big game under similar circumstances. In addition to grazing upon grasses, this antelope feeds upon the fallen fruits of certain trees and otherwise supplements the meager grazing possibilities of arid hillsides.

In the records of large game heads, the specimen of the greater koodoo listed at the top has horns 71½ inches in length, and, below this are seven heads each exceeding 60 inches in horn length.

THE greater koodoo (*Strepsiceros strepsiceros*), often spelled kudu, carries the longest horns of any of the African antelopes. In size and impressive character of horns, it is approached only by the sable antelope, the giant variety of which possesses great, sweeping horns but a few inches shorter. Greater koodoo are large animals and have a body size well proportioned to set off the great spiral horns to best advantage.

These antelope are to be found over a large part of Africa south of the limits of the Sahara. In some parts of South Africa, notably Cape Colony, it has been exterminated, but over other parts of its range it is still fairly common although local in its distribution. It frequents hilly or broken country which it seems to prefer to plains. It does not live in the heavy forests of the Congo, its favorite habitat being the brushy hillside, where it is adept at concealment and well protected by its neutral coloration. Good koodoo territory is usually very dry but with water accessible either at a river or water hole.

Greater koodoo are shy, wary animals, most active at night, early in the morning, and late in the afternoon. As the sun rises, they retreat into the shade of a thicket, where they spend the midday hours. When feeding, they wander out of the thorny jungle into the openings to graze, but when alarmed they take full advantage of all the cover available. They are said to be very acute of hearing. One hunter has suggested that the sound waves are conducted



The cross-hatching indicates the site of the Group



ANIMALS by Robert H. Rockwell.

BACKGROUND by Wm. R. Leigh.

FLORA AND FOREGROUND by Albert E. Butler, assisted by George F. Mason and Joseph M. Guerry.

BIRDS by Raymond B. Potter.



The cross-hatching indicates the site of the Group

The African Buffalo

THE African buffalo (*Syncerus caffer*) is one of the group of wild oxen, all of the members of which are more or less closely related to the domestic ox. This particular variety of wild ox is one of those less intimately related to barnyard cattle in physical characters and the contrast is even greater when applied to behavior. The African buffalo bears the reputation, rightfully acquired, of being one of the most dangerous large game species for man to hunt. Fierce and intractable in disposition, possessed of great vitality, and clever in selecting the place and time for a charge, this animal has brought many a hunt to a tragic end.

The African buffalo is widely distributed over Eastern Africa, from about southern Abyssinia to the Cape of Good Hope, where it is usually to be found near water. Environment to its liking may be found from the warm coastal plains up to elevations of 10,000 feet in the mountain ranges. In open, desert-like situations where water is scarce, buffalo do not occur.

The African buffalo is social in habit and the animals are found in herds the size of which varies from ten or a dozen to one hundred or more. The herd is composed of both sexes and apparently no one bull dominates the herd to the exclusion of all other bulls. The horns of the cows are not as massive as those of the bull and, while the former will charge an enemy upon slight provocation, the bull has the reputation of being more vindictive and less

easily swerved from his purpose when pressing a charge home.

These buffalo feed mostly at night and lie up during the heat of the day, often in some marshy spot such as is portrayed in the group. Toward sundown they come out of cover to graze; after sunrise next morning they move back en masse from the feeding grounds into a thicket of brush or whatever vegetation the region affords. If the locality is one where water is to be found only at a river, buffalo will drink just before retiring for the day and may move back several miles before taking their rest.

The African buffalo is alert and must be stalked with care. All of its senses are keen, and the man who would observe this animal must guard against a quick eye, a sensitive nose, and a perceptive ear. The animal does not customarily charge unless it has been attacked, although there are records of unprovoked attacks upon people.

The African buffalo has suffered far more from the ravages of disease than from the attacks of man or other large animals. On several occasions outbreaks of epidemic violence have made heavy inroads upon the members of this species, one of the most serious of these taking place in East Africa late in the nineteenth century, when it has been estimated that not one in ten thousand was left alive. That the remnants were able to reestablish the present large numbers is a striking illustration of the vigor of the species.



ANIMALS by James L. Clark.

BACKGROUND by Wm. R. Leigh.

FLORA AND FOREGROUND by Albert E. Butler,
assisted by Dudley M. Blakely, Joseph
M. Guerry and George F. Mason.

The African Lion

the men working on a railroad project, killing many until they, in turn, were killed by Lieutenant Colonel Patterson.

The favorite food of lions is zebras, wildebeest, hartebeest, and other antelope of similar size and general habits. Lions sometimes lie near water holes to ambush animals as they come to drink, but often stalk close enough through tall grass or thick brush to permit of a final short rush. This rush of a stalking lion, or the charge of an angered one, is of great speed, but this speed cannot be sustained for any great distance.

In some parts of Africa where conditions are ideal for the lion, where there are great numbers of the species upon which the lions prey, and where the everyday association of lion and game herds has accustomed the herbivores to the necessary presence of the big carnivore, the animal world shows a surprising disregard of the lion. Lions may be in full sight of antelope which do not stampe as long as the cats are indifferent, and species like the reedbuck or bushbuck may use the same thicket in which lions lie up for the day.

Family groups of lions are frequently seen. Apparently, a lion and lioness may be mated for a long period, perhaps permanently, or one male may have several females which, with their cubs, will constitute a group of a dozen or more.

The lioness has from two to six cubs in a litter, but the usual number to be seen with a wild lioness is two or three.

THE African lion (*Felis leo*) has been described under various subspecific names. These geographical races differ but slightly from one another and to the layman there is but one lion, the African lion. A lion occurs in Asia, a few are still extant in India, but in this instance also the variation in geographical range is correlated with but slight physical differences.

Formerly, a good photograph of an unstrained lion was a prized trophy rewarding a patient and lucky stalk. Today there are well known districts where the photographer can drive in a motor truck and be certain of photographing not one but many lions. Along with the increase of splendid photographic records of the king of beasts has come an accumulation of life history data, in many cases with motion pictures to describe behavior.

The lion is to be found in practically every large-game field in Africa with the exception of a few regions where it has been exterminated. It does not go into heavy rain forest nor into the heart of desert areas where game is too scattered to prove a reliable source of food. Within recent historical times it has disappeared from the countries bordering the Mediterranean, and even later from the Cape Province.

In general, the lion does not molest man unless it is attacked by him, but individual animals, for one reason or another, may become man-eaters. The most famous of these were the lions known as the "man-eaters of Tsavo" and in this instance two animals took toll of



The cross-hatching indicates the site of the Group



ANIMALS by Robert H. Rockwell.

BACKGROUND by F. L. Jaques.

FLORA AND FOREGROUND by Albert E. Butler,
assisted by Joseph M. Guerry.

The Bongo

mammals to stalk and observe.

Several races of this antelope have been described, the one shown in the group being the eastern race, *Boocercus eurycerus isaaci*.

The eastern race makes its home in forest where bamboo grows in extensive thickets. The undergrowth is thick and the cover so dense that not only is it most difficult for man to travel there, but also impossible for him to see into it for more than a few feet. In spite of the large size of the bongo, it is able to pass through this jungle at a surprising rate of speed and to move about, when skulking, without the noise which even the most skillful hunter must make under such circumstances. The keen senses of this antelope and its mastery of a difficult environment have kept it from falling to the rifle of very many white hunters.

While the bongo may rest, lying down to chew its cud, during the middle of the day, the natives say it does all its feeding during daylight hours. As there is no oppressive exposure to the direct rays of the sun in these humid forests, and the bongo is able to detect the coming of an enemy well in advance of its arrival, there is little need for night activity.

The bongo are apt to run in herds but these are not large; because of the thick cover, observations on the actual numbers are wanting, but it seems to be of common occurrence to find several animals together. Major Maydon, hunting bongo in Kenya, writes that he believes the big old bulls are very apt to travel by themselves.

THE bongo (*Boocercus eurycerus*) is the deep-forest representative of the tragelaphine antelopes, the group of antelopes with spirally twisted horns typified by the bushbuck, koodoo, and eland. With its glorious brown to black pelage and well-proportioned body, it is probably the handsomest member of the group, although its horns lack the inspiring length of those of the koodoo and the massive character of the eland horns.

The bongo is never found out of heavy forest and its proper environment is deep, primeval stands of timber such as are associated with great rivers like the Congo or with humid mountain slopes. Roughly, its range extends from Liberia, the Gaboon, and Sierra Leone, through the forested land that follows the Congo drainage, east to Uganda, and along the Mau Escarpment to Mount Kenya. Throughout this area precipitation is favorable to luxuriant plant growth and in many sections the rainfall is very heavy. It is not uncommon for mammals of humid districts to show a marked tendency toward dark coloration. With the bongo, the dark pigment is a rich brown quite distinct from the color of other tragelaphine antelopes, but the common ancestry may still be detected in the presence of stripes and white throat-bands. Roosevelt and Heller consider it to be most intimately related to the eland. The coat of the bongo blends well with the dark forest environment and is of great value to an animal naturally wary and watchful. It is one of the truly difficult African



The cross-hatching indicates the site of the Group



ANIMALS by John W. Hope.

BACKGROUND by Wm. R. Leigh and Dudley M. Blakely.

FLORA AND FOREGROUND by Albert E. Butler, assisted by Dudley M. Blakely.

THE giant eland (*Taurotragus derbianus*) is the largest of all the antelopes. In body size it is as large as a domestic ox. While the giant eland is scarcely any larger than the common eland, with respect to body size, its horns are larger and more massive.

This species has a restricted range and is not found outside of a small area lying between the White Nile and Bahr-el-Ghazal and a similar circumscribed area in Senegal. Even in these regions the giant eland is not plentiful, and the total number alive today is relatively small. They run in small herds of from ten to thirty or forty, and because of their scarcity and local distribution, it is often very difficult to locate the animals.

The giant eland prefers dry plains of thorny scrub. It is a browser rather than a grazer and feeds upon the leaves of trees and shrubs. Often it breaks down branches to get at the foliage, and by using its horns, it can reach as high as seven or eight feet from the ground. The animals are great travelers, pulling off leaves while on the walk, and covering many miles in acquiring a meal.

Like many of the species of African mammals, the giant eland goes to water just before dawn and then, fortified against a dry, hot day, strikes back from the water into a dry back country. The terrain frequented by it is rather more arid than that preferred by most other antelope, and its ability to cover long distances between water holes makes this animal all the more elusive.



The cross-hatching indicates the site of the Group

The Giant Eland

It will be observed that both sexes of giant eland carry horns, and although those of the cow may be as long as those of the bull, they are not as great in diameter and lack their massive character. The twist in the horns is characteristic of members of the subfamily of antelopes which includes bushbucks, koodoos, bongos, and elands.

The giant eland is wary, and the gray to tawny color of the pelage which blends into the background of thorn scrub through which it travels aids it in escaping observation. Not much other game is to be found in good giant eland country, and a hunting trip for this species must, perforce, be organized for the one animal alone, especially since shooting at the occasional roan antelope or hartebeest encountered would frighten the shy eland out of the country.

Its greatest enemy is man, since it is too wary and strong to be stalked successfully by lions. Unless the lion can approach by stealth (a difficult matter in the type of country where giant eland live), close enough to bring the first rush of the cat to the head of the eland, the latter is strong enough to shake off the lion. This antelope is not capable of any great burst of speed but, when frightened, breaks out of an ordinary walk into a fast trot. The maximum effort results in a gallop, but this is not sustained for any great distance.

Much of the territory inhabited by giant eland is also sleeping sickness country, a fact that has operated to keep hunters out.



(Above) Mr. and Mrs. Martin Johnson at camp in the gorilla country, which Akeley called "the most beautiful in the world"



Carl Akeley using the camera which he invented. It proved invaluable for work in the field

Camera Safaris

How the beauty of African wild life and landscape has been captured by the photographic lens and made its contribution to the Akeley African Hall

By MARTIN JOHNSON

All photographs by Martin Johnson

THE enthralling creation of African Hall first concerned Osa and me in about 1922. We had just returned from our first African safari; our feature film "Trailing African Wild Animals" was completed and about ready for the market, but we wanted it gone over and given the stamp of approval before being released; this had to be done by an African expert, and of course this could be no one but Carl Akeley whose exploits in Africa were known by everyone interested in the so-called "Dark Continent."

Carl Akeley

Accordingly I made arrangements through a mutual friend to meet Mr. Akeley, and on reaching his offices in the American Museum, I found him at work on his lion spearing group. At this time he was just starting the clay models from which the bronzes were to be cast. His Nandi spearmen were composites from original models he made in Africa, photographs, drawings, and selected types of American negroes which he was using to make sure of perfect figures. I will never forget the pride I felt when he asked my opinion as to the forms of the many negroes he inspected. They must be figures as near the perfect type of Nandi as it was possible to get, and when he asked my opinion, I was forced to use great caution, for Osa and I had spent only two years in Africa, and very little time among the Nandi tribes. Most of our experience with savages up to this time had been with the natives we had encountered during the nearly ten years

we had spent in the South Sea Islands and in Borneo.

The first few hours at the Museum I was in the presence of *Mr. Akeley*, but through that rare charm and feeling that he had, probably because of our mutual interest in wild things and of course in photography, it soon was "Carl," and never again did I think of him in any other way.

I now became an almost daily visitor at the Museum. Carl in turn visited our apartment and had many a dinner with us, always having a romp on the floor with "Bessie" our orang outang, and "Kalowatt" and "Wah" our two gibbon apes.

I knew that I never made a nuisance of myself and was never in Carl's way. He made me feel that. We had one of those understandings whereby we could be together for an hour without saying a word as he worked on his lion spearing models or on the mounting of his Gorilla Group. Or I would sit and watch him and listen to his stories of African adventure, of his plans for the future, and most interesting of all, his plans for the African Hall.

Early planning

I wish it were possible for me to state just when Carl's African Hall idea started, but I don't know. I know his ideas were well under way when I first met him. He had small models of the proposed building, the groups, the bronzes, and all the details that he visioned in the completed hall, but each day as we would talk he would make additions to his details, change or elaborate them.

It now seems to me that Carl was just then

forming the actual model in his own mind. He was constantly getting new ideas that would change the ideas of the previous few days, but two of his thoughts stand out above all the rest, African Hall *must* be Africa, it must be true in every detail, and it *must* be done according to the new and modern methods of taxidermy. As he told me:

"Everything that has been done in the American Museum of Natural History in the way of African exhibits must be thrown out and completely discarded; we must start all over again."

As I look back to those weeks when I listened to Carl's plans, I marvel that everything has worked out just as he planned, even to the finest detail.

"I want to collect the groups myself," he told me. "I will take an assistant taxidermist along, and he will teach native skinners to work under us and do the work according to our ideas. Then I will have a couple of painters; they must be the best men in their line; one a landscape painter to get the scenery, the grass, the trees, the background, everything as perfect as it is possible for man to reproduce nature. Then another painter to do the animal studies and to work in the background, and an accessory man to collect the trees, the rocks, the pebbles, samples of the trees, bushes and grass."

Then he spoke of the photographic work necessary to supplement the measurements he would take of each animal before it was skinned. He wanted scores of pictures showing every contour, muscle and joint, every posture at rest and in motion.

"Tame" pictures most difficult

I doubt whether any one who has not tried it has any conception of the difficulties connected with making wild-animal pictures. The easiest thing to do is to shoot an animal with a high-power rifle at a comfortable and safe distance, or to run it down with a motor car, picturing the process and its excitements. The hardest thing is to picture that same animal in a calm, undisturbed state of nature. But we had worked out many of the problems on our first trip, and had thought out various new schemes we were eager to try.

Never have I spent a more interesting three months than during this time that I visited Carl almost daily. African Hall was the dream of his life. He was dreaming and planning

ahead toward the time when he could get back to Africa and start his new work, and his dreaming caused me to dream. In fact, it was his thinking out loud that was responsible for the pictures and books that Osa and I have brought out of Africa since then.

Necessary backing

The photographic program which I worked out would require several years and a considerable outlay of money. The details of organization were complex. It was Daniel E. Pomeroy who came to our assistance. He had seen our film, "Trailing African Wild Animals," and was especially impressed with the photographic opportunities in Africa. He established a corporation, and provided \$150,000 for our work.

Then we found ourselves on the way back to Africa where we were to remain for nearly four years while making "Simba." Osa and I built our grass home at Lake Paradise and a couple of years later Carl returned with R. H. Rockwell, his assistant, R. C. Raddatz, to collect the accessories and help in the taxidermy work, W. R. Leigh to do the background painting, Arthur Jansson to do the animal studies, and Mary Jobe Akeley, his wife, to attend to the business details.

Carl was in Nairobi several months before Osa and I were able to get down from Lake Paradise. We found Carl and his assistants working on their first group, not far from Nairobi. The rains were on and he did not care to get too far away until the country dried up, making traveling easier. Then again he wanted to be in Nairobi to meet George Eastman and Daniel E. Pomeroy, who were on their way out for a combined big game hunt and to help Carl in securing the groups.

Mr. Eastman, Mr. Pomeroy and Dr. Audley Stewart arrived, and moved to the house the Akeley's were using at the edge of Nairobi. Osa and I were living at the old Norfolk Hotel, but most of the time were out at the house helping prepare for the first safari out of Nairobi. The rains were on—and I mean on, too! It seemed as though these rains were doing all they could to embarrass me, for I had impressed on all concerned that they should be in Nairobi by the middle of May in order that all arrangements could be made to go on safari by June 1, the official time for them to stop. But it rained and rained day after day. By the middle of June it was still raining and every-

one was getting impatient, so it was decided that we would make a short safari into the Kedong Valley about forty miles from Nairobi, encamp there, and help Mr. Eastman secure a few trophies.

After a few weeks in the Kedong Valley we received word that the rains were stopping in the north country, so Carl and his safari pulled out first and made camp at a water hole on the Kaisoot Desert, a short distance north of the Guaso Nyiro River.

A real beginning

About ten days later the rest of us came along on the way to Lake Paradise. We stopped a night with Carl and here I saw the first actual work that was to result in making Carl's dreams come true. Mr. Leigh showed us the first paintings he had made, and I watched Carl and Rock and Raddatz at work on the first giraffe skin.

Leaving Carl and his staff at work at the water hole, the rest of us, including Philip Percival and Pat Ayers, safaried up to our home at Lake Paradise, then we returned by easy stages to Carl's camp again, stopping at various water holes for pictures and for a few trophies that both Mr. Eastman and Mr. Pomeroy wanted. Mr. Pomeroy secured a beautiful lesser koodoo, and Mr. Eastman secured a most interesting picture of a rhino charge. We saw a few elephants. I made the best leopard flashlight I had ever made, and Mr. Pomeroy shot his first lion.

It must be realized that a camera safari is a much more pretentious and exacting undertaking than a mere hunt where one is concerned only with food and ammunition. The photographic equipment alone runs to considerable weight and it must be carried in duplicate to guard against losses and accidents.

The problems encountered are many and complex. The camera makes certain demands. There must be fair light. The shadows must fall right, else the picture will be flat and uninteresting. The angles of view must be selected so as to avoid bald skies and awkward compositions. The footing must be stable and steady lest vibrations mar the picture. And that is only the beginning. The blind must be built to windward of the water hole so that the scent of the camera man does not reach the animals on some wafting breeze. If possible, the blind should be slightly higher than the spot to be pictured, because the scent, carried by the rising

heat of the body tends to go upward. Also the blind must be as perfect a bit of camouflage as possible. The animals have a critical eye. They do not admire a conspicuous blind. It offends their taste in landscape and challenges their sense of discretion. They do not enjoy having their Africa tinkered with. They do not like the click of a camera either. They never consciously get confidential with a photographer. African animals have only two lines of action with reference to the camera. They either run from it or at it. Neither treatment is entirely satisfactory to the man behind the camera.

Many animals can be photographed from blinds, such as most antelopes and the other grazing animals like the giraffe and zebra. Also now and then one gets a chance at the lions and leopards and other beasts of prey which follow the herbivorous animals to the water holes. But there are animals in Africa which seldom or never drink—the gerenuk for instance. It is but by the merest chance that such animals stray within the range of a water hole blind. They must be stalked afoot by the camera man. It is always a stern chase, which is notoriously a long chase—with usually nothing more to reward the effort than a handsome rear view of a vanishing animal with his tail waving good-bye as he goes over the hill.

Choosing a water hole

Returning to Carl's camp we found that he had finished curing the skins for his water hole group, but Carl was not satisfied with the water hole setting in which the animals were to be mounted, so we spent a day, just Carl and I, walking to a water hole that I thought was typical of the water hole country of the Northern Frontier. Carl liked it and we made quite a few pictures of it from different angles. The only trouble was that the background in the distance was not good. It was necessary to have some hills or mountains in the distance to complete the sky line.

I knew just the water hole he was looking for; it was on the opposite side of the Guaso Nyiro River, almost opposite his present camp. I gave him the directions how to get there, and it was from this place that the finished water hole setting was made.

Osa and I found it necessary to hurry on into Nairobi, so we pushed on ahead, while Carl and Mrs. Akeley and the Pomeroy-Eastman safari went around Mt. Kenya to the north,

stopping a few days at Embu Swamp where the Buffalo Group was secured.

Then all of us together in Nairobi started getting ready for the long safari south to the Serengetti Plains in Tanganyika. A few weeks later found us camped on the banks of the almost dry Seneraro River, and a little later we moved about a hundred miles to the Guremetti River.

Here on the Serengetti Plains we spent about three months and every day was a full day for all of us. We broke into separate parties in order the better to carry out our individual purposes. Mr. Eastman had by now secured the animals he was to contribute to the African Hall and was busy hunting trophies for his personal collection. Osa and Mr. Pomeroy were busy each day going after the Impalla Group. Carl and his party would usually spend a day securing animals needed for the groups, and the next day in skinning and curing, although I have seen Carl and Raddatz work almost all night through after a lucky day.

I would go after pictures each day and had wonderful success in getting the plains types of game, but no lions. Then one day Carl and Mrs. Akeley suggested that we make a picnic day of it and look over a valley where others in our safari had found a large number of lions. We found the lions—thirteen of them, in what we named Lion Valley. Day after day we photographed them, then we would lay off a day or two so that Carl could catch up with his other work, as Lion Valley furnished only pictures, and Carl must keep his own work moving along.

"Capturing" the color of Africa

One day Osa and I were returning from a long day on the plains; it was late afternoon as we were moving along the side of a hill; the lighting effects were beautiful as we looked away across the plains,—rocky outcroppings in the distance, the S-shaped dry river bed in the foreground, and game in countless numbers quietly grazing in big herds in every direction. In the middle distance were a couple of herds of giraffe, wild beasts all over the place, resembling drawings I have seen of buffalo on the American plains in the old days—zebra, topi, kongoni, Thompson's and Grant's gazelles; down under the trees by the river were waterbuck; a wild pig and some younger

pigs trotted across the open space just below us, their tails in the air like flag poles without the flags,—a most interesting, beautiful and peaceful scene,—just Africa. Osa and I wished we could get a picture of it in color, but this was impossible. Then Osa motioned back of us, still higher up the hill and commanding a better view than even the one we had, and there we saw Mr. Leigh with his easels and equipment for painting; he was getting in color what we could never get with the cameras.

Drafted for a hunt

One morning very early (we were always up and eating breakfast before sun-up), I was preparing to go out for another day with my cameras, when Osa and Dan Pomeroy came up with the command that I accompany them on a hunting expedition for the day. Carl was sick in his tent; some of the groups were nearly finished, but a few animals were missing from various groups. Dan suggested that we try to get these animals, but I was reluctant to go. I was having the time of my life with my cameras; the plains were dotted with animals in big herds, a score of different species, lions were plentiful, and I wanted to make pictures while the sun shone, but Dan and Osa argued that I was working too hard and needed a rest; they could not realize that while I was working hard I was having more real thrilling enjoyment than anyone in camp. However, I was forced to accompany them. At first they were not going to allow me to take a camera along, but I flatly refused to leave camp without at least one camera, so they allowed me to fetch an Eyemo, the smallest of the cameras making regular 35mm professional film.

Now I had a grouch on. As I looked up at the cloudless sky, and then at all the game scattering as we moved across the plains, across little dongas and through small wooded spaces, it seemed that every group of animals was in a more beautiful photographic setting than ever before. It seemed they were tamer than on other days and easier to get close to. I became grouchier and grouchier as we moved along, and then to cap the situation we came upon a small herd of giraffe that moved slowly ahead, to be joined by a few zebra, wildebeest, gazelles, and kongoni. They moved slowly, kicking up their heels and stopping to watch us, then moving ahead as friskily as a bunch of young colts in a pasture. They were so

intent on watching us that they did not notice where they were going, and then they suddenly found themselves cornered in a bunch of big rock outcroppings, in a little horseshoe space, with us covering the exit. The light was perfect, the most beautiful grouping of plains animals I had ever seen. I quickly got my Eyemo ready, started it going, made about three feet of film, then the blame thing jammed. Using language that I don't often use, I opened it up, found the film hopelessly tangled, ripped it out and loaded a fresh roll, and was within half a minute of being ready to make pictures when the animals stampeded and rushed past, and away off on the plains. I was the sickest photographer that ever lived, and even now when I look back over the scene that day, I feel sure it would have made the most beautiful wild animal scene ever taken by anyone.

Consolation

Well, you can imagine that this did not help my disposition. I was such a grouch that I am surprised that Dan did not become fed up and order me back to camp; but he probably knew just how I felt and tried to take my mind off the rotten luck I had just gone through, for he saw a lone wildebeest, a very fine bull, just the one wanted for the Plains Group. He turned to me and said "Get him, Martin; he is the exact wildebeest Carl has been wanting."

Now, I am a very poor shot. I don't care to shoot and consequently I don't keep in practice. I own some very fine and expensive guns, but my favorite is an old 405 Winchester that no one else takes seriously. I have had it for many years, and while, as I have said, I am not a good shot, I do hit things with it—just sheer luck. But usually when I do shoot, I do it when I am alone; then if I miss there is no one to laugh behind my back.

But I was in a bad humor and did not care what happened, so I took hasty aim, pulled the trigger, and down went the wildebeest dead as a stone. Gosh! I was surprised. But I helped place the animal in the motor car, and we started back to camp, as all animals for skinning must be treated as quickly as possible after being shot so that the hair does not slip.

Half a mile farther on, a very fine Grant's gazelle was found half asleep under a tree. Osa stalked to a position where she could get a good shot, pulled the trigger and missed, very unusual for her, as she really is a good shot.

Well, feeling as cussed as I did, I raised my rifle and before Osa could get another shot, I pulled the trigger and down went the Grantie, shot clean through the heart, so clean in fact that he stood there for a few seconds exactly as though he had not been hit. My first thought was that I had missed, when he slumped down dead. And Dan and Osa slapped me on the back, telling me what a marvelous shot I was.

Another prize

But the big event of the day was to come. When nearing camp, I saw three pigs away off on the horizon, clearly outlined on the top of a small hill. I don't know how far away they were, but I do know they could not have been less than five hundred yards, and a pig is a pretty small object at that distance. A couple of wart hogs were needed for one of the groups. I had the car stopped, stepped out, and without taking careful aim, I fired. It was only a gesture for I was still sore at the world. Even at that distance we could see the pig tumble over. Going up, we found him stone dead.

That was a pretty good day, three animals with three cartridges. I was feeling all puffed up when I returned to camp, especially when Dan made the most of it in the telling, but I was mighty careful from then on that I did no more shooting before an audience. I had a reputation in camp and I meant to keep it.

A halt in work

By now Carl was a pretty sick man and it was decided that it would be best to send him into Nairobi, so one of my best and most comfortable trucks was bedded down for him, a place where Mary would be comfortable was made, and with John Wilchusen, our expert mechanic from the Willys-Knight factory, driving, he was taken into Nairobi to a nursing home, while the rest of us remained behind. Dan took it upon himself to get the remaining animals for the groups, then we all went into Nairobi. We found Carl much better, but still in the hospital.

We now scattered in different directions. Dan went down to Tanganyika where he secured the Greater Koodoo Group. He made another safari to the Kinna River country on the edge of the Kaisoot desert and finished the Lesser Koodoo Group. Mr. Eastman went up to Mount Kenya after elephant, but was not

successful in getting a big one. He could have shot medium and small elephants, but he wanted a big fellow. Osa and I went back to Lake Paradise, and shortly afterward Carl left the hospital, and with Mary and Mr. Derscheid and Mr. Raddatz and Mr. Leigh went to Mt. Mikeno to secure the accessories and the paintings for the Gorilla Group, and to finish the plans for the Parc National Albert.

There is no need of my going into details as to what happened there, for I am sure that everyone interested in Africa and the American Museum of Natural History, knows of the tragic death of Carl Akeley, but one thing I would like to speak of.

An appropriate resting place

One day, before Carl took sick, he and I were talking of the gorilla country. By this time Osa and I had covered most of East Africa, and Carl was telling me of the photographic opportunities of the Congo. He told me of the adventures he had while with Mr. and Mrs. Herbert Bradley when they secured the Gorilla Group. He went into detail about the beautiful spot where he had been sitting when he saw his first gorilla, and in a dreamy way he said that when he died, he would like to be buried at that very spot. So it was a strange coincidence that he should be taken sick and that he died at almost the very spot he had told me about some months before, and was buried at this place, in the country he loved so well, among the gorillas that he had worked so hard to save from extermination.

Mr. Eastman returned to America, Dan Pomeroy returned a few months later, while Osa and I remained on a few months to complete "Simba." Then we, too, returned to New York. We saw the African Hall start to materialize, but our hearts were in Africa. Osa and I did not remain long in America. Soon we were back in Africa, this time with Mr. Eastman on the Nile and in the Congo and in Uganda, where he secured his white rhino and his elephant.

The elephant presents a special set of problems to the camera hunter. He sleeps through the day and eats in the cool of the evening and night. We have spent weary weeks following various small herds before we could catch them under light conditions that would permit the making of satisfactory pictures. And there is always the possibility that if you get too close

you will spend more time getting out of their way than you will taking pictures.

Then we returned to America again, and the African Hall was moving along slowly. Again we returned to Africa, this time to film "Congorilla" and to visit Carl's grave on Mikeno.

With us was DeWitt Sage, who climbed Mikeno with us. We heard from the pygmies that the gorillas were now on the opposite side of the mountain from where Carl was buried, so it was some weeks before we finished our work with this group of gorillas and safaried over the mountains to Carl's grave, up and down hills and valleys at an altitude around 12,000 feet all the time. Almost exhausted we arrived in the saddle of Mikeno late in the afternoon, with a cold, drizzling rain sweeping through the valley. Osa, DeWitt and I went directly to Carl's grave before making any preparations for camp. Briefly we paid our respects to the sleeping Carl, one of the best friends we ever had. His grave was in remarkably good condition, covered with a cement slab, his name and date of his death engraved over the head, surrounded by a high log stockade to preserve it from the buffalo in the vicinity.

An unhappy beginning

Here we built camp alongside the grave, and spent a miserable night. The ground was soaked with rain, cold fog drifted into the tent; we could not sleep warm because our bedding was wet, and we did not have enough blankets; but outside our porters were in worse shape than we were, they had no tents. They just rolled up in their soaking blankets and went to sleep. I expected to have a lot of sick natives on my hands next day, but they were used to such hardships and not one even showed a sign of cold when we arose next morning with the sun shining clear and bright.

Then we examined the grave again and found that Raddatz had done an excellent job when making it. The large slab covering it was in perfect form without a single crack, and the inscription was as clear and legible as the day it was placed there. It was evident that Mary had selected the best location to be found, as the drainage was perfect.

During the following days Osa made minor repairs to the stockade and planted evergreen

flowers around the slab, while DeWitt and I explored the surrounding country.

Patience rewarded

The first place I now wanted to visit was the spot that Carl had told me about, the spot where he had first seen gorillas, and the place he had described as the most beautiful view he had ever seen. Magollo, Carl's old guide, knew the exact spot and took us there. It was only a stone's throw from his grave. When DeWitt and I reached the spot, it seemed anything but beautiful. The cold, damp fog rolled over the country so that we could see nothing a few feet away, but we decided to linger in the hope that the weather would clear. We built a fire, and determined to wait for a rift in the clouds. Intermittently the sky would reveal itself for a minute or two, then disappear. Patience is a virtue, they say, and in this instance we were bountifully rewarded for our three hours' vigil. Clouds and fog were peeled off the mountain-side. The sun broke through, glorious and clear. We could see for fifty miles or more. Active volcanoes sent thin streamers of smoke into the air. Beyond were rolling mountain ranges. We could see Lake Kivu in the distance, and alongside it a range of mountains to the west which our guides reported were the habitat of gorillas. The scene unrolled before our enraptured gaze was a magnificent panorama, noble, majestic, and overpowering in its effect—a fitting canopy for the final resting place of Carl Akeley, who was its discoverer for the world of white men.

Now that I think it over, I agree with Carl as to the wild beauty of this place, and I will always think that Mr. Leigh's striking paintings that form the background for the Gorilla Group, have captured Africa as it has never been done before.

As I write this, Osa and I are aboard a steamer in the Red Sea on our way to Borneo. Three weeks ago we spent several hours going through the nearly completed African Hall, and we marveled at the wonder of it all. To us it is the finest thing ever done of its kind. We stood in front of the Gorilla Group and again saw that wonderful view from Mikenno. We forgot the hardships and the mist and rain and cold. We saw only that marvelous view with the Gorilla Group mounted into the scene, so real and so colorful. That group is a masterpiece.

Then we moved to the Water Hole Group near Archer's Post on the Northern Guaso Nyiro River. We have camped in at least half a dozen places in the distance in that very scene. It is perfect in its makeup—the water hole itself, the mountains in the distance, the Dom palms scattered between the river and the water hole. Some, who do not know Africa, will think the colorings are exaggerated, but we know they are not. We have visited this place at least a dozen times during the past sixteen years and know the scene as reproduced in the American Museum is perfect in every detail.

The Plains Group

Then we moved to the Serengetti Plains Group. Here again is perfection. Thousands of animals to be seen in the distance are just as you would see them if you went to that spot right now. And we recalled the day we had stopped and looked over the plains and then back to Mr. Leigh as he was painting back of us. We pointed out to each other the places where we had camped during the past sixteen years. Every detail was perfection, and there in the group was the big wildebeest I had shot while with Osa and Dan; and the Grant's gazelle.

Then we were in front of the Impalla Group that Osa and Dan had worked on so hard in order to get the animals of just the right size. I was not along when they secured this group, but every mounted animal meant an adventure to Osa.

And there was Dan's Greater Koodoo Group. Neither Osa nor I were along when he secured the Koodoo, but Dan had told us of his trials and hardships in getting these beautiful animals. We met in Nairobi at dinner the night Dan returned from Tanganyika, and heard his thrilling story of getting them in that hot, rocky, semi-desert down near Dudoma.

We were not along when Mr. Eastman secured the Buffalo Group at Embu, but we know that buffalo swamp well, and know it is true to life—the cow herons on the backs of the buffalo and scattered about in the swamp, snowclad Mt. Kenya in the background, the hills in the middle distance, all just as they should be and all marvelous in their perfection.

The bongo and the giant forest hog among the dense bamboo forests—why, we could almost feel that we were there again, especially Osa who has spent much time up there

hunting bongo and fishing for trout in the clear mountain streams.

Realization

It's a wonderful hall, that African Hall. Surely if Carl could see it today he would not be able to find a flaw, and how proud he would be that his dream had come true, and that the people of America could see Africa exactly as it is—Africa that will some day disappear as civilization marches in.

Osa and I feel proud that we have had a small part in making Carl's dream come true. The elephant herd in the center of the Hall was not completed when we left America, but we can visualize it from the drawings and small models. Mr. and Mrs. Davison spent months in getting the four elephants to add to the four that Carl secured and mounted before

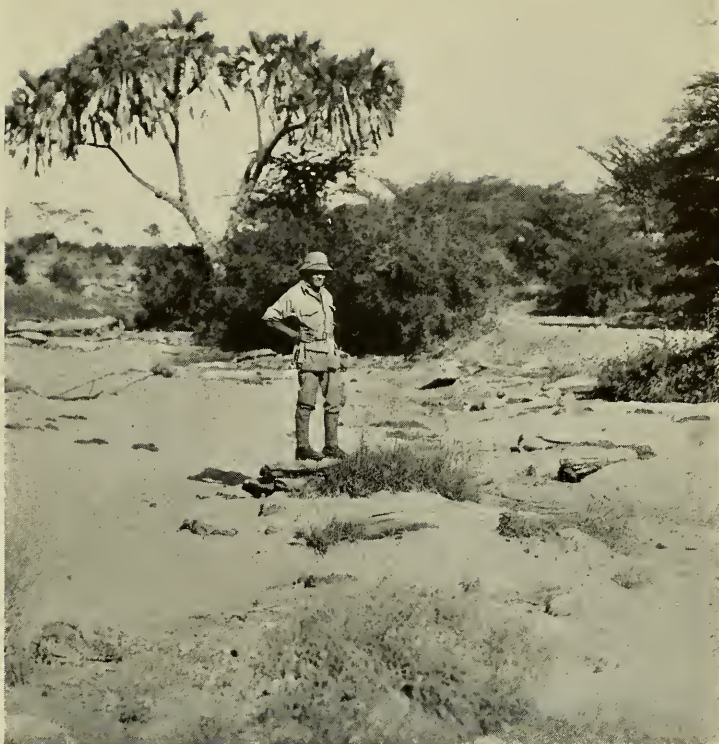
he died. We were with the Davisons when they shot the elephants on the Tana River in East Africa—every elephant an adventure. What a thrill for them when they see their herd combined with Carl's!

The men behind the Akeley Hall

It was the late Henry Fairfield Osborn, for twenty-five years president of the American Museum, who saw Carl's dream start and helped work it out. It was the energy and enthusiasm of Dan Pomeroy who pushed the Hall through from beginning to end; President F. Trubee Davison whose interest kept the idea going; James L. Clark and his staff of taxidermists who have supplied the last word in mounting; the staff of painters who have reproduced the African scenery so truthfully.



(Right) Carl Akeley surveying the water hole which was chosen as ideal for reproduction in the American Museum group



(Below) The personnel of the Eastman-Pomeroy-Akeley African Expedition





(Above) Mr. Akeley changing a film pack in the field



(Left) Mr. Eastman with a native porter in Tanganyika

(Opposite page) Upper picture—Mr. and Mrs. Akeley with a group of Lumbwa natives

Lower picture—Messrs. Leigh and Jansson, artists, showing the sketch for a group background to Messrs. Pomeroy and Eastman





The giraffe—a creature that makes a fantastic picture on the African landscape. These were photographed on the Serengeti Plains, where game in countless numbers quietly grazed

The most difficult type of picture to obtain is one showing wild animals in an undisturbed and natural state. The photographer has not only to consider the usual problems of light, shadows, and composition





A water hole is an ideal spot for a photographer of wild life to catch his game. A giant eland may be seen above in the center foreground, with several oryx and zebra near by

ut has to work without letting the alert creatures know of his presence by sight, sound, or smell. The picture below of a herd of Grant's gazelle is well worth such effort

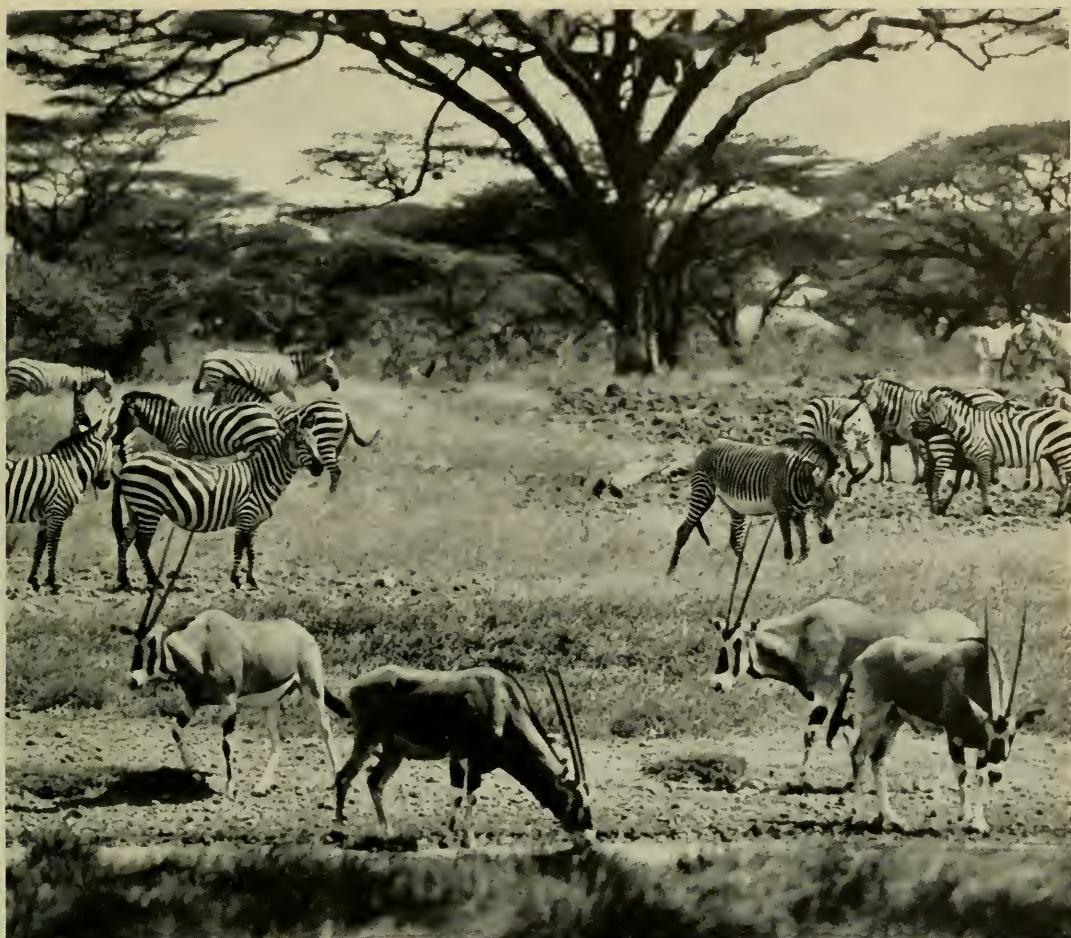


(Right) Camp of the Eastman-Pomero-roy-Akeley African Expedition combined with the Johnson party at Tanganyika



(Below) A leopard which made a flash-light picture of itself (in coöperation with Mr. Johnson) at Lake Paradise





(Above) A typical assemblage in the search for water—oryx and zebra at Chobe water hole

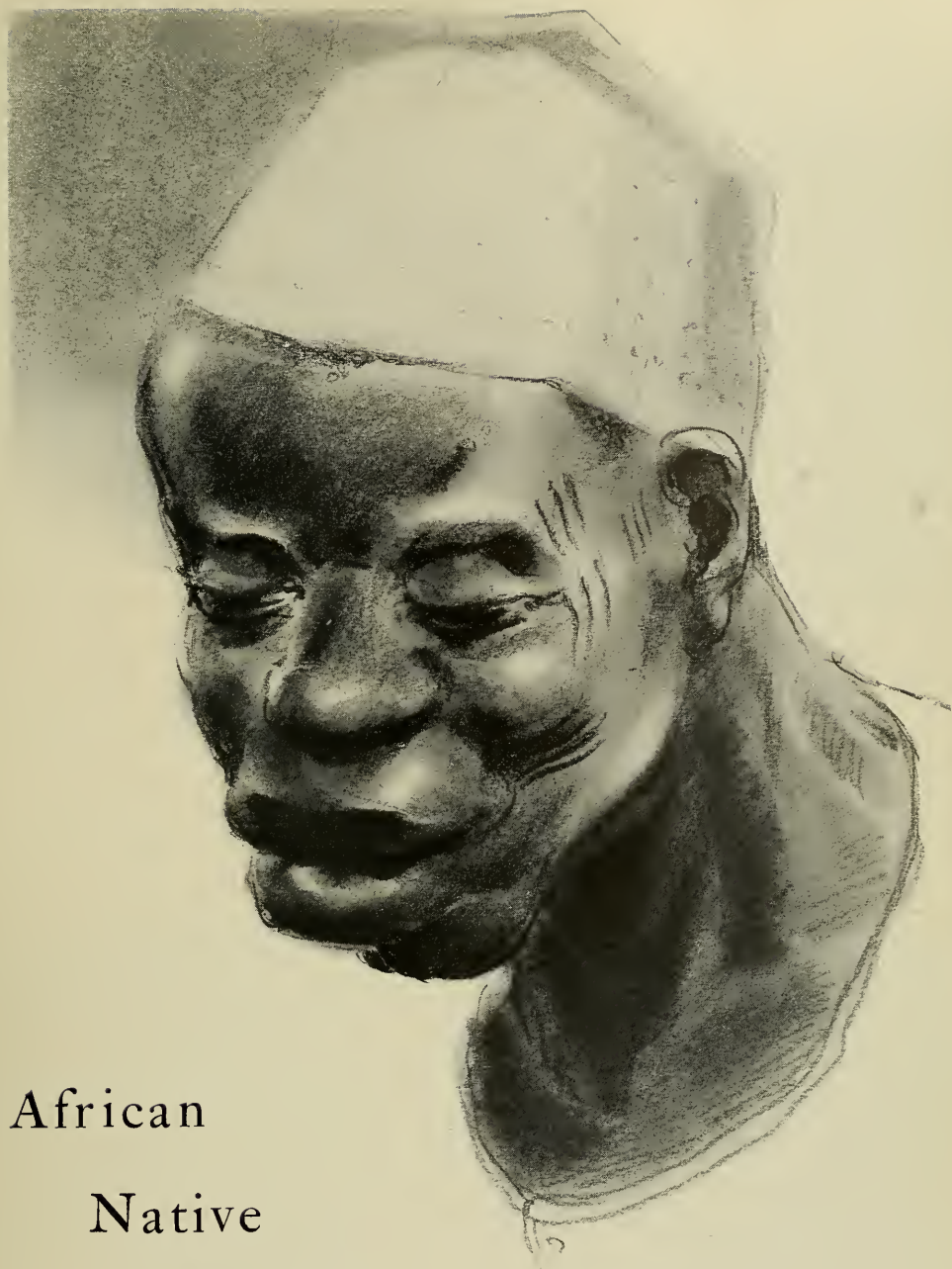


(Right) A group of wild dogs apparently entirely unaware of their proximity to a camera



Carl Akeley's final resting place on the slopes of Mt. Mikenno, in the gorilla country he loved so well. (Above) Mr. and Mrs. Johnson at the end of their pilgrimage to pay tribute to the memory of their departed friend

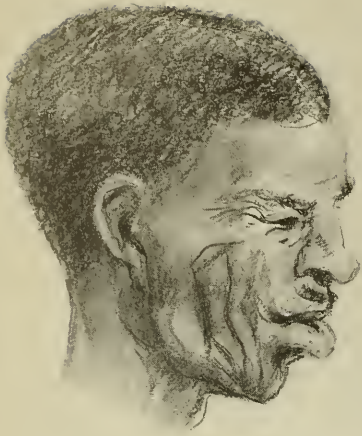




African Native Types

*A series of drawings by Carl
N. Werntz, President, Chi-
cago Academy of Fine Arts*

*A Hausa merchant, from Lagos,
Nigeria. He offers for sale in-
tricately stitched leather novelties,
all the while blissfully unconscious
of the similarity of their design to
the pattern on his own tattooed skin*



(Above) The artist sketched this individual because his facial angle was so like that of the wax Bushmen in the Cape Town Museum



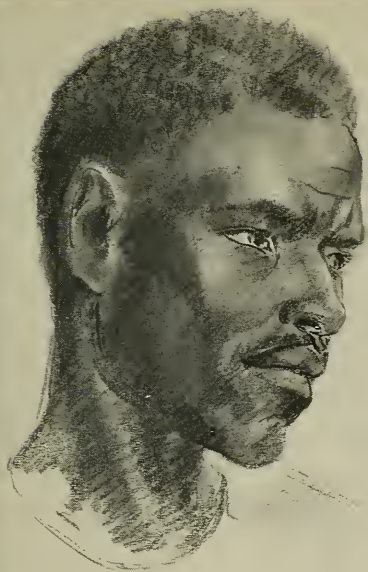
(Above) "Nona"—escaping some of her race's cranial distortion—is a true Hottentot woman, rather pretty in bright print dresses fashioned after an ancestral "Missie's" wardrobe

(Below) This old Wamanyama woman dancer of Mombasa has crowded every possible decoration into her headgear and painted her face white to celebrate the end of Ramadan

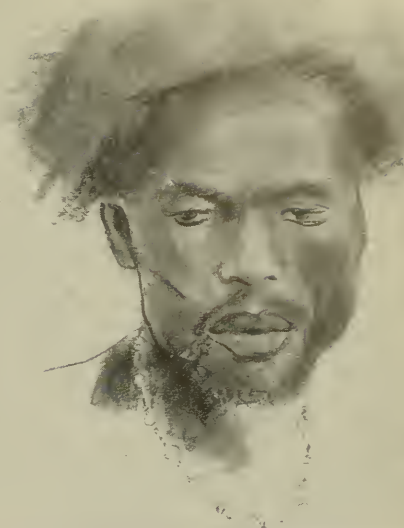


(Below) The Abakota market woman of Lagos wears a typical headdress without which she would suffer loss of trade



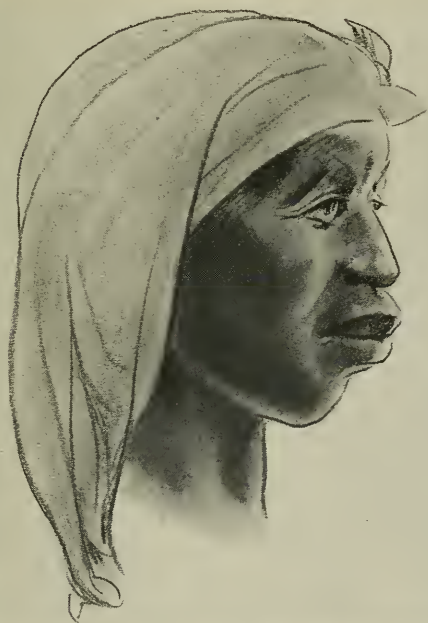


(Above) "Mwemba" a member of the Mtoka Tribe, Northern Rhodesia. He was adopted in infancy and raised to manhood by Hottentots. He is now an intelligent garage worker



(Above) Pholongwane Magugula is a warrior in the krall of the Paramount Chief, Swaziland. Occasionally he writes poetic war chants

(Below) A Chimondo girl from Hana del Norte, many miles inland from Portuguese West Africa's coast. She works at collecting coconuts for a Garden of Eden oil mill

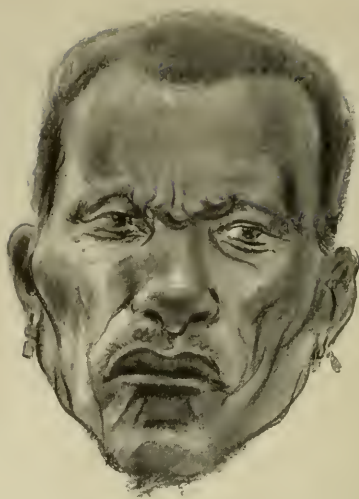


(Below) Ntitobhi—a Swazi "princess," sister of the Paramount Chief. She was the only member of that "royal" family who was willing to sit for a portrait



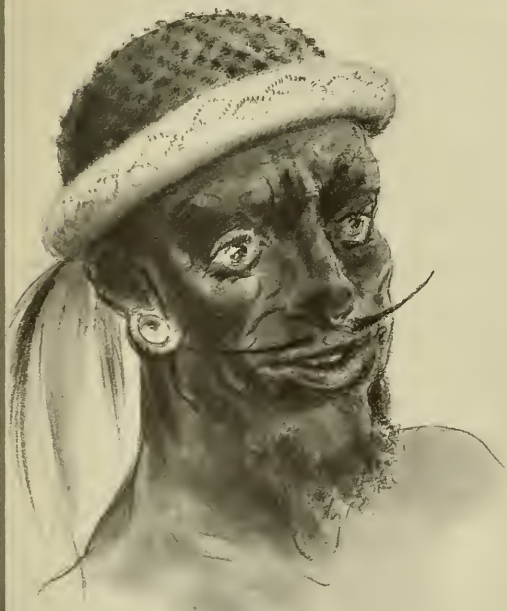


(Above) Eshowe, a Zulu girl, decorated with beads strung on her own hair grown long for the purpose. The beads are European, the craft African. Eshowe writes her love letters also in beadwork

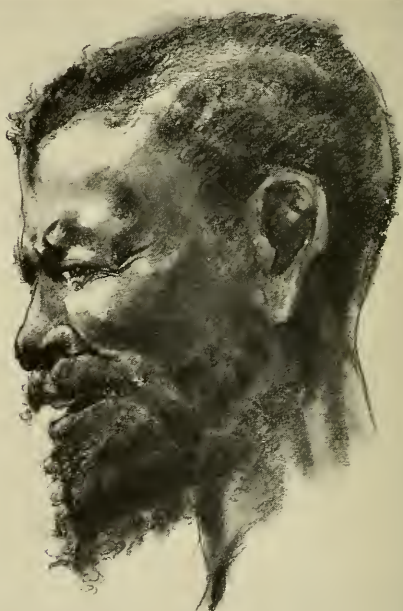


(Above) Jafuta, Matabele Induna. Intelligent, soft voiced, and deeply concerned for the depleted food supply of his people, he was found miles out in the trackless bush south of Victoria Falls

(Below) Ready for a celebration is this Zulu headman, whose ceremonial feather headdress and waxed moustache proclaim him a dandy



(Below) Sobhusa, Paramount Chief (hereditary "king") was reluctant to pose because he was not dressed in official silk hat and frock coat





(Above) Induna Dhlamini. The official position of this Swazi Paramount Chief adviser is indicated by the feathers in his hair which were selected for the purpose with the most painstaking care



(Above) This Hottentot sketched in Walvis Bay—a town not quite registering as either land or water—readily admitting his race, claimed the name of “Joseph,” but when pressed, acknowledged he really was “Gachab”

(Below) A Fula merchant of Accra, British Gold Coast, bears a close resemblance to his Moroccan brothers across the Atlas



(Below) Proud of his office is Police Sergeant “Mciniseli,” a trim government employee in Manzini, Bremersdorf, Swaziland





A NATIVE ARTIST

This Kubindo sculptor in Luanda, Portuguese West Africa, like any artist, loved his creations. Though glad to sell

for civilization's modern exchange, his natural recompense came by finding others who liked his birds of carved wood

The Image of Africa

Africa and its beauty—mysterious jungles, rolling plains, strange trees and flowers, roaming animals—invite the visitor to the American Museum to explore at his leisure

By JAMES LIPPITT CLARK

*Director of Arts, Preparation and Installation,
American Museum*

BEHIND the scenes of a great institution like ours there lies another little world, quite different from what our visitors suspect when passing through our quiet, spacious halls, viewing scenes from other lands so real they quite forget they're in a museum.

Back of these closed doors our little world just buzzes with its infinite interest and manifold activities of management, research, and exhibition.

Little, too, does our visitor suspect that from our Museum building pour forth each evening more than five hundred men and women who serve our institution in one way or another throughout the year.

Highly specialized units

Around each activity are grouped individuals especially selected to serve that particular branch in some way or other. Not least of these multiples of highly specialized units is the department of arts, preparation and installation, a group of artists, craftsmen, technicians and assistants, who, in coördination, create, besides many other things, those colorful exhibits of animals in nature, those scenes which are truly works of art, like great paintings in three dimensions.

Such exhibits fill African Hall. Akeley did much, through his development of technique, to make possible such exquisite pieces of work. Without his tireless hours of work and research, he never would have developed the

sculpturing method of setting up animals, instead of "stuffing" them; nor would he have developed that ingenious and highly technical method which makes it possible for us now to undertake a whole herd of elephants as the centerpiece for African Hall. Elephants before were a bugaboo to taxidermists and museum directors alike, for they implied such seemingly insurmountable difficulties that they were only very occasionally attempted by some courageous soul or some ambitious one who, ignorant of the difficulties, went headlong to disaster. And that is why so few are now to be seen on exhibition.

Progressive ideas

These improved methods, with the artistic ability of the various members of the preparation staff, have alone made possible those wonderfully lifelike animals now to be seen in African Hall, while other progressive ideas, in the construction of groups and group cases and details attendant upon them, all laid the foundation for the very successful culmination of this beautiful hall.

My association with Akeley began in 1902, when, coming to this Museum purely as an animal sculptor, I became acquainted with him while he was still associated with the Field Museum. He became interested in my work, and after a time divulged to me all the secrets of his new methods. He told me he looked to me to "carry on," and from then until his death we worked side by side, in Africa, in the Museum, in the development of his camera, and in the planning of this great hall.

He died when on the threshold of the realization of his greatest dream, and it fell to his

associates to carry on. To me came the part of organizing the staff for creating the groups themselves and guiding the artistic phases of these and the hall. Akeley had constructed a small architect's model of his proposed hall. This, on a scale of one inch to one foot, showed the main and mezzanine floors, with spaces for sixteen groups to a floor and his four elephants in the center.

In this, one or two little sketch models of groups suggested what might be the treatment of the others. Obviously, as there were so many kinds of animals in Africa, the difficulty was not what to put in, but what to leave out. Opportunities, too, would often govern the selection and securing of a group, so Akeley went to Africa on his first trip with an open mind.

As a result of this first African Hall Expedition—the Eastman-Pomeroy-Akeley African Expedition—several groups were collected, and upon my return from the Morden-Clark Asiatic Expedition, I was asked to take full charge of this work and organize a staff to cope with the very pretentious program ahead of us.

No such thing had ever been attempted before, either in quality or scope, and there were no precedents to guide us. Ways and means had to be found for the first time, problems had to be overcome as they arose, and methods invented to meet new demands.

A staff organized

First of all was the building up of a staff, which eventually totalled some forty-five, all directly or indirectly on African Hall. With outstanding co-workers like Mr. Albert E. Butler, my associate chief, Mr. W. R. Leigh, as master background-artist, assisted by Dudley Blakely, Messrs. R. H. Rockwell and John W. Hope as the leading animal sculptors, and Messrs. U. Narahara, G. E. Petersen, G. F. Mason, J. P. Guerry on the flora and foregrounds, and a score of other hand-picked artists and craftsmen, we began to move forward in the building of these exhibits.

Now that we had started, questions and problems not previously anticipated began to arise, while, for the time, at least, no answers could be found. Things were dependent upon one another, and the only way to solve them was to build a larger miniature model of the hall, wherein we could work out these prob-

lems and at the same time develop the ensemble of groups and hall.

This we did, scaling it two inches to one foot, which was large enough to develop our plans. From architects' blue prints of the building itself we built this model, setting structural columns and other fixed features in their proper places and then developing the interior treatment of case fronts and group spaces.

The group in miniature

When the structural and architectural problems were solved, we concentrated on the groups themselves, the animals to be shown, the type of country and its flora. From a mental picture based on our personal experience and data at hand, we began constructing our little groups, also in miniature. Little animals were modeled and painted, little trees and little rocks made, and then all assembled in our little group, behind which the artist painted a scene of the African veldt or jungle forests. All was arranged to tell the story of how and where these animals lived, and changes were made to perfect the composition, both in form and color. It was like a little doll's house—placing each little piece of furniture so as to develop the best decorative treatment of that little room.

Several groups were carried on at one time, purposely, so that we might, while making them, get them as varied as possible and show not only different animals, but totally different types of country and totally different plant life.

These were made in contrasting color tones, moods of nature, to give further variety. It was give and take here and there, until our little groups were well balanced by contrast and accepted as final. These then became our working models, our "blue prints," to guide us. Problems of construction, lighting, balance, technical difficulties, and many other lesser pitfalls were all solved in this miniature hall, and all of our uncertainties and experimenting were finally behind us.

We could now go forward. The background artist knew just what he was to paint; the animal sculptor knew just how to pose each animal; and the creators of the flora and foreground knew just what plants were to be made, how large they were to be, and where each was to go, so that it could be built to exactly fit the spot.

True, minor changes would be made as we

progressed, but only if they suggested themselves as improvements, but for the most part everything was closely adhered to. Otherwise, the careful planning in our little model would go for naught, and our group might flounder in hopeless confusion, far beyond ever bringing it back into a coördinated unit of artistic composition.

Opportunities in the field

None of this could have been accomplished so successfully of course, had not most of those working on it been to the field and seen Africa. There is no way of imparting to a creator of an artistic unit those subtleties which give that finesse that differentiates the ordinary from the exquisite. Such things must be felt, must be absorbed and assimilated, and then in turn, with understanding and enthusiasm, given out by the creator.

In so much as he has had the opportunity to see the beautiful and the power of feeling it, just so much will he give out in the expression of his work. Whatever success African Hall may enjoy, therefore, is due to the careful selection of our personnel and the opportunities they have had in going to the field.

The successful creation of a group or a hall does not begin behind the closed doors of the laboratory or office, but has its conception from a knowledge of the field condition. Akeley would never have dreamed his hall, had he not been to Africa several times and had its beauty and wonders indelibly impressed upon his mind.

So with the unit of a group—its first conception must come from experience in the field, from someone's knowledge, based upon what he has seen. Animals, plants, and material cannot be taken without a plan, an idea, of what the unit is going to be. Therefore, our groups are very often conceived in the very lair of the animals.

And with the animals—a successful group begins with the careful selection of the individual animals through the field glasses, even before they are shot. Then follows the painstaking and intelligent preserving of the valuable skins, that they may arrive at their destination without damage.

This is also true of the plant life, first selected for the part it plays in the animal's life or what its presence may indicate to the botanists or the geologists. Each unit selected should have some significance in relation to all others in the group.

In this way our groups gain in educational value. Even in the case of the background, it is not just a scene. It is a painting of a very definite spot in Africa, selected because it not only is the place where the animals were taken, but because it typifies the characteristic country in which they are to be found.

And so it goes—ever back to that intimate study of nature, before we dare make a selection, or even a decision. Much of the creative side is over when the material reaches the Museum. From then on, the technical side is foremost, wherein much labor and patience are involved.

True, not all the creative work is done, for now we must recreate what we have torn down in the field in order to bring it back. Now we have but the flat, dirty, and ugly-looking skin of the animal and a greasy lot of bones. We have none of the style, posture, or rounded conformation of his beautiful body. We have none of those veins and tendons and ripples of the muscles or the flash of the eye or pitch of the head. All looks hopeless.

"How can you ever make anything out of that mess?" says our visitor.

Those old dry bushes with dead leaves; and old tin cans full of dirt; bundles of stuff that looks like hay; pieces of old rock; some logs and an old tree stump—they all look headed for the ash heap.

Re-creation

Well, that is exactly what the department of arts, preparation and installation does—recreates those lovely groups from a "mess" like that. That is the material side. The art comes from elsewhere, from what we have seen, from what we have absorbed, from what we have felt.

Now the animal sculptor begins his clay model of the animal. From measurements, photographs and studies, he places the skull and leg bones of the animal on a frame and piles on clay until he has an anatomical study of the animal without the skin, the clay going over the bones where the muscles came off. While he carefully sculpts the contours, the tannery is at work preparing the valuable skin, which, in a relaxed condition, is frequently thrown over the model to check the fit and posture of the animal.

When all is satisfactory, a plaster mold is made of this clay model, and in this mold is

constructed a thin, light shell of maché and wire screen or burlap. This shell, reinforced with wooden ribs and iron rods in the legs, is removed from the mold and assembled, and now carries its own weight.

The skin, now completely tanned into soft leather, is relaxed in a poison-water to prevent attacks by insects, and in this flexible condition is applied to the modeled form with an adhesive. It is arranged as one would fit a wet glove on the hand, adjusted here and there, until each part is properly placed over its final position. The seams are sewn together and then it is allowed to dry.

Carefully made glass eyes of proper color are inserted and the lids modeled softly over them, while the cartilages of the ears are entirely replaced with sheet-lead replicas.

When thoroughly dry, a good brushing and arranging of the hair, painting of the eyes, lips and nostrils, add the finishing touches which give that final effect of life. Hardly can one believe, turning to other old bones and skins still untouched, that such a lovely creature could be made of them.

As for the old logs and sticks and bundles of bark, these become trees, and upon them go green leaves, shapely and fresh, as if in nature, so lifelike that our visitor hardly suspects they are made of beeswax and cotton, sheet celluloid, or just colored crepe paper. Bushes, too, come to life, with a burst of gorgeous flowers, which only Solomon's bees could detect, "re-created" from that jarful of colorless and wilted, but preserved, bunches of seemingly nondescript vegetable matter.

Growth of the units

All is definite material—supplemented, of course, by pencil sketches and color notes, to supply those elements which have been fugitive. Tins of soil serve as samples for the ground, while bits of rock give the color and texture of the big ones too heavy to bring back home and which we have decided to recreate also. From our photographs we faithfully reconstruct replicas in wire screening which we cover with burlap and plaster and stipple with a sponge or brush, to give it the desired texture. From our sample, an artist carefully colors it so true that we ourselves cannot be sure which is which, unless we pick it up and feel the weight.

Clumps of old dead grasses, mosses and

lichens are rejuvenated in a bath of hot water, which swells them back to normalcy. Another bath in glycerine, water, and arsenic holds them against further shrinkage and possible attacks of hidden insects, while they are air-brushed with colors of selected hues.

True to the model

Unit by unit grows throughout the various corners of the studios, while in the hall itself, after group cases have been constructed of iron and plaster and have been surfaced with canvas, the artist paints the background.

Now he must follow our little model closely and not deviate, lest he disturb important features of our composition. All units have been so dovetailed in their careful placing that to disturb one now would involve changing all, and we have gone too far for any reconsideration.

Lights are installed, adjusted from above to enhance desired color tones or to cast sunlight and shade over animals or parts of our group. Units, like rocks or bushes or even an animal, are put in from time to time to establish the proper relations of color between foreground and background.

With all units complete—painting, animals, plants, trees, rocks, etc., which may take a period of from one to three years after all this material has been taken in the field—we finally give the group a "dress rehearsal," and assemble them all within the case.

It is only now that we may break faith with our little model and turn wholly to our group, for now we have it all together and can see in the big life-size unit how well our little model has worked out.

Factors sometimes change when enlarged to life-size form, and only now can we best judge whether a change here or there will improve the whole, or not. Seldom do we make any radical change, hardly more than moving something slightly, or transposing two lesser objects.

With the final arrangement approved, the groundwork is laid in and constructed around the major units now in place.

For this we use a framework of wood, covered with wire screen, burlap and plaster, much like the rocks, and give it texture and a surfacing with the natural sand or soil, as the case may be, while the colored clumps of grasses

and smaller bushes are incorporated in the ground as we proceed. Débris from the ground, broken sticks, dead leaves and blown grasses, a land-snail shell, a piece of an old horn from some departed denizen, are strewn about in careless manner, as the last finishing touches to our group.

A final once-over, arranging the direction of some blades of grass, slightly adjusting a light that it may put a sparkle in the eye of an animal, a shadow here or there—and the plate glass goes in place, not vertically, but on a slant, so that one standing in front of it may not see reflections.

One by one our groups grow into being and take their chosen place in large niches of the hall, for they are selected for those very places, to make the hall an ensemble equally as much as a setting for the group.

The Hope panels

Large bas-relief panels, beautifully modeled by Mr. John W. Hope, and finished in silver, adorn the darker areas of the case fronts above group openings. Silver, too, is the color note of the mezzanine group fronts. Its life and neutral color serve well the ensemble of the hall, and likewise the group.

The great centerpiece of African elephants will, of course, be the most outstanding and

awe-inspiring unit in the hall. As one enters from the Roosevelt Memorial, one sees before him a whole herd of these ponderous beasts. In no museum is there an exhibit to compare with it. Eight in all form the group, four originally mounted by Akeley, and four collected by President Davison and now being mounted by Mr. Robert H. Rockwell, of this department.

A herd of elephants in itself is an astounding and momentous piece of work to attempt, yet it is but a part of our African Hall program.

Life-size bronzes of African natives, by Malvina Hoffman and others, will stand between groups before the columns, while all is bathed in a diffused light emanating from indirect fixtures in the ceiling.

Jungle light

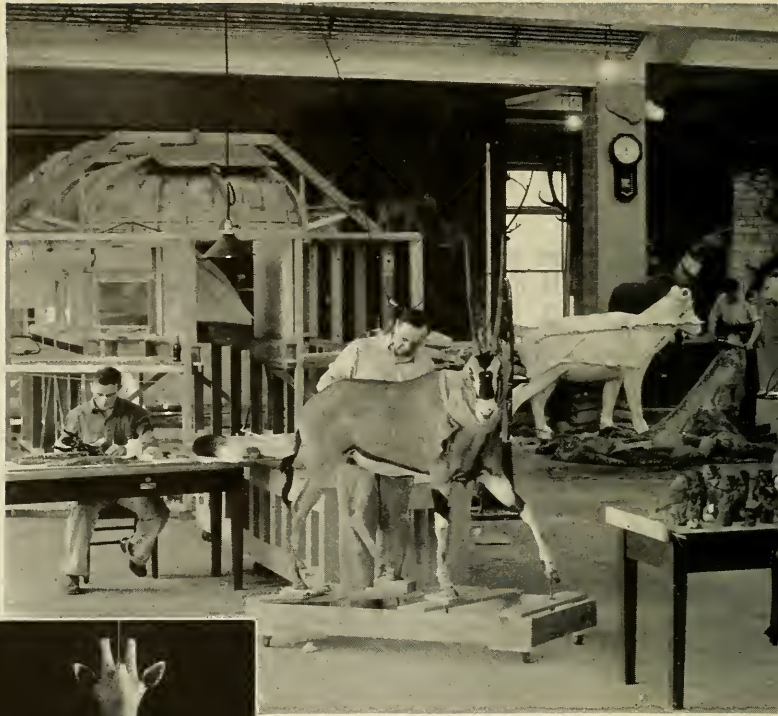
Upon entering the hall, one finds himself in the deep mysterious lighting of an African jungle. Not a single light opposes the eye, while the groups themselves stand out in a blaze of sunlight, as if one were looking through open windows across a torrid veldt.

Passing from one to another, our visitor sees Africa and its wonders—its roaming animals, its colorful flowers, strange trees and rolling plains and forest jungles. Transplanted Africa stands before him—a result of Akeley's dream.



One of the panels modeled by John W. Hope to go in the case front above the groups. This panel adorns the Giant Eland Group.

(Below) Mr. R. H. Rockwell giving the finishing touches to the clay model of the large giraffe for the Water Hole Group



(Above) Activity in the top sky-lighted studio of the Museum. Most of the animals shown here are in the Hall groups. In the right foreground a preparation is to become part of the herd of eight elephants

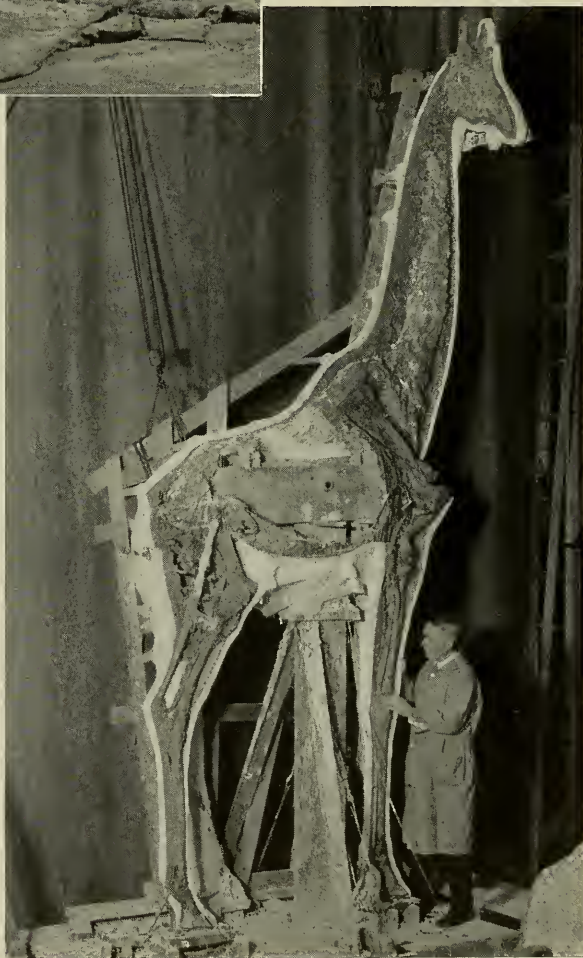
(Below) Detail study of the head of the large bull eland in the Giant Eland Group





(Below) One side of the three-piece plaster mold has been removed from the completed clay model of the giraffe

of the preparation department at the American various stages of creation are for the African ator is paring down an elephant's skin, which that forms the central exhibit of the Hall



(Below) Detail photographs of newly collected animals are a valuable aid





The foundation for mounting an animal is an armature constructed of wire mesh, burlap, or plaster, using the leg bones, skull, and any others that may be helpful in giving the proportions, action, and other characteristics of the individual specimen.

This armature is sufficiently flexible to permit change of action or position at any stage of making the model. Water clay is built up on the armature, using the field measurements as a guide to the accurate reproduction of the animal



RECREATING



When the clay model approaches completion, the skin is soaked and tried on. Any slight changes that may be found necessary are made after this fitting, and the skin given a final try-on before proceeding with the casting of the model, as shown in the photograph at the lower left.



A plaster mold is made in three pieces and reinforced on the outside, so that it can be removed from the model without breaking, and also make the building of the manikin more convenient

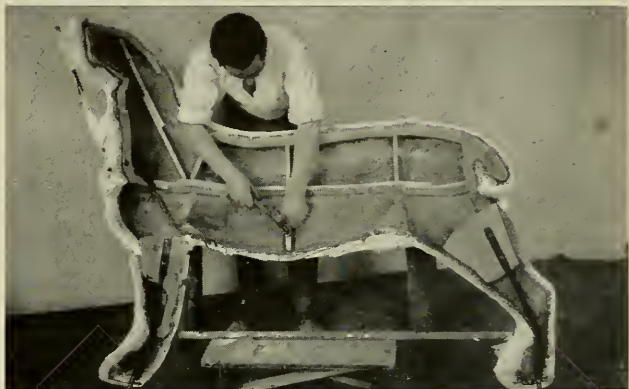
The manikin is built of burlap, wire mesh, and a very durable and hard-drying papier maché, reinforced inside with wood ribs cut to the body form and secured with maché. The burlap is first fitted into the form with glue, after the mold has been sized with glue. Thus, when the form is completed, it may be released from the mold by soaking the plaster with water. The three sections are joined after removal from the mold.

At this point the figure is an exact replica of the clay form

AN ANIMAL

The skin, which in the meantime has been tanned, is now applied to the modeled manikin with a special and enduring maché paste. Soft, slow-drying maché is used wherever necessary to bring out the delicate modeling of veins or wrinkles and details around the eyes, nose, and lips.

The glass eyes are fitted into position with great care after the skin is in place. Finally, with the waxing and coloring of fleshy parts, the mount is complete





(Above) The several plants shown here have been reconstructed in paper, wax, and celluloid by Mr. Narahara, who has had formalin-preserved specimens, photographs, and color notes, taken in the field, to guide him

(Right) A close-up photograph of a plant to guide the preparator in assembling the various fabricated parts



A form such as the ant hill shown at the left is too fragile to be shipped without breakage. However, with a few well-preserved samples for texture and with good photographs, the preparator can reproduce the form with impressive accuracy



(Left) This detail of a tree base almost engulfed in an ant hill has been reproduced in the Giant Eland Group

(Right) Trunks of large trees are seldom used in a group, but are modeled in maché over a form built of wood, wire mesh, plaster, and burlap. Photographs of the tree and samples of the bark are all that are needed by the preparator



(Below) Mr. Raddatz, a member of the Eastman-Pomeroy-Akeley African Expedition, is here shown making plaster molds of freshly selected leaves at the field base





In no other museum have whole halls been planned and carried out as a unit. Even while carpenters, iron-workers, and masons are con-

structing the cases, an artist is at work painting a background. Every available preparator is at work on some part of a group



A study of an African plant

The Water Hole Group

THERE has been an exceptional opportunity in each of the four corners of the Akeley Hall of African Mammals to build habitat groups of unusual size and depth. This has been especially effective in the portrayal of panoramas, mountain vistas, and great game herds. One of these larger exhibits is the Water Hole Group, representing a scene along the Guaso Nyiro River.

The water hole is to the animal life of Africa what the public square is to a town; it is the center of activity, the focal point of interest. At the water hole the various species come to drink and, social or solitary in disposition, mingle, perforce, with the other animals. Here the beasts of prey naturally find a favorable concentration of potential victims. The African water hole is one of the world's big spectacles of wild life.

In many parts of Africa, where a long, rainless season dries up small streams and practically eliminates available surface water, there will be local areas where the geological configuration provides a supply of water just under the surface of the ground. In such a spot a well or a natural depression will yield water in an otherwise semi-desert environment. Furthermore, this particular spot may afford the only water for a district a great many square miles in extent. Frequently the mammals dig out

their own depression, when Nature has not provided one, and when the soil is soft, a series of water holes may be established.

The giraffe (the subspecies shown is the reticulated giraffe, *Giraffa camelopardalis reticulata*), in comparison with other mammals, seems to be a misfit, a caricature of the normally proportioned animal. At the water hole the long forelegs seem especially awkward, for the giraffe cannot get its head down to the ground level, much less to a depression below, without spreading the forefeet wide apart, and it is fortunate that its neck is so long.

There are a great many varieties of African gazelles but the Grant gazelle (*Gazella granti*) is one of the best known and most easily recognized. It is the largest of the African gazelles and there are quite a few sub-species or geographical races, the one shown in the group being *Gazella granti raineyi*.

Most of the gazelles are plains or open country antelope, preferring the wide, open spaces to the forested areas. A few species work upward into broken country, follow valleys up into the mountains, or find congenial environment on an elevated plateau. The Grant gazelle wanders with the great assemblage of game that roams upon plains more or less well-grassed, with thorn scrub and occasional sparse forest growth.







GIFT OF MR. GEORGE EASTMAN.

ANIMALS by Robert H. Rockwell, John W. Hope, and Louis Jonas.

BACKGROUND by Wm. R. Leigh.

FLORA AND FOREGROUND by Albert E.

Butler, assisted by George F. Mason, Joseph M. Guerry, and Carlton McKinley.

BIRDS by Raymond B. Potter.

DIRECTION, James L. Clark.

SCIENTIFIC DIRECTION, H. E. Anthony.



As is true of so many plains antelopes, the Grant gazelle relies upon its fleetness of foot to escape from its enemies. All its senses are keen, its power of vision being especially good, and it does not attempt to hide or to seek cover. Since there is so little cover which would hide a gazelle in most of the country frequented by these animals, the ability to keep well in the open from a predatory animal is the all-important factor.

The beisa shown about the water hole are of close kin to the gemsbok, the oryx featuring another group in the African Hall. The particular subspecies in the water hole group is *Oryx beisa annectens*, a variety ranging from the Tana River to the border of Abyssinia.



Beisa show a preference for dry plains where they can feed in open stretches of grassland. They may also be noted in areas dotted with low, thorny scrub. They travel in bands of as many as fifty individuals, but more often are seen in small groups. A herd is controlled by an aggressive old bull which keeps less powerful males out of the company until such time as a newcomer is able to drive him out to wander alone or with another outcast like himself.

Not only do the mature males fight actively among themselves, but they are not slow in turning their long, sharp horns against other species. In this reliance upon their natural weapons, both sexes compel respect from the other mammals, and a wounded beisa must be approached very cautiously and with the expectation of a charge.

In most of its behavior the beisa conforms to the usual pattern of dry plains animals, most active morning, late afternoon, and night, relying upon good vision, powers of scent and speed for protection from enemies, and possessing an ability to lead a successful existence with very little water.

The Grevy zebra (*Dolichohippus grevyi*) may be used as a representative of the rather large group of African zebras, although it has certain anatomical characteristics which the specialist uses to set it apart from the other striped horses. To the layman there is an affinity of relationship denoted by the conspicuously striped pelage and the compact horselike build of the zebras which makes it easy to identify one of these animals at a glance.

The zebra is one of the favorite food animals for lions, but despite the inroads of predatory animals, the zebras occur in great numbers over a large part of Africa. The Grevy zebra is essentially a plains type, grazing on the dry grasslands and through districts where no heavy forest occurs. It ranges from south-eastern Abyssinia south to the Tana River. It usually travels in bands of from five or six to several hundred animals.

The Grevy zebra is much larger than the Grant zebra and has more stripes. The two species may be found, sometimes, in the same territory and even mingle in a common herd.

—H. E. ANTHONY

Future Plans for the

By F. TRUBEE DAVISON

President, American Museum

AFRICAN HALL, as it stands today, is a splendid memorial to Carl Akeley and a living testimony to the generosity of those who gave their time, thought, and funds to the realization of his magnificent vision.

Still, superb as it is, the Hall is but partly completed. Only half the number of groups which eventually will be housed in this latest and loveliest of all Museum halls, have been collected and installed.

Out of the total of twenty-eight groups that have been planned, fourteen are financed and only ten are really completed. The remainder, fully as interesting and important as those now provided for, await the sponsorship of those who would like to lend a hand in the effort to perpetuate within the protecting walls of the American Museum a cross section of the Africa which Akeley knew and which is rapidly disappearing.

It may be well at this time to give a brief outline of the habitat groups still unprovided for in the Museum's African Hall project. They include black rhino from Kenya, addax from the Sahara Desert, okapi from the rain-soaked forests of eastern Congo, mandrill monkeys from the coastal regions of West Africa and the spectacular Colobus monkey which is not only celebrated for its beautiful markings but also intensely interesting from a biological standpoint.

Among other interesting groups which we hope to create in the African Hall are the following:

A scavenger group which would show a typical African scene with the scavengers of the veldt, such as vultures, marabous, jackals, and hyenas converging upon the remnants of a lion kill.

A leopard group which would show one preparing to attack its prey—perhaps a red river hog. In that way we would show two animals—the leopard and the hog—in their natural setting. Pigs are a favorite prey of

A preliminary plan for the Lesser Koodoo Group, one of the miniature sketch models designed for the mezzanine of the Akeley African Hall



Akeley African Hall

leopards, and the red river hog is a very spectacular member of the pig family.

Although the ostrich is a bird naturally to be sought in a bird hall rather than in a hall devoted to mammals, still it seems proper to include one or two members of this interesting family in one of the groups. There are several reasons for this. The first is that the ostrich occupies a permanent place in the public mind in connection with Africa; and secondly, it is considered as big game by most people who travel in Africa. The picture we plan might, for instance, show a male bird with his head down and his wings spread, driving off a family of wart hogs which happens to be passing too close for comfort.

Of course, African Hall would not be complete without a group of chimpanzees showing how these great apes live in the treetops of the West African jungles. This group would give a vivid picture of their family life, the nests they build and the food they eat. It would afford an interesting comparison with the great Gorilla Group which is already completed.

Also to be mentioned is a cheetah group depicting this very interesting animal which has the appearance of a cat but has claws like a dog and is one of the fleetest animals alive. This beautiful creature is like a leopard, but has long legs, and the spots on its coat are a series of black dots instead of broken circles.

Others who have written articles on Africa and the Akeley Hall of African Mammals for this issue of *NATURAL HISTORY* have presented a far more detailed picture of the American Museum's aims and interests in this connection than it is possible for me to do, but I want to point out that in African Hall we strive to do much more than merely keep a record of the animals of Africa. Each group is not alone an exhibit of the type of animal it features, but it is a complete cross section of the region, which reveals the geology, botany, bird, and reptile life of the region. It goes so far as to cover even the meteorological features such as characteristic types of clouds.

When Akeley dreamed this hall, there were but very few who realized that it was possible

A miniature sketch model of the Klipspringer Group, one of the fourteen planned for the mezzanine of the Akeley African Hall

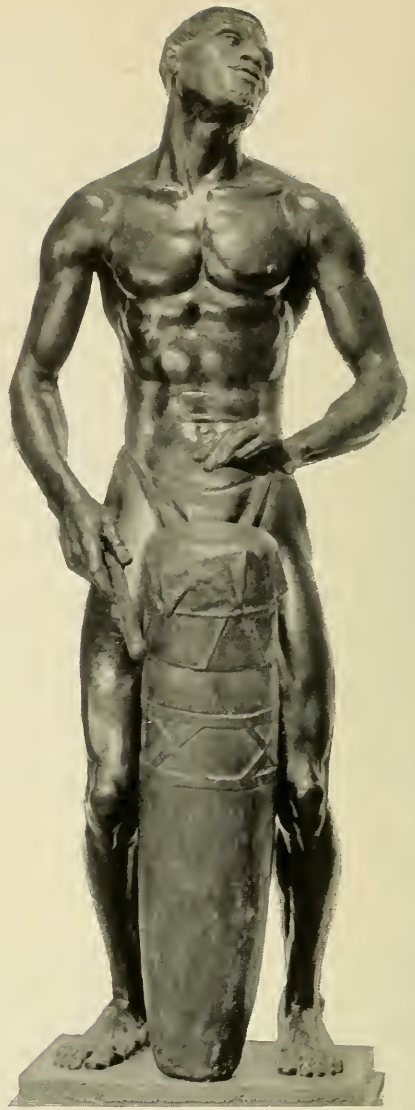


for the great herds of game to shrink and for the abundance of animal life to dwindle. Only a few men, like Akeley, seemed to realize that a large part of this animal life will eventually disappear and that something must be done to preserve their record. This was what stimulated him to dream this great hall and, now, his associates who appreciated his foresight begin to realize that the end Akeley predicted is not as remote as many people thought. In fact, in spite of drastic conservation measures, the magnificent game animals are being destroyed. It is not so much sportsmen who kill the game as it is the advancing wall of humanity as it expands over the surface of the globe and enters hitherto remote sections, looking for new and tillable lands. Unfortunately, big game and man cannot live together, and even National Parks in Africa, similar to those in the United States, do not eliminate problems in the saving of game within these protected areas.

Hand in hand with conservation goes the work of the American Museum of Natural History and similar institutions to preserve for posterity an accurate picture of Africa. All things change, even Africa. The "Dark Continent" of Stanley's day became the "Bright Africa" of Akeley's time. Probably the period is not remote when cities and plantations will

(Right) The bronze figure of a tom-tom drummer which will add a human element to the African Hall. It is the work of Malvina Hoffman and the gift of Mr. George D. Pratt

(Below) A miniature sketch model of the Black Rhino Group. These animals would have to be collected in East Africa

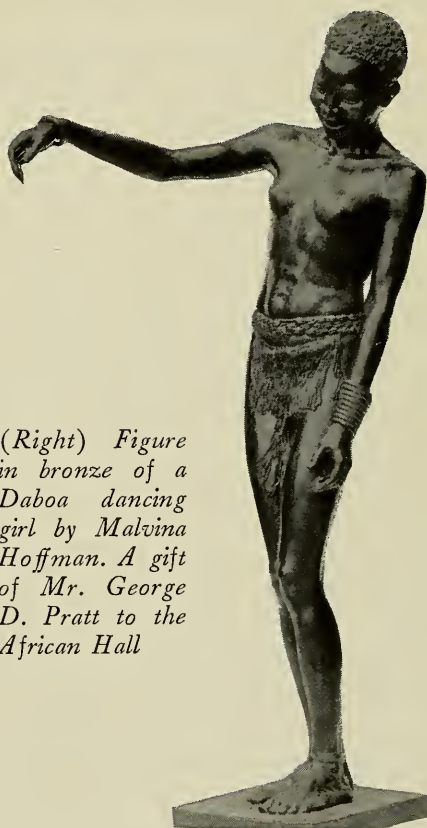




(Above) A miniature sketch model of the South African Group which would include specimens of springbok, wildebeest, and blesbok. All of these animals are now extremely rare and rigidly protected by law

conquer nature and primitive life on the veldt. The situation in Africa is somewhat like our own in this country. Years ago huge herds of buffalo and other game roamed the western plains. Today the herds are almost gone, and it is the advance of civilization that has destroyed them. The same is bound to happen to Africa, and that is why it is so important that our educational institutions make available for millions of people who never will see Africa, as well as for the generations that are to come, an accurate, beautiful, and instructive picture of African wild life, before it is too late.

I am proud to predict that the Akeley African Hall of the American Museum will be the finest of its kind—a memorial to a frontier that won the hearts of men such as Akeley, but the Hall is only partly complete as it stands today, and I sincerely hope that funds to finish this magnificent picture of an Africa that some day will exist no more will be forthcoming in the near future.



(Right) Figure in bronze of a Daboa dancing girl by Malvina Hoffman. A gift of Mr. George D. Pratt to the African Hall

Science in the Field and in the Laboratory

Expeditions, Astronomy, Education, Nature Trails, Fish, New Publications

Edited by A. KATHERINE BERGER

The Third Scarritt Expedition

The Third Scarritt Expedition of the American Museum of Natural History, sponsored by Mr. H. S. Scarritt and led by Dr. G. G. Simpson, worked for four months in central Montana last summer and the results are now being worked up at the Museum. With the assistance of Mr. A. C. Silberling, an able and well known local collector, two fossil quarries were opened and extensively worked, both at sites previously discovered by Mr. Silberling, and many other localities were examined. About 1,500 specimens of fossil mammals were discovered, of which 635 include considerable parts of skulls or jaws. Mr. and Mrs. Fenley Hunter of Flushing worked with the party during June, and Dr. Walter Granger and Mr. Albert Thomson, of the Museum staff, also worked in the field later in the summer. Mr. F. Trubee Davison, president of the Museum, and Mr. Scarritt also made shorter visits to the camp.

The summer's collection is one of the most important of early mammals ever made. It consists of remains of extinct animals that lived almost at the beginning of the Age of Mammals, some 50,000,000 years or more ago, and so casts light on many problems of the origin and early history of the mammals. The work of freeing the tiny and delicate fossils from the rock in which they were found is being done by Mr. Thomson, and will take many months. Until this is complete, it will be impossible to say exactly what is included in the collection, but from what has already been done it appears that about seventy-five species are probably represented, many of them new. Perhaps the most interesting of these are the primates, the oldest members of the group to which man himself belongs ever to be discovered anywhere, represented by many fine specimens in the new collection.

Most of the fossils collected in Patagonia, South

America, in 1933-34 by the Second Scarritt Expedition, have now been prepared and are being studied, and one, a fine skeleton of a new animal named *Scarrittia*, has been placed on exhibition.

Astronomy and the Hayden Planetarium

On Sunday January 5, the regular monthly change of program takes place in the Hayden Planetarium schedule, when the new lecture on the winter constellations will be given at the first afternoon lecture at two o'clock, and from then on during the entire month. This lecture will include a general discussion of constellation figures and mythology, dealing in particular and in detail with those of the winter skies. In addition to pointing out the figures of the constellations, the lecturers will tell the age-old stories connected with the various star groupings.

During the first two months in which the Hayden Planetarium has been open, more than 220,000 persons have attended the performances given there.

There will be a meeting of the Amateur Astronomers Association on Wednesday evening, January 15, at 8:15 o'clock, when Mr. James Stokley, director of the Fels Planetarium in Philadelphia, will speak on the subject "New Eyes to the Heavens." This will be an illustrated lecture, open free of charge to all those interested, and held in the large auditorium of the American Museum of Natural History, 77th Street and Central Park West.

Prize-winning posters

The thirty-eight prize winning posters, submitted by art students in the high schools of Greater New York in the Hayden Planetarium Poster Contest, have been placed on view in the Hayden Planetarium. In all, 351 posters of excellent quality were entered in the contest from twenty-eight schools in the five boroughs. The posters were judged by a group of well known artists—Mr.

Wallace Morgan, Mr. Lucian Bernhard, Mr. Thomas Benrimo, and Mr. Fred G. Cooper—who kindly served, together with members of the American Museum staff. The prizes, which were art materials attractively boxed in specially made blue boxes covered with silver stars, were generously donated by Binney & Smith. The prizes were presented by Doctor Sherwood in Education Hall on the afternoon of November 26.

Travel sketches

From December 24 to January 12 a series of travel sketches by Carl Wernitz entitled "Other Peoples, Other Places" will be on view in Education Hall.

Free motion pictures

The series of Saturday afternoon free educational motion pictures for 1936 will start on January 4 with the film "When Winter Comes." "Alexander Hamilton" will follow on January 11; "Animals—Wild and Not So Wild," on January 18; and "Fish Tales" on January 25. In February the pictures will be "Vincennes," "Bottom of the World," "Abraham Lincoln" on February 15, "George Washington" on February 22, and "Wolfe and Montcalm." This program will run until June 27.

Members' lectures

Dr. Wilfred Osgood of the Field Museum of Natural History will give the first of the spring lectures to Members on February 13. He will speak on "Ethiopians and Their Stronghold." On February 27, Mr. Arthur C. Pillsbury will give the second lecture in the series, "Growing Plants Without Soil." The course for children of Members will be opened on February 15 by Mr. Charles Crawford Gorst, speaking on birds and giving his fine imitations of their calls and songs.

Junior Science Clubs

In coöperation with the American Institute of the City of New York, the American Museum entertained the annual Science Congress of Junior Science Clubs of the American Institute on December 26 and 27. The American Institute arranged several special Christmas lectures in connection with the Congress, the speakers being: Commander Charles E. Rosendahl, Commanding Officer, U. S. Naval Air Station, Lakehurst, N. J.; Dr. E. C. MacDowell, Department of Genetics, Carnegie Institution; Dr. W. F. G. Swann, Director of the Bartol Research Foundation, Swarthmore, Pa.; Captain Albert W. Stevens, U. S. Army Air Corps, Flight Commander of 1935 Stratosphere Flight. The talks were broadcast from the Museum auditorium over WEAF.

Bear Mountain Nature Trails

The winter program of the Bear Mountain Trailside Museums and Nature Trails includes several new types of activities. Work is going forward on two relief models to be placed in the Trailside Historical Museum. The models will show the routes taken by British troops in the attacks upon near-by forts Clinton and Montgomery during the American Revolution. Excavation carried on, during the fall, in the West Redoubt of Fort Clinton, revealed valuable information that will aid in the construction of a miniature restoration of the ramparts.

A collection of sixteen species of local fish has been added to aquariums in the Zoological Museum. This exhibit is now housed in the Botanical Building. Fourteen species of small mammals, twenty-one reptiles, and many insects, crustaceans, and amphibians, all local, are on display at present.

The Orange County Science Teachers' Association meet at the Trailside Museum on alternate Sundays for the purpose of attending conducted hikes in the interior of the Bear Mountain-Hariman Section of the Palisades Interstate Park. These walks are designed to acquaint teachers with out-of-door facilities for nature study. Several iron mines have been visited and, in the near future, journeys will be made to beaver ponds and to other points of interest. The teachers are permitted to collect material for classroom use.

In connection with studies of the mammal life of the Hudson Highland area, carried on for the past nine years, nightly excursions by automobile are made into the interior of the park when weather permits. Powerful spotlights are used to aid in the observation of nocturnal animals. The problem of the distribution of white-tailed deer is of primary interest in this survey. It has been determined that many individual deer occupy approximately the same territory during the winter months. The record number of deer, observed in a single night along forty miles of highway, is sixty-two. In an attempt to encourage the animals to remove themselves from close proximity to the highways, three hundred pounds of salt have been distributed in the more remote sections of the Park.

—W. H. CARR

James Henry Breasted

Prehistoric archæology sustained a serious loss in the death, on December 2d, of Prof. James Henry Breasted of the University of Chicago.

Professor Breasted was not only a teacher of ancient history and of Egyptian and Oriental languages, but as director of the Oriental Institute he promoted archæological research in Egypt and the Near East on a larger scale probably than any other man. Naturally he was concerned chiefly with

the advanced cultures of early historic times; but, fortunately, his interest did not stop there. As proof of this he prefaced his textbook, *Ancient Times* (1916), with a brief but well balanced chapter on "Early Mankind in Europe." A few years later, in 1919, he presented a lengthy paper before the National Academy of Sciences in Washington, entitled *The Origins of Civilization*, in which among others things he sought to show that the Neolithic culture in Egypt dates back to about 18,000 B. C. His alleged facts, namely, the repeated occurrence of artifacts in the Nile Valley silts down to a depth of as much as eighty feet, so far as known have never been disputed; but they appear to be ignored by several recent writers, who would place the beginnings of the Egyptian Neolithic as late as 6000 B. C. In the meantime, however, Breasted directed an extended investigation in the Nile Valley and the adjacent Faiyum Basin, having for its object the correlation of Paleolithic implements with the prominent gravel terraces. The field work, carried out by K. S. Sandford and W. J. Arkell, two English geologists, was continued for a period of years and the valuable positive results have been published by the Oriental Institute in two sumptuous volumes.

In view of such accomplishments it is regrettable that Professor Breasted could not have lived long enough to have instituted a similar survey for the great valleys of Mesopotamia. However, as a result perhaps partly of his efforts, much intensive archaeological work has recently been carried out, particularly in Palestine; but whether this is so or not, prehistoric archaeology must forever be indebted to Professor Breasted, who saw man and his culture as a single phenomenon and who did much to clarify it.—N. C. N.

A Striped Marlin

The department of fishes of the American Museum has received the skeleton and fins of a striped marlin from Mr. Templeton Crocker who secured it at their request, on a recent trip to Lower California. Compared with similar material of the blue marlin already in the Museum collection,

this fish is seen to have a more slenderly tipped smoother spear, longer, more pointed lower jaw, straight versus curved pectoral fin, the front rays of the dorsal and anal fins less heavy and these fins less pointed. Its relationships are evidently with the Atlantic white marlin rather than with the blue or others of the black marlin group.—J. T. N.

Early European Civilization

The Library of the American Museum has received from the New York Academy of Sciences Luigi M. Ugolini's recent work entitled *Malta, Origini della Civiltà Mediterranea*. The volume is illustrated by 114 text figures, many beautiful full-page plates, and a map. It is an interesting and welcome addition to the Library's collections on early European civilization.

Appointment

Dr. J. Eric Hill has been appointed assistant curator of mammals at the American Museum to fill the vacancy created by the resignation of Dr. Robert T. Hatt. At the time that Doctor Hill was appointed he was engaged in the study of special mammal problems under Dr. Joseph Grinnell, director of the Museum of Vertebrate Zoology, University of California. Doctor Hill is a graduate of the University of Kansas of 1931. He has spent several summers in the field for the University of Kansas, as well as in California, Oregon and Manitoba, on his own account. Doctor Hill has published a note on a new amphibian from Kansas and several other short papers on rodent anatomy. A report on the pocket gophers of the Lower Colorado Valley will be published shortly in the Journal of Mammalogy as a joint article by Dr. Joseph Grinnell and Doctor Hill.

Recent Museum Publications

BULLETIN

Vol. LXVIII Art. VIII.—Results of the Archbold Expeditions. No. 7. Summary of the 1933-1934 Papuan Expedition. By Richard Archbold and A. L. Rand.

RECENTLY ELECTED MEMBERS

A REPORT from the membership department lists the following persons who have been elected members of the American Museum:

Patrons

Mrs. Harry Snyder
Miss Dorothy Jane Snyder
Messrs. William D. Campbell, Willard H. Carr, Dean Sage, Ernest Shoemaker.

Fellow

Mr. Charles T. Wilson

Life Members

Mrs. Alfred G. Kay
Dr. J. Warren Bell
Mr. Melville P. Cummin

Sustaining Members

Mrs. Evelyn W. Adams
Messrs. James H. McGraw, George F. Singer.

Annual Members

Mesdames George A. Beardsley, Ethel Clyde, J. Clarence Davies, Clifton V. Edwards, Reginald E. Gillmor, R. M. Gunnison, Charles H. Hampton, Anna C. Jefferson, H. S. Manges, E. M. Murtaugh, Charles H. Talcott, E. C. Vogel, June E. Willis.

Misses Blanche Adler, Dorothy M. Blondel, Sybil M. Boland, Martha Carlson, Frances H. Dickerson, Christina M. Koehler, Ruth Lees, Christine M. Nilsson, Dorothy S. Nye, Beryl Parker, Phyllis Stanley, Ethel G. Stringfellow, Gertrude R. Wilson.

Doctors Martin Biederman, J. de Raismes Combes, Joseph Hajek, Robert M. Stecher, D. E. W. Wenstrand, Paul M. Wood.

Professor George G. Scott

Messrs. K. C. Atwood, Jr., William Felton Barrett, Aaron W. Berg, Robert O. Blair, Clayton P. Chamberlin, Alfred W. Church, Bernard Easterson, Ernest A. Edwards, Lanius D. Evans, Thomas B. Frank, Frank J. Fuhrmann, Howard S. Gans, G. Jarvis Geer, Francis Greer Goodman, John Henry Hammond, Joseph B. Hare, Chas. J. Hendrickson, William H. Hosford, Henry N. Jasper, Jonathan T. Lanman, Paul A. Lynch, Rowland R. McElvare, Francis W. Powers, Wm. A. Prendergast, John K. Prentice, Edwin H. Ranges, H. H. Roth, Frank L. Skeldon, Melvin Spencer, Charles N. Teetor, Lewis J. Trounstone, Herbert Waller, Arthur K. Woodman.

Associate Members

Mesdames Joseph J. Benjamin, B. R. Billings, Frances B. Bostwick, G. C. Bourne, Caroline M. Brown, William H. Bryan, Anne Cornell, Alan C. Doig, Peter Dolese, Helen W. Fields, D. D. Fischer, A. D. Foster, W. M. Garton, W. J. Gluckert, Henry T. Hall, Marjorie Hart, Robert Parsons Howell, Marion S. Jones, Frieda Keferstein, Leona M. Lee, Wilfred L. Letendre, J. Wallace McKenzie, Geo. W. Murray, A. E. Otto, L. C. Pardee, Edith Parish, Charlotte B. Perry, Anna Fairfield Pevoto, George J. Puckhafer, J. L. P. Robinson, W. A. Savage, Barbara M. Scholding, H. M. Spandau, Robert H. W. Strang, B. M. Walpole, C. W. Williams, John D. Williamson, Ira M. Young.

Mother Teresa

Sister Margaret

Misses Constance Avery Atwater, Mary Compton Aymar, Cora A. Beard, Marie Brahdry, Mae Carden, Kathryn E. Cooksey, Maybell Criner, Anna M. Cronin, Ethelwyn Doolittle, Helen B. Dorseheimer, Grace Eldridge, Frances R. Ferris, Elizabeth W. Fisher, Nellie D. Fisher, H. Forbes, Edith E. Giles, Dulcie E. Greenwood, Harriett L. Hamilton, Josephine S. Hannaford, Blanche B. Hanson, Edith Guild Henderson, Zada E. Herrick, Virginia L. Houghton, Ruby M. Jolliffe, Eleanor M. Kelly, Emma S. Kumfert, Stella Lefever, Nancy Lloyd, Nancy Norman, Nellie R. Nye, Marion T. Pleasants, Blume Regenbogen, Edna B. Richter, Alice T. Rowe, Vera M. Sakemiller, Charlotte Schuchardt, Ann Carter See, Ruth K. Shaw, Catherine Smith, Viola M. Sohn, Effie M. Sutch, Charlotte L.

Timmerman, Marion B. Warren, Lena R. Wellington, Jane A. Wilson, E. Frances Woodward.

Reverends Francis S. Majewski, Thornton B. Penfield, Otto Wendell.

Doctors Fred J. Badger, P. F. Brabec, Harry D. Brice, James B. Conant, H. F. Dailey, Michael Epstein, George Garthwaite Fisher, Lloyd W. Fisher, Harry W. Gauchat, Charles W. McClure, L. G. Morah, Wm. H. Park, Olin Sewall Pettingill, Jr., Myron A. Roberts.

Professor Carroll L. Courtney

Captain David D. Graves

Messrs. Richard N. Adams, R. J. Anderson, Stanley Arnold, Edwin Montgomery Bailey, Sr., Robert H. Baker, John E. Ball, Wm. Wallace Bancroft, Edward J. Banker, E. J. Bartlett, Ernest A. Batkins, Wm. S. Behrens, Fred Blumenthal, W. Chester Bottome, F. M. Boyce, Harry B. Braun, R. C. Casselberry, Eustace M. Chamberlain, C. A. Clapp, John Dodge Clark, Robert D. Coghill, Paul Connor, Harward W. Cram, Perry Davis, Joseph Dellapent, John A. Denison, Robert D. Denton, Nicholas Dietz, Amos F. Dixon, Ransom W. Edwards, Humphrey N. Ervin, James McNelledge Fadeley, Richard A. Fayram, Ruurd G. Fennema, Wayne H. Fisher, Jr., Robert G. Foster, L. Woodward Franzheim, Robert W. Fuller, Frank J. Garrett, Peter Dunne Garvan, F. A. Gaylord, H. M. Giffin, G. M. Goodman, Albert P. Gresser, Wm. H. Hampton, Wm. Albert Harbison, Russia Harris, William F. X. Harrison, Einar Hille, Samuel F. Holmes, Jonah H. Honig, Charles J. Hudson, Forrest R. Hughes, Ralph B. Hurlburt, Chester D. Jones, H. Thorn King, Jr., Samuel Knox, Charles F. Koughan, Frank H. Lamb, Louis Laroche, John E. Layton, Harold Levy, Arta Lewis, David C. Liebler, Arthur Long, Clarence Lyon, Frank S. Magee, Benjamin W. Morris, Jay Robert Morton, Ernest Mutschler, George Hewitt Myers, Charles E. Neil, Leslie F. Nims, Bobbie Novotny, John J. O'Connor, Edward O'Neil, Austin H. Parker, James Parker, Jr., Edgar H. Parkman, Y. C. Paschall, Harold C. Paull, Van Kirk B. Perkins, Rutherford C. Plaut, Allan K. Poole, Jr., Dewey M. Price, A. D. Purdy, J. A. Putnam, K. I. Rainsalo, William D. Reichmann, H. E. Riddleberger, John O. Roach, Lucien F. Rose, Lowell W. Saunders, Harrison M. Sayre, Emil Maro Schleicher, Oswald Schlockow, Julian E. Schonnengel, Max Schwabacher, R. Seibel, Henry B. Sell, Eugene Sheldon Shreve, Edwin G. Shuttleworth, W. H. Singer, Jr., Philip Holmes Smith, Merrill Snyder, Wm. H. Spahn, Joseph C. Spang, Clarence J. Stay, Theron D. Stay, Harry Stevens, William H. Stoffel, Harvey L. Sweetman, John A. Sweetser, Jr., R. P. Tappenden, Max Theiler, Glenn S. Thompson, Charles H. Topping, Charles T. Trace, Alfred W. Tyrol, Jr., R. S. Underhill, Norman J. Vile, John P. Wadham, Bradford H. Walker, Joseph A. Weber, John Hallock Welsh, G. W. Wharton, Jr., Wynant Wilday, Earl B. Wilkins, James Willits, Seth Wilson, Clement B. Wood, E. G. Woodbridge, Alex. Wooden, John G. Woodruff, Harry A. Wright, Daniel D. F. Yellott, Jr., Charles H. R. Young.

Reviews of New Books

Exploration, The Animal Kingdom, The Sea, Photography, Primitive Peoples

EXPLORING TO-DAY. By Lincoln Ellsworth. Dodd, Mead & Company, N. Y., 1935, Octavo, 194 pp. Illustrated.

SHORTLY before starting on his present hazardous Antarctic Expedition, Lincoln Ellsworth finished the writing of a book, *Exploring Today*, which should be in the hands of every youth and would-be explorer. In the course of the sixteen chapters, Ellsworth relates the trials and tribulations that he had to overcome before he became an explorer. He reveals that exploring expeditions today have definite objectives and that the personnel is, for the most part, highly specialized. Furthermore, he tells in detail just what an explorer's job consists of, how to prepare for it, and how to carry on. He dwells also upon the value of exploration to mankind. His advice to those who want to become explorers is to study the subjects in which they are particularly interested, and supplement this with such field work as can be arranged at or near home. The most interesting part of the book is the experiences of a selected group of explorers as told by the explorers themselves. The book is well printed, well illustrated, and timely.—CHESTER A. REEDS

OVER AFRICAN JUNGLES. By Martin Johnson. Harcourt, Brace & Co., New York. 1935, 263 pp., 100 photographs, \$3.75.

THIS latest account of the doings of Osa and Martin Johnson lives up to the expectations aroused by the earlier books and pictures of this much-traveled pair. In an excellent specimen of the book-maker's art, profusely illustrated by splendid photographs, and written in an entertaining manner, the Johnsons "go places and do things."

Over African Jungles is the story of the last expedition to Africa from which Martin Johnson brought back the film which later appeared under the title of "Baboona." The Johnsons have had a long experience in Africa and have known all of

the methods of transportation. They have progressed by stages from travel afoot to the comparative luxury of motor transport, but in this last undertaking they achieved the ultimate in travel by utilizing the airplane—two of them. The author brings out in a graphic account the great advantage to be derived from the use of the airplane. A journey which demanded 160 days from Stanley, at the cost of great discomfort and even the lives of many of his retinue, can be traversed in comfort, if not actual luxury, in a mere matter of hours.

The Johnsons lead an exciting existence and they do so many interesting things that it is difficult to select specific episodes for comment. Each day in the field has its program of activities which may vary from the physical transport of the party over vast stretches of wild country—an event of itself to thrill most people—to plans for an intimate association with wild life incident which may lead to all sorts of fast-moving and even dangerous developments. Threatened charges by lions and rhinoceroses seem to be a commonplace, and every now and then the charge becomes more than a threat, as might be expected when individuals insist on prying as deeply into the intimacies of African wild life as do the Johnsons.

The travel by airplane involved in *Over African Jungles* comprises 60,000 miles and the itinerary was sufficiently varied to present a cross section of animal life, including the native peoples, from the dry, desert lowlands to the high peaks. Certain features were planned for this expedition, among which might be mentioned the return visit to the pygmies of the Ituri Forest where the Johnsons had made friends on an earlier expedition, rambles among the lions on the Serengetti Plains, flights about the snowclad peaks such as Mt. Kilimanjaro, and the filming of a baboon colony later to be staged in "Baboona."

The text is written in an easy, narrative style, but it seems to this reviewer, at least, that the presentation might have been a little better

planned; and if the chapters had been given definite headings, it would have been easier to keep track of the chronological sequence of the expedition. However, this is, perhaps, of no great moment to the average reader who will be carried along by the story without any disturbing reflections upon sequence in time or place; it is only a reviewer who is forced by the nature of his assignment to card index and find a reason for everything. Suffice it to say that the reader will find *Over African Jungles* a book not only interesting to read but one in which he can feel a pride of permanent possession.

—H. E. ANTHONY

THE MAMMALS OF CONNECTICUT. By George G. Goodwin. *State Geological & Natural History Survey Bulletin No. 53, State of Connecticut. 1935, 221 pp, 33 plates, 19 fig.*

THE mammals of the Atlantic Seaboard have scarcely received their due share of attention in the recent writings of naturalists. Perhaps this is due to the fact that it is taken for granted that the mammals of the most thickly settled section of the United States are so well known and so much has already been said that it would not be worth the effort to carry out an intensive study of them at this late date. It is a common failing of human nature to be so interested in the far horizon that the things of value in one's own dooryard are completely overlooked. It is a fact that we still have much to learn about our eastern mammals, and the field is far from exhausted. For this reason it is particularly gratifying to note the appearance of Mr. Goodwin's comprehensive report on the mammals of Connecticut.

This volume is by all odds the most complete and the most satisfactory work on the mammals of any of our northeastern States. The basis for this report is data secured by several seasons of field collecting and by a careful search of literature and all available records. Because Connecticut has lost some of its original fauna such as the wolf and the panther, the old records are of particular significance today. However, these records are by no means as complete as one could wish, and mammals such as the moose and the wapiti which should, by every dictum of logic, have occurred in Connecticut, are nowhere reported to have done so. Students of our vanishing eastern wild life will find Mr. Goodwin's historical treatment of particular interest.

In discussing the present-day fauna, the author has followed a workmanlike presentation of data. He gives common and scientific names, a general description, and comments upon color and size, general geographical distribution, with a paragraph on the special distribution within Connecticut. This data is followed by an account of the life his-

tory of the species in question. Mr. Goodwin has drawn freely upon the life-history data recorded by other authors, but in the case of many species has added interesting comments based upon his own field observations.

The report is illustrated by sketches drawn by Francis B. Shields who has been quite successful in catching characteristic poses of his subjects.

It may be predicted for this report upon the mammals of Connecticut that it will prove to be not only interesting reading for the nature lover and a useful reference book for the student of the mammal fauna of Connecticut, but also a valuable contribution to the natural history survey of the State.—H. E. ANTHONY

A CHILD'S STORY OF THE ANIMAL WORLD. By Edward G. Huey. *Reynal and Hitchcock, New York. 335 pages. \$3.50. (indexed).*

THIS is a fine book for children between the ages of eight and twelve. It should also be considered as compulsory reading for natural science instructors in grade schools, and for natural history museum workers who wish to discover new methods of approach to teaching problems wherein children are concerned. Mr. Huey, of the Calvert School of Baltimore, knows his subject not less but his audience more. To run through the systematic gamut of animal life from amoeba to gorilla in a single volume is certainly an ambitious project in itself. To present this same material for the enjoyment and enlightenment of children becomes a task that few have accomplished successfully. The author has succeeded so well that his handsome, large book at once becomes the answer to a long felt need.

The volume is in twelve carefully planned parts. The first, "tells what animals are made of, who belongs to the Animal Kingdom, and many surprising facts about some animals that look like plants." Part two relates entertainingly "about the animals with jointed legs, that zoölogists call Anthropods: also how to tell a spider from an insect and why the lobster is cousin to both."

The chapters go on to tell of the sequence from "oysters to octopus," "the age of reptiles," and all the way to part seven "which will make you sit up and take notice, with its stories of the queerest mammals—those that lay eggs and those that have pockets." The final part "discloses the mystery behind the facts (in this book) and tells why zoölogy opens the door to all kinds of fascinating things in the world about you." The chapter on evolution "How and Why" offers the best introduction to this subject for children that we have ever read.

An eleven-year-old boy visited our Bear Mountain Trailside Museum office a short time ago. He was to enter a hospital on the following day for an operation that would ultimately place his leg in a

plaster cast for two months. Mr. Huey's work lay on my table, together with a number of other books. While the boy's mother talked with me, he at once began turning the pages of the *Animal World*. As he looked at the pictures and read here and there for a space of twenty minutes, his mother explained that she had brought the boy to our out-of-door museum to "keep his mind off himself" until the morrow, and also to secure advice as to how he might be diverted during the long weeks of pain and inaction that lay ahead.

"Could you suggest any books for him," she asked.

Without awaiting our answer, the boy, with eyes bright, asked "Couldn't I have this one, mother?"

In the last analysis the child himself will be the critic of books intended for his use. We could think of no better recommendation than a recital of the above incident. Perhaps if Mr. Huey reads this review, he will wish to send a copy of his book to the boy who liked it!

The greater number of the splendid illustrations are from both the American Museum of Natural History and the New York Zoological Society. This might indicate that the book has somewhat of a "museum plan" and so it has, justly and unavoidably. A book of this character must, of necessity, be planned as a zoological outline—a black and white representation of systematic natural history museum displays, if you will. This is decidedly in its favor.

William H. Hudson, who objected so strenuously to "stuffed specimens" admitted in *Birds and Man* that museum exhibits "might be made useful to young students of zoölogy." Mr. Hudson might have altered his expressed opinion that mounted animals are a "falsification and degradation of nature," if he could have seen a modern museum of today. The truth is that books of this sort and museum displays, too, are essential to any broad zoölogical study on the part of children. It would, of course, be an impossibility for a child to observe all of the creatures mentioned, in the field. The book thus serves the purpose of acquainting its youthful readers with all types of creatures to the end that he may become better equipped to appreciate the familiar wild life about his home and in his summer camp. The museum illustrations, especially of the lower animals, are indispensable. The numerous line drawings by H. R. Daugherty and Olive Earle are of distinct worth, too.

Simplicity of expression, clarity of ideas, and soundness of fact, combined with a straightforward, sane, man to man discussion, without a hint of "talking down," are all essentials that must be incorporated in any popular science reader that a child will take to his heart. This book fulfills all of the above qualifications and, in addition, has a personality of its own.—W. H. CARR

PARADE OF THE ANIMAL KINGDOM. By Robert Hegner. The Macmillan Company, New York. 675 pages, 743 illustrations. \$5.00, (indexed).

THIS large volume (it weighs five pounds), might well be a companion to *A Child's Story of the Animal World*, reviewed above. It is distinctly intended as a book for adults, yet the superb series of pictures would delight any child. Doctor Hegner's parade would require many hours to pass a given point and the entire procession would hold the onlooker's interest and close attention to the end.

The book is a revelation in concise, popular-scientific writing. Doctor Hegner, who is professor of protozoölogy in Johns Hopkins University, marshals his forces in orthodox fashion from protozoa to mammals. The chapter on the "First Animals" treats a subject, difficult to popularize adequately, with a keen appreciation of the general reader's viewpoint and with the highest regard for accuracy.

Life history studies are given for each type of animal. A careful explanation in each instance tells of habitat, enemies, food, locomotion, methods of self preservation and of reproduction. The subject balance is excellent. There is no trace of over-emphasis upon any one group of creatures.

Doctor Hegner writes with wit and charm. In describing a living place of the hedgehog hydroid, he remarks that "Only an overworked imagination could conceive of such a bizarre place to live as the top of a snail shell inhabited by a hermit crab." The description of the animal itself and the treatment accorded the coelentrates as a whole ranks high in the entire book.

In introducing this group, the author asks, "How would you like to be nothing but an animated stomach with perhaps a load of superfluous jelly to make you look stout and prosperous? If you think this would please you, we suggest that you study the group of animals we call Coelentrates, a word that means 'hollow intestine.'"

Did we say that this was a book for adults only? Change three words in the above paragraph and what child would not understand?

The chapter dealing with Amphibia begins in this way: "In many respects the Amphibia, such as Frogs and Salamanders, lead an enviable and carefree existence. The Greeks gave them the name Amphibia which means 'double life,' but this double life has nothing to condemn it, since it simply refers to the habit of spending part of the time on land and the rest of the time in the water. In fact, a sort of summer vacation on a river or lake or at the sea shore, delightfully extended throughout the year, with a swim whenever desired and sun baths galore."

Slight excursions into the realms of generalization and anthropomorphism should by no means

discourage readers of encyclopædic books. Nevertheless, if a salamander in our northern country "desired" to swim and enjoy a sun bath in mid January, we fear it would be frequently disappointed! Forgive me, Doctor Hegner, but there it is!

This book should prove of the very first value in school, museum, and public libraries, as a ready reference for inquiring students of general zoölogy. Its scope is so all-embracing that it is impossible to convey any idea of its worth by merely quoting several paragraphs as above. Any naturalist or nature student would be glad to own this volume. We would also like to recommend this book to nature teachers and to nature trail builders.—W. H. CARR

THE SEA FOR SAM. By W. Maxwell Reed and Wilfrid S. Bronson. Harcourt, Brace and Company, Inc., New York, 1935.

THIS is the story of the seas from the days when the world was new. W. Maxwell Reed, writing with young readers in mind, describes first the formation of the earth, then the earth's capture of its satellite, the moon, so important a factor in the movement of the seas. The story of how the continents apparently float about over a fluid mass beneath the earth's shell and of how the continents are continually being raised and lowered, often a rather involved concept, is presented in a very clear and lucid manner not only for the young person to whom it is addressed but also for the more mature reader. The history of the seas, as told here, appears to favor the Wegener theory of the separation of the continents. That is to say, one great continent, Pangea, was present in the early days of the world and for hundreds of millions of years remained the sole land mass. Then during the Cretaceous it began to split up. The Western Hemisphere broke loose and the rift between Pangea and this new world became the Atlantic Ocean.

The discovery and exploration of the seas from the times of the Greeks to the circumnavigation of the globe by Magellan is discussed in an all too brief chapter. The theme returns to the more physical aspects of the sea with a description of the ocean bottom could we walk through its canyons, climb its mountains, and traverse its plains. Several extremely interesting chapters on the waves and tides follow.

At this point the story is taken up by Wilfrid S. Bronson, who has written and illustrated the portion of the book dealing with life in the seas. He writes of almost all of the main groups of invertebrated animals from the simple protozoa through the fishes to the sea-living mammals. Mr. Bronson has done an excellent job, for he not only describes the animals themselves with a rare freshness, but

manages to impart something of the unsuspected turmoil of life beneath the waves.

Mr. Reed then tells of the Gulf Stream, other ocean currents, and the formation of icebergs, their size and their eventual breaking up. An interesting chapter, contributed by F. C. Brown, describes how, by means of tides, winds, ocean currents, evaporation and rain, the sea mixes the many organic and inorganic elements entering it.

The last portion of the book gives the reader a glimpse of how theories are made, disproven, and sometimes forgotten. An account of Charles B. Lipman's amazing discovery of living "germs" imbedded in coal fifty million years old and in specimens of rock meteors is accompanied by the admonition that acceptance of this as a definite fact must rely upon a preponderance of evidence in its favor and also upon a critical examination of the conditions surrounding its discovery. Could not these "germs" have entered the coal at a later time? By questions such as this Mr. Reed introduces the young reader to the scientific, objective frame of mind.

The collaborators have successfully tackled the staggering task of portraying the sea's physical aspects and its teeming life with no sacrifice of fact for fancy. The book is exceptionally well illustrated with photographs, Mr. Bronson's drawings of undersea life, which are especially effective, and diagrams borrowed from the literature of geology. A unique feature of the presentation, the constant challenge to the young reader to weigh statement and conjecture, to demand sufficient evidence before acceptance, and to consider hypothetical working bases as such and as no more, is a philosophy of which many adults are incapable much less a child of twelve.

It is unfortunate that the publishers have determined on the age-limits of twelve years and up. The story flows along very smoothly, but because of some of the ideas involved, must needs draw upon a vocabulary certainly several years above that of the twelve-year-old. For a sophomore or junior in high school, or in fact for any interested adult it is a fine book.—G. MILES CONRAD

THE ALLIGATOR'S LIFE HISTORY. By E. A. Mcllhenny. 117 pp. 18 figs. Christopher Publishing House, Boston.

THE alligator, the largest American reptile, has been extensively studied by embryologists and anatomists; but its life history, its daily habits and contacts have remained largely conjectural. Strange though it may seem, much more was known of the social life of a Madagascar crocodile than of our own familiar 'gator. But now thanks to the careful studies of a naturalist born and raised in the heart of the Louisiana alligator country, this much

needed information has been worked out and published in book form. Mr. E. A. McIlhenny has seen fit to present his studies in popular style. Probably few of his readers will realize how many original and important contributions to animal behavior are compressed within these few pages.

McIlhenny's book definitely establishes the fact that the mother alligator defends her nest, and takes care of her brood over one winter. There is some evidence that she even feeds them. Males have definite dens to which they return, often from great distances, year after year. The bellow of the male alligator, like the call of many male birds, is an advertisement that a particular territory is occupied. Females are not able to bellow, but they can give a guttural snarl—in reply to the male. The musk glands which have always been considered alluring devices are often emptied of their pungent odors during fights between males. Hence they may aid in defense as well as in attraction of the opposite sex.

Some of the most interesting sections of the book give a first-hand account of nest building, den digging, and methods of feeding. "Alligators seem to know the difference between poisonous snakes and non-poisonous snakes. When an alligator catches a cotton-mouth moccasin, which is a poisonous snake, as soon as the snake is grasped in its mouth it is shaken vigorously until quite dead. When a non-poisonous snake is caught, it is not shaken, but killed by being crushed between the jaws." It further seems that alligators must rise to the surface if they are to chew their food. Objects that can be swallowed whole are disposed of while submerged.

The alligator has the richest mental life by far of any American reptile. The rapid disappearance of this magnificent species from many parts of the South is greatly to be regretted. McIlhenny records an eighteen-foot specimen shot in 1879, and describes his difficulties in obtaining large specimens in recent times. He has shown how alligators rapidly increase when protected. It is to be hoped that the splendid little book McIlhenny has published will arouse a greater interest in the personal every-day life of America's largest saurian. It is only by such interest that one can hope to secure adequate protection.—G. K. N.

HANDBOOK OF THE HEAVENS. Edited by Hubert J. Bernhard, Dorothy A. Bennett, and Hugh S. Rice. Whittlesey House, McGraw-Hill Book Co., New York. \$1.00.

PERHAPS the most difficult task for one who wishes to acquire a general knowledge of astronomy is the "breaking in." Text books seem rather pedantic and too full of information, and if the novice associates with those interested in the sciences, their superior acquaintance rather awes him. It is to initiate such novices that the *Hand-*

book of the Heavens has been prepared. While written under the auspices of the Junior Astronomy Club, it is not childish in form. Its general arrangement is that by which man originally learned the sciences. The first quarter of the book deals with the constellations, with charts for the seasons and detail maps for the different sections of the sky. Sufficient text accompanies these maps to describe the ancient groups and make them live for the observer.

The next quarter of the book treats of the Solar System, and discusses the earth's companions, the planets, and the moon. Then meteors and comets are given brief mention but sufficient to encourage one to hunt farther for more information. It is in this section the telescope appears. Man's knowledge of the Solar System grew by leaps and bounds after Galileo applied his glass to the sky. And that same vista opens here for the student. If he has a small instrument available he is encouraged to use it, but if not, the pictures in the book must satisfy him.

The latter half of the book deals with more telescopic objects, double and variable stars, nebulae and clusters. Eclipses and asteroids are given a place. The chapters on the use of the telescope and photography will interest many.

In so short a book no subject can be adequately treated. It is not the intention to do so and the editors and authors would have misplaced their energy had they tried. So many books divulge the special interest of the writer by an over-emphasis on that subject at the cost of adequate space for something else. By collaboration this was avoided in the *Handbook of the Heavens*.

A glossary closes the book and for the benefit of the veriest beginner it might be enlarged to include many words innocently used in the body of the book but not sufficiently defined there. A valuable addition would be a recommended list of books for further reading, perhaps one good book on each of the subjects mentioned.

—WM. H. BARTON, JR.

THE CHINESE. THEIR HISTORY AND CULTURE. By Kenneth Scott Latourette. 2nd ed. combining Vols. I and II in one book. The Macmillan Company, New York. \$6.00.

TO this reviewer, who lays no claims to a very profound knowledge of Chinese history and culture, this massive book by Professor Latourette is a welcome and handy guide into a field ordinarily omitted in the education of westerners. The plan and the content of the book is as simple as it is logical. After a brief geographical description of the area which was to be the scene of the Chinese drama, we are led into a discussion of the interrelationship of environment with the political and cultural characteristics of various sections of China. Then follows a section on the origin of Chinese civilization both from archaeological and

traditional evidence. With the preliminary spade work accomplished, the historical China emerges. Its successive dynasties and its political vicissitudes are examined succinctly and clearly. The second volume is confined to the treatment of the principal aspects of Chinese life under such heads as government, economic life and organization, religion, social life and organization, art, language, literature, and education.

The detail in Chinese history is so vast and the ramifications of its culture so complex that more than two volumes would be necessary to satisfy a specialist. Therefore, it is hardly just to quarrel with Professor Latourette for his omissions. But it seems to this reviewer that the sections on the various expressions of art and literature are rather perfunctory. The connections with the esthetic development of the west are largely neglected and the discussions of some of the art forms are too thin to be more than superficial. One has a feeling that they are mentioned for the sake of completeness and not for the light they shed on Chinese character and Chinese civilization.

The reader, however, cannot but be impressed by the vast range of Professor Latourette's scholarship, by the catholicity of his selection of authority, and by his pleasant style. It is a vivid picture that he limns of the most ancient civilization in the world with a continuously vital civilization. For the busy adult who is eager to acquire a familiarity with the gargantuan outlines of a fascinating country, this book is to be recommended.—H. L. S.

THE COLLARED LIZARD: A LABORATORY GUIDE. By D. Dwight Davis. New York, The Macmillan Company. 1934.

THIS is a short concise guide to the dissection of the collared lizard. It is sufficiently detailed, however, to give the student a comprehensive view of reptilian anatomy. Too often in an undergraduate course of comparative vertebrate anatomy the reptiles are dismissed with one or two classroom lectures or at best a laboratory study of an atypical form such as the turtle. Thus it would seem that Mr. Davis's choice of the lizard is fortunate, for this form is one of the least specialized of the existing members of the class and it is also readily available.—G. MILES CONRAD

WELLCOME PHOTOGRAPHIC EXPOSURE CALCULATOR HANDBOOK AND DIARY 1936. Issued by Burroughs Wellcome & Co., \$0.75.

As in former years this little volume contains much condensed information concerning photography. Naturally the use of the products made by the company that issues the book is stressed, but this does not detract from the useful-

ness of the general statements. The blank pages for recording the conditions under which pictures are made should remind amateurs not to neglect this important step in developing their skill. The exposure calculator is about as perfect as one that does not actually measure the light can be made.

—F. E. LUTZ

PRIMITIVES AND THE SUPERNATURAL. By Levy-Bruhl, Lucien. E. P. Dutton and Co., New York, 1935. \$5.00.

FOR many years now, Professor Levy-Bruhl has devoted his amazing resourcefulness and energy to tracking down, in likely and unlikely places, in the accounts of missionaries, travelers, and ethnographers, odd and bizarre facts about the way in which the mind of primitive man works. This book is less oriented to one basic idea than have been his others; it is more a collection of odds and ends of strange ideas and practices, about which Professor Levy-Bruhl can express—as he has so often expressed before—his unflinching amazement that primitive man is not as logical as he thinks modern man is, or should be. The book should interest especially two types of readers, those who are wont to report, carelessly and gaily upon the customs of the natives whom they may chance to encounter in their wanderings, and those who like to meditate upon how logical we ourselves have become. The first class of reader, the explorer, the naturalist, the interested and note-taking traveler, will have an opportunity to see how strange an assortment can be made up out of chance observations such as he brings back to civilization. The second reader, he who thinks we are logical and scientific, has only to cudgel his brains a very little to find examples of equally pre-logical thinking among ourselves.

While the pages are filled with the vivid, bizarre, and arresting, they nevertheless are organized to no point which is new or revealing. Modern ethnological research deals not with Primitives or with "the Primitive," but with many and diverse primitive peoples, each with a view of life which contains its authenticities and its amazing contradictions—when seen from the outside. Professor Levy-Bruhl in his comments is essentially the cultivated Frenchman who believes that the substitution of the metric system for systems with an older history and more internal contradictions, means a genuine revolution in the way in which people think. He is content to wonder and to comment on the ways of those who know not the metric system and its analogues, and in so doing he fails to explore the rich and diverse possibilities for understanding, not the "primitive mind" but the human mind, which material on primitive peoples offers us.—MARGARET MEAD

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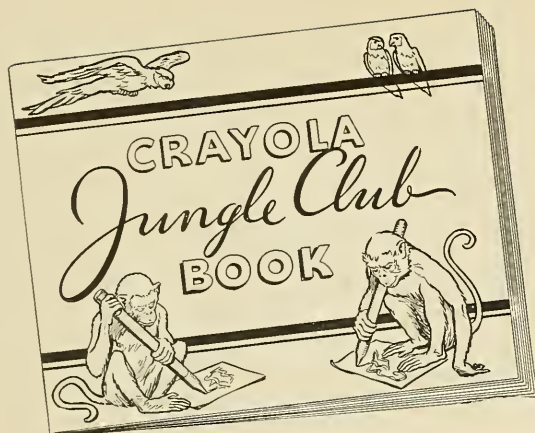


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The Journal of the American Museum of Natural History

VOLUME XXXVII



FEBRUARY 1936

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PUBLICATION OFFICE: 246 Meadow Street,
New Haven, Conn.

MANAGER: Tom Davin.

EDITORIAL: Edward M. Weyer, Jr., Editor;
A. Katherine Berger, Associate Editor; Dorothy
L. Edwards.

Manuscripts should be sent to the Editor, The
American Museum of Natural History, New
York, N. Y.

SUBSCRIPTIONS: NATURAL HISTORY is sent to all
members of the American Museum as one of the
privileges of membership. Membership Super-
viser, Charles J. O'Connor.

ADVERTISING: Sherman P. Voorhees, The
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THE LARGEST SHRINE IN TIBET

Embellished with gold leaf, the roof of this striking structure gleams brightly in the rarefied air of over 13,000 feet. Gyantse, where it is located, is the third largest city in Tibet

and was an early halting place on the journey which took Suydam Cutting and Arthur Ver-nay to the mysterious city of Lhasa, the abode of the supreme ruler of Tibet

Mr. Cutting tells here the story of his unique negotiations with the Dalai Lama, incarnation of Buddha, master of the Potala palace-monastery and supreme ruler of Tibet; and of his subsequent visit to the forbidden city. He took the first motion pictures of Lhasa; and the photographs reproduced here from his extensive collection, are the most extraordinary ever shown of this mysterious city.

In Lhasa — The Forbidden

An extraordinary trip to a city which few explorers have reached, where the palace-monastery of the Dalai Lama stands supreme

By C. SUYDAM CUTTING

Trustee, American Museum of Natural History

THE explorer who tries to visit Lhasa is confronted by a political and religious bulwark that is well-nigh impossible to penetrate. Tibet is a closed country to all foreigners, and Lhasa, the abode of the Dalai Lama, is guarded probably more closely than any other city in the world.

The first definite progress that the writer made toward gaining entrance to Lhasa was in 1928. In that year application was made by the Roosevelts through the Government of India for a permit to cross the southeastern corner of Tibet en route to the Chinese province of west Szechwan.

His Highness the Dalai Lama

The proposed expedition, in company with Theodore and Kermit Roosevelt, had no immediate bearing on Lhasa, but it was the beginning of negotiations with the Dalai Lama. One must begin there in a small way. Lieut. Col. F. M. Bailey, the political officer at the frontier who handled the request, thought there was no chance of gaining entrance even to this corner of Tibet, but some months after the original communication had gone up to Lhasa, an affirmative answer was received.

The ensuing expedition never actually

utilized the permit, for an alternative route to the destination was followed. But the significance of this contact in view of subsequent events, was enormous. It was the opening wedge.

Strengthening relations

That winter we journeyed in high country along the Tibetan border of China, a region inhabited by the Tibetans, Lolo, and Nashi. Then in 1930 followed a trip to Gyantse. Foreigners are permitted by treaty in limited numbers to visit this city, about a hundred miles beyond the Tibetan border. But a solemn promise over one's signature states that one will not travel beyond the immediate vicinity of the city. Here was another opportunity to press negotiations, and it was not lost. A letter in Tibetan requesting permission for further travel was dispatched accompanied by the conventional scarf to the Dalai Lama. Also many presents were distributed.

The two head men at Phari at the border were given decorative Hammacher Schlemmer aluminum ware, and the Governor at Gyantse received a cuckoo clock. Each of the five members of the Kashag, or High Council at Lhasa, was sent a self-winding wrist watch. The Dalai Lama's presents naturally had to be chosen with especial care. A gold self-wind-

ing wrist watch was only the beginning of his gifts.

He was a man of fifty-seven, shrewd in the ways of statecraft. But on the gentler side, it was known that he loved animals enormously. He had always wanted Lieut. Col. Bailey, the frontier officer, to send him, of all things, an ostrich. He must have seen a picture of one. But as Lieut. Col. Bailey tried to explain to him, it would have been impossible for an ostrich to survive the rigors of travel to the Tibetan plateau. Hoping to provide something equally amusing, I sent the Dalai Lama a pair of dachshunds. A week went by and then a telegram came from him which showed that some interest was being taken in the animals. He asked what their names were.

A week later, however, came his answer to our petition. Permission to visit Lhasa was denied; but, great luck, the caravan could cross the nomad country on its way back and visit the city of Khampa Dzong. The letter stated that there was general disapproval of strangers traveling into the interior of Tibet; but he and the Kashag gave permission and hoped I would have a pleasant journey.

The British had shown great consideration by allowing me, with the local Tibetan Governor's permission, to wander anywhere I wished in the great Gyantse Valley, which was ordinarily forbidden country. The proper Tibetan permits were made out, and every Tibetan was kindness itself, including the Governor of Khampa Dzong, who invited me to stay at his house and was the deserving recipient of my last remaining cuckoo clock.

I was closer to Lhasa than ever before. Friendly relations had definitely been started.

Letters from the Dalai Lama

In the following years a number of letters came from the Dalai Lama. The Tibetan script, on native paper, was always accompanied by a typewritten translation, done by the Dalai Lama's secretary. Both are contained in an intricate envelope addressed in both Tibetan and English, and sealed with the official seal. Our correspondence had much to do with the affairs of Tibet. I was asked to see if wool merchants in the United States would buy Tibetan wool via Calcutta. In response to this, several merchants were induced to write to Pangda Tshang of Upper Bengal and Lhasa, who has the monopoly in this product,

which is used in the manufacture of carpets. These negotiations have not progressed as favorably as they might, however, and the matter is still one of my considerations.

An autographed portrait of Hoover

Letters were also entrusted to me to be delivered to the State Department of the United States. The Dalai Lama wished to establish good will, although for diplomatic reasons there could be no direct communications between the governments. The letters were duly answered and sent back by me with an autographed photograph of President Hoover. Finally I was even asked to induce the United States Congress to buy silver and send it to Tibet in bond. This was an attempt to avoid the India export tax, and was quite hopeless for several reasons, but it gave me an excellent chance to send a letter bearing the letterhead of Congress.

When negotiating with orientals, anything that enhances one's importance never fails to benefit one. For this reason I always made it a point to write to the Dalai Lama every time I could use imposing stationery. The Dalai Lama knew that the Viceroy of India strongly backed my purpose to visit Lhasa, but the mere fact of my knowing him counted, too. So I was careful to write to Lhasa on the household note paper of the Viceroy, also on that of the Commander-in-chief, whom fortunately I also knew—never on hotel paper.

All this time presents were going back and forth. I sent the Dalai Lama a long glass cocktail shaker which, though it would not serve him in the ordinary manner, would be useful in mixing his buttered tea; also illustrated books on American architecture, a chair with a folding canopy, silver plated polar bears on agate, an ornamental glass bowl, and some fine woolen blankets. The dachshunds, as well as a pair of Dalmatians which I sent later, are still alive, but they have never produced puppies.

The Dalai Lama sent me Tibetan *Apso* dogs in three lots, which unlike my gift, are breeding successfully.

The Dalai Lama continued to write regularly. Whenever I came to India I was to advise him of the fact, and so forth.

Then in December, 1933, he died. The cable from his personal assistant reached me on Christmas day, notifying me of the "tem-

porary passing away” of the incarnation of Buddha. (His successor must come from among the children born on the night he died and is selected by the priests by omens. But to date, his successor has not been discovered.)

“Knowing your constant correspondence with late Holiness,” the cable read, “hope to receive assurance of continuance of your friendship at this unfortunate conjuncture.”

So following the sad death of one who had become a real friend, correspondence continued with the Kashag, or High Council.

Later in 1934 with permission from Lhasa

there was a plan to go to Southeastern Tibet with the Roosevelts and to cross a big section of the plateau; and it was hoped that this might be the time for Lhasa. But because this expedition was to be chiefly for the purpose of collecting animals, and since shooting is counter to Buddhist law, we dropped the project.

Therefore, when Mr. Vernay and I planned the expedition described in this article, anthropological and botanical collections were the object of it, not hunting.

Negotiations this time went smoothly. My name was by now well known in high circles



ROUTE OF THE EXPEDITION TO LHASA

The dotted line indicates the route taken. Lofty passes separate Central Tibet, where Shigatse and Lhasa are located, from India. The Tibetan Plateau is intersected by moun-

tains and habitable valleys. Up to 14,000 feet agriculture produces peas, barley, and hay; above that to 16,000 feet nomads roam with their sheep, yaks, and goats

in Lhasa, I had always kept my promises with the government, and had endeavored to help the Dalai Lama in various ways. Permission to visit Shigatse only was granted, but we hoped that once we had reached this sacred city we might be allowed to proceed to Lhasa. And we started out from England early last July with great expectations.

Our first objective, Shigatse, is second only to Lhasa in size and political importance. It is the official residence of the Tashi Lama (Panchen Rimpochi) who is the spiritual head of the Buddhist world. Political reasons several years ago, during the life of the late Dalai Lama, caused the Tashi Lama to leave Tibet and take up his residence in China, where he still resides. At the present time there is a good deal of active talk as to his return to Shigatse in the summer of 1936, but the matter is shrouded in political intrigue which cannot now be discussed.

To reach Shigatse, which lies at an altitude of 12,800 feet, one follows either of two routes from India: one via Gyantse and the other via Khampa Dzong. The distance by the latter route is shorter, being 183 miles from northern Sikkim as against 236, but it is also by far the higher, crossing one pass that is over 17,000 feet. We chose the former route.

The passport which allows strangers to enter the interior of Tibet is a document written in Tibetan and bearing the Kashag's seal. Presentation of this document along the specified route of travel always brings immediate recognition. We actually carried two letters, however—one the regular passport, and the other in the form of a red pennant, which they call an "arrow letter." This letter proved of infinite convenience to us, and its use merits explanation.

A courier

When traveling in Tibet, it is the custom to change pack animals as often as required, and so to apportion this business amongst the various villages. Distances are consequently divided according to where the changes occur, and, since we nearly always made double marches, the routine was to change animals twice a day. Here is where the "arrow letter" became so valuable, for it traveled ahead of us by one or two days. Its presentation notified villagers and gave them ample time to collect their animals, which might be miles distant, tucked away in

some valley where there was good pasturage.

Anyone who travels in the interior of Tibet will invariably be struck sooner or later with the realization that the country has never changed. Countries sometimes are so backward that they appear still to be existing in the seventeenth century or thereabouts. But with Tibet, the period could easily be a thousand years or more ago, and for this situation there are definite reasons.

A closed country

Consider the term "Forbidden Land," which is so often applied to Tibet. Along its southern border lie Nepal, an independent Hindu kingdom of Mongolian stock, and two native states of India, Sikkim and Bhutan, both of Tibetan stock. Natives of these three are allowed into Tibet, and do some trading with the inhabitants; but Tibet's racial intercourse ends here. Indians from India and those other races who live along the far-flung frontiers of Tibet may not enter, nor are any permanent resident government representatives allowed. Prompted largely by religious motives, the nation, an ecclesiastical one much dominated by Buddhist priests, will not tolerate foreigners or foreign customs and products.

In view of this and of the fact that the country is practically self-supporting, with a plethora of everything needed in daily life, it is not hard to understand why Tibet has not changed and why no one in the country particularly wants it to.

The social order is a complete feudal system such as existed in Europe during the tenth century. How truly fascinating it is to travel there, to live in the houses of the natives, to rub shoulders with them, eat Tibetan food in company, and to know all the time that the culture and manners are a changeless relic of a forgotten era. Add to this that the people of all ranks are charming and virile, that they possess a fine sense of humor and are ultra polite, and that they live in strong, well-built houses amply comfortable, and you can understand that exploring in Tibet can be most interesting and delightful.

One is at first somewhat surprised at the peculiar salutation received everywhere from the common people. Any peasant upon approaching a foreigner or nobleman sticks out his tongue and holds it out for a second or two. This is the polite gesture of greeting.

The Tibetan plateau is a country of very different altitudes. Shigatse and Lhasa lie in Central Tibet, where although the land is not as high as in the regions to the north and south the altitude is nevertheless extreme. The plateau is intersected by hills and mountains, graced here and there with high snow-capped peaks. It is a land of habitable valleys that range from gorges to vast plains. The higher the altitude the less fertile the land and more rigorous the climate.

Agriculture, which produces largely peas, barley, and hay, becomes scanty at over 14,000 feet. Here crop raisers begin to merge with the nomads, who roam with their herds of sheep, yaks, and goats up to 16,000 feet.

Anywhere on the plateau the climate is naturally a cold one, and even if people from south of the Himalayas were permitted to settle in Tibet, the altitude and cold would make their environment absolutely unsuited to their welfare and health. The winters, except to those inured to them for generations, are unbearable. During this season the higher one goes the more one is subjected to icy southeast winds which, blowing a full gale during the daylight hours, raise fearsome clouds of dust often mixed with snow that go hurtling over the great grasslands.

Traveling conditions

Summer is the proper time to visit this country, but the summer is short. At 14,000 feet early July is still coldish with possible snow flurries, and August is the period of rain everywhere. Usually during this latter month the mornings are clear, but cloud banks from the western mountain tops soon cover the valleys and by one o'clock a sweeping cold rain has arrived, often accompanied by hail.

The Central area is part of the watershed of the mighty Tsang Po River (Brahmaputra). This river is fed by innumerable tributaries that rise from upland springs and snows. All during August the many rushing streams are muddy from the masses of silt the rain has washed down from the mountain-sides. From the middle of September on through October the weather at 12,000 feet is perfect with a brilliant warm sun all day every day, yet with frost at night. This is the fine weather period, yet by mid-October at 14,000 feet the autumn is well under way and the cold winds are in full sway.

From this it is easy to understand that Tibetans must be a hardy race, particularly as there is little fuel in this bare country.

A splendid reception

Shigatse is situated in a huge, lovely valley surrounded by mountains. Our approach, late one afternoon, followed the river Nyang Chu, which three miles north of the city debouches into the Tsang Po. The first landmark one sees, arriving from any direction, is the great lamasery of Tashi Lhunpo, situated near the base of a mountain slope about a mile from the city. Its many gilded temple roofs completely dominate the landscape. Thirty-five hundred lamas reside here.

Word of our arrival had been sent ahead, and a splendid reception had been prepared. Guides met us at the outskirts, and the crowds which milled about our caravan as we passed through the narrow streets of the poorer section made our progress seem like a triumphal entry. We passed on to what might be classed as the more well-to-do residential quarter, and stopped at a house which was lent to us by the nephew of the Tashi Lama. There a small reception group awaited us. Buttered tea, the staple of Tibet appeared, and we were introduced to two gentlemen who were to act as permanent ADC's during our sojourn.

One wing of the house, situated in a lovely park, had been made ready to receive us and was hung with draperies and banners; also there was additional space for servants and kitchen. While on trail and stopping at different native houses, our permits required us to pay for rent and all other accessories we might want, which the natives were required to supply us at current rates. Here in Shigatse, however, the house was a gift of the Government and everything was made as comfortable as possible in true Tibetan fashion.

Next morning, as definite etiquette required, we started to make our round of calls on the high officials. These comprised three: the Governor in Tashi Lhunpo (a very high Lama, indeed the ranking authority of the district), a second very high Lama, and lastly the Dzong Pen or Civil Governor, who lived in the Dzong or city fort.

The high lama's residence was at the top of a tall massive building, and was reached by climbing a series of great wooden ladders (stairs are practically unknown in Tibet). He

occupied two floors, which were divided into sitting rooms, verandas shaded by awnings, sleeping quarters, and a shrine corresponding to a private chapel.

We sat down to buttered tea and native sweetmeats, such as one would have at any social call in Tibet. The conversation, as always, was begun with platitudes and politeness—"Do you feel tired after your long journey? Were you treated well on the way? Is your house comfortable?" etc. etc. Conversation was much facilitated by a native woman of Shigatse who once had been an ayah in both Calcutta and Darjeeling and could do excellent English-Tibetan translation. She remained with us during the stay of ten days. The Governor promised for us a special review of 500 city troops of the regular army on the morrow; and with the usual polite salutations we took our leave and passed on to other calls.

First the Lama, then the Dzong Pen. These calls were similar and plenty of buttered tea was served at both. Living quarters of these officials, in sharp contrast to the massive grim exterior of the building they were in, were quite attractive. We had presents for each, which according to custom were presented to a servant on first entering and then no further attention whatsoever was paid to them. Tibetan scarfs had, of course, been properly exchanged.

Outdoor parties

Except, now, for the return calls, of which there were only two, for the High Lama pleaded his age as the excuse for not visiting us, the stricter formalities were over and we came to the lesser formalities such as lunch parties; these were truly delightful affairs. The weather, which had been very rainy, had just cleared up and the gentry of the city had decided, as is customary throughout Tibet during the fine weather, to hold such parties in the fine parks under their big summer tents. Three of these parties were held—one in the park of each of the Tashi Lama's summer palaces and one in our own park.

The tents are pitched in the shade of specially planted poplars (trees do not grow naturally as the plateau is above the tree-line); then from noon onward one or more days are spent there. A field kitchen is set up in a small adjoining tent where a mid-day meal is prepared. Recreation takes the form either of chatting or, what is very common, competition in archery, a sport

for which there is real enthusiasm. The arrow, a curious one with a blunt perforated head that causes it to whistle as it passes through the air, is shot at a target from a range of about fifty yards.

Soldiers and priests

Two interesting shows were put on. The first was the military parade in the city's parade ground. There is little point in discussing the details of this affair other than to say that the troops did not seem all to have been chosen from the better physical elements of the population. The band, it might be said, which with leopard skins was somewhat modeled after native British units, played far better than the marching of the men, in their ill-fitting uniforms, merited. The parade was followed by a buttered tea party at the Colonel's house.

The other show, which was of great interest indeed, was a concentration in full regalia, maroon cloaks and yellow hats, of all the 3500 Lamas of Tashi Lhunpo. They congregated *en masse* in a great court of the lamasery which was dominated on one end by a raised dais on which stood the now empty seat or throne of the absent Tashi Lama. They remained in this court half an hour milling around and chatting together, amused and unperturbed by the moving picture camera, for the use of which the Abbot had given his permission.

Our real objective here as elsewhere was the acquisition of a botanical and anthropological collection for the Kew Gardens of England and the American Museum of Natural History respectively. As soon as the populace learned of the latter interest, masses of people congregated outside our house with many articles of ethnological value to sell. All the things which the Tibetans use in their daily life and the objects used ceremonially in the temples were offered for sale. This was exactly what we wanted.

As for plants we had to go slightly farther afield, as the near surroundings of the city were intensely cultivated and the land immediately beyond was quite barren of any flora. A trip to the Tsang Po valley, however, was excitingly successful, and a few days collecting proved highly gratifying.

A last word for Shigatse. Most of the streets are broad and clean and there is no congestion of population. It is true that it teems with beggars, most of whom are blind, yet what Tibetan

city does not? It is as hospitable a city as one could wish for.

It is the custom of the Tibetans to return presents, and this is what we received: 8 sheep, 19 sacks of barley flour, 15 dozen eggs (very few edible), 20 pounds of black Chinese brick tea, 2 trays of vermicelli, 10 goose eggs, 3 sacks of clarified yak butter (in yak skins with hair on) of 12 pounds each, 2 pieces of jade.

On to Lhasa

During our stay in Shigatse numerous references were of course made to Lhasa. While it was not to be denied that Shigatse was a fine city, even its own citizens admitted enthusiastically that Lhasa was the queen of the land. It was naturally with intense excitement that we turned our caravan in that direction.

Our new permit which was necessary to visit this city was received, and read as follows:

"All Dzongpens and Headmen between Gyantse and Lhasa and along the road are all hereby ordered to bear in mind with permission of the Lamas and high officials of the kingdom: American Sahib Cutting and party have started from Gyantse. This passport is granted to the effect that you shall supply on payment without any objection or delay six riding ponies and 15 pack ponies. They should also be supplied, whether it is an intervening stage or a halting place, with fuel for kitchen, birdfruit (eggs), milk, etc., on payment according to prevailing custom.

"Given under the seal of the Tibetan Trade Agent."

We gauged our departure so as to reach Lhasa on an auspicious day, for because it is a holy city to do otherwise might interfere with the welfare not only of the city but of the entire nation. There are good dates and especially good dates, and we consulted the Tibetan almanac to select the best that was feasible.

Beyond Gyantse the plateau shortly rises to over 14,000 feet. Then after crossing two high passes the trail drops way down to the Tsang Po at 11,000 feet. Following this river downstream and up the Kyi Chu, one traverses country of a fairly low altitude. This section is populated, very fertile for agriculture, and all most beautiful indeed.

Practically the only export from the region we traversed is wool, which, however, goes to India in large quantities. From this the natives buy their imports, which are very limited in-

deed. Of metals they use copper, brass, and iron, which are transported on animals' backs. They use also some silver, but practically no gold.

The portion of the plateau over which we traveled is woefully lacking in mineral resources. The late Messrs. Hayden and Cossom recently made a survey, at the request of the late Dalai Lama through the Government of India, over some of the region that we traversed and quite an area of the high country north of Lhasa. But the late Mr. Hayden, who was a trained geologist, could not report the presence of any mineral deposits of any value. Incidentally, he was guaranteed by the government of Tibet a fair payment in rupees in return for his services, but refused the sum, claiming he had been paid many times over by the great interest of his trip.

Mineral resources elsewhere

East of Lhasa is the area the Tibetans call Kam. Here the plateau gently falls as one proceeds eastward toward China and Assam, but in a northeasterly direction the country rises. Little is known of these parts of the plateau, but one can safely assume, since one so very rarely sees the presence of gold in Lhasa even among the rich and since so much metal comes from India, that this country is also lacking in minerals.

A similar condition would seem to exist in far eastern Tibet, the section belonging chiefly to China although containing small independent kingdoms such as Muli and Lolo. The author made a trip through a large part of this country and although a general statement would not be warranted, it can be said that there was very little evidence of mineral wealth, though hardly the dearth of the plateau. Gold, concerning the existence of which in Tibet there has recently been some speculation, did not seem to exist at all.

After being on the trail some days we drew near Lhasa. After the bleak, higher levels, the many areas of emerald green grassland, although swampy, were a lovely sight. Finally a bend in the long valley brought into view the great Potala, seven miles away.

A magnificent spectacle

It was indeed an awe-inspiring sight. Just as Shigatse is dominated by the lamasery of

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Tashi Lhunpo, so Lhasa is by the Potala; but of the two the latter is by far the more beautiful. It is indeed devastating to behold; and the spectacle increases in beauty as one approaches. Towering above the city, supreme now and forever, it is possibly the most magnificent building in the world, including the Taj Mahal. Although it has general shape only, with no balance of its component parts, it seems to wear better and better on intimate scrutiny. The most effective point from which to view it is probably the stone causeway which is lined with trees and water. What a building, and by full moon! Its architecture, purely Tibetan, reminds one definitely of no other style. It was begun perhaps in the tenth century, but renovations in the early seventeenth century developed it into what it is today. It could make one dream of ancient Persepolis, for perhaps this is what Darius might have lived in. There is room for much delightful speculation.

Guides had been waiting for us well outside the city, and as guests of the government we were escorted in. The way led past the Potala along a broad street with fine private buildings on the left and a vast open meadow on the right everywhere planted with clumps of willow. In the heart of the city where the bazaar

is located, the streets, most of which are broad, are clean for an eastern city and do not seem nearly as massed with population as in either India or China. The buildings are well constructed, roomy, and with pleasant exteriors.

There is no glass made in Tibet and its transportation by caravan for windows is well-nigh impossible. Laden animals and humans pass here and there, (there is not one wheeled vehicle in the entire country) covered temporary stalls of temporary bazaars line certain streets, with the better permanent shops in the basements of buildings. Nowhere do bad smells, filth, or flies exist—so different are Tibetan cities from the general run of the eastern ones.

Our quarters were located in a perfect spot about two miles from the bazaar and adjoining Norpa Linga, the summer palace and regular residence of the late Dalai Lama. We occupied a small house with stable adjoining set in a huge walled garden of poplars and willows, such as have been planted all about the city.

The population of Lhasa is supposed to be about 40,000 but no census has ever been taken. Of these inhabitants about 16,000 are celebrate lamas who live in great lamaseries of which the two largest are Drepung (meaning a heap of poured rice) with 7500 lamas and

Sera (meaning a heap of hail) somewhat smaller. The inhabitants of Tibet are priest ridden and, in matters of politics and especially the choosing of a new Dalai Lama, the influence of these great lamaseries particularly Drepung, is very strong.

The government of Lhasa is made up as follows: There is a council called the Kashag made up of five—four lay nobles and one Lama, all of middle age or older. This council is a very powerful unit and, constituting the active governing body, it meets once a day. Above these in rank are: the Prime Minister, Si Lon Yapshi Lon Dun, and the Regent, Re-ting Po gya tsap Rimpoche, a reincarnate Lama chosen by the late Dalai Lama before his death. These latter two men, about thirty-five and twenty-five years old respectively, have the highest authority, the latter being able to demote at will any member of the Kashag from his high rank.

The title denoting membership in the Kashag is Shapé. At the time of our arrival the Regent and the senior member of the Kashag, Trimon Shapé, were absent searching for clues that could lead to finding a Rimpoche baby who might prove to be the reincarnation

of the late Dalai Lama. Calling on the remaining officials took up the entire next day. These all, living in the city, had large houses that were usually anything but pretentious from their exteriors but really attractive and comfortable within.

The height of formality

During these visits had come real formality. The scarfs offered here had to be of the very best quality, brand new and both folded and presented in one special way. The presents to each had been sent to Lhasa several weeks before and, of course, were never alluded to.

Beyond our quarters to the westward extended Norpa Linga, the park of the late Dalai Lama, and three summer palaces. These are situated in a huge walled enclosure planted with poplar.

The Potala is the traditional winter palace of the Dalai Lama. But the late Dalai Lama chose to live in three renovated summer palaces exclusively save for one or two weeks in the year. Broad arborescent walks that would be beautiful in any estate in the world criss-cross the park. The residences, surrounded with flower

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KASHAG.

beds and wholly of Tibetan architecture, give one a strange feeling of something perhaps more European than anything one has seen elsewhere in Tibet. Exterior and interior of both, like the grounds, are immaculately clean. There are electric lights (hydro-electric), a Dodge and two Austin cars (the latter brought up in parts)—all entirely disused. There are also large stables and, in one far corner, barracks that housed what was called a regiment of infantry.

No one lives in these houses now except one high lama and at times a sort of major domo of the place who is a noble in gold dress. Both of these were in attendance when we went and entertained us with a most delicious lunch under one of the white awnings.

The rooms in the houses are lavishly decorated with beautiful wall paintings, banners, and fine wood carvings. The furniture is mixed; there is some silk upholstered European furniture of a rather stiffish type, also Tibetan couches along the walls which are used for both sitting and lying on.

On the way out we passed a small artificial pond with a gilded summer house near by where in hottish weather His Holiness (the late Dalai Lama) used to sit and watch his ducks sporting.

Tibetan cuisine

Several lunch parties were held which we attended (Tibetans do not have guests to the evening meal as they go to bed so early). These entertainments were always the same, being long meals of excellent food eaten with chop sticks. The food varies little, usually being first sugared rice, an emblem of good luck, soup with vermicelli cut in strips by hand and tiny bits of tender mutton, small mutton balls or strips of the same with few vegetables, all highly spiced with pepper. For drink, one begins with the everlasting buttered tea and later a native barley beer called *chung*. This contains perhaps one half of one per cent alcohol, as Tibetans are not given to spirits and even rarely smoke, although some cheap cigarettes are beginning to filter in.

Should one be riding in the suburbs or in the city proper, there was always something of

interest. Several times we would come upon Shapés in their gold robes, which is Tibetan full dress of high rank. These would be riding in front of about a dozen of their own people, all mounted. On such occasions, we, like all others, would dismount and doff our hats, to be rewarded with immediate recognition.

Never was there such weather! As it was early October, there was a strong frost every night, but in the mornings a brilliant sun appeared in a cloudless sky and remained with us until it set over the western mountains. So dry was the air that all dampness in the ground, after it had thawed, was rapidly absorbed, leaving a perfect terrain not too dusty.

Finally there came what Arthur Vernay and I thought was an appropriate time to take our departure. As at Shigatse, we had received many presents, so we left cards for officials and friends (this is not a Tibetan custom) and started back over the long trail to India. We knew that late October at over 14,000 feet was unpleasant, with cold temperatures and high winds, and we had plenty of them both.

It is to be hoped the reader will appreciate how exceedingly interesting the unique country of Tibet is. There is definitely no reason to presume the country is opening up. It is not. Tibetans have certainly the right to resent foreigners, yet what a shame it is that their country is not more open.

Most people have looked upon the country as a land shrouded in mystery and quite unknown, but this is hardly true. Much romanticism can be written about it, whether the author has actually been there or not, and the material is more apt to be appreciated than if written about any other country in the world, as the name Tibet bears such an extraordinary lure.

Yet there is still much to be learned of its people and of vast unexplored areas, inhabited or uninhabited. That the people want nothing of the outside world is due to the influence of the priests. This is a country which scarcely knows the existence of the rest of the world. All live their lives in complete ignorance of the outside, and it is fortunate for them that they do, for they are perfectly satisfied, and a healthier or more cheerful lot of people it would be difficult to find.

The Forbidden

[illegible]

(Above)
A letter from
His Highness the
Dalai Lama, written by his
scribe. Long correspondence be-
tween Mr. Cutting and the Dalai Lama
led to an invitation to visit the forbidden city

(Right) Palace-monastery of the Dalai Lama
(Below) The envelope which carried the
above letter



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C. Suydam Cutting Esq.,
32, Nassau Street,
New York City,
U. S. A.





On the trail to Lhasa. The Fort of Penadzong on the shore of "the Lake of the Nomads' Upper Pastures" (Yamdruk Tso). Note the Prayer flags in the water



(Right) Streets in Tibet are broader, cleaner, and less congested than in most other eastern countries. A square in Lhasa



IN THE LAND

(Left) A lama school. Here under the trees near the lamasery of Drepung the students are taught Buddhist text

(Right) *The caravan on trail at 14,200 feet between Sikkim and Shigatse, which is the spiritual capital of Tibet and was the expedition's first objective*



(Left) *A typical courtyard of a Tibetan house where the caravan passed the night. The houses are well built and amply comfortable*

OF THE LAMAS

(Right) *A halt for tea in a Tibetan home. The people of all ranks are charming, hospitable, and full of good humor*





A portion of the bazaar of Shigatse. Situated at 12,800 feet in a huge valley surrounded by mountains, Shigatse is the official residence of the spiritual head of the Buddhist world, the Tashi Lama

Head of the largest Buddha in Tibet. The photograph is taken from a height of thirty feet. The face is of gilded wood



In the great lamasery of Tashi lied to greet the expedition. low hats, the throng milled about visitors but undisturbed by the



Lhunpo, where 3500 lamas gathered wearing maroon coats and yellow hats for half an hour, amused by the notion picture camera



The famous lamasery of Tashi Lhunpo. Its many gilded roofs dominate the landscape



(Left) Exterior of the summer palace of the Tashi Lama at Shigatse



(Left) Private quarters of the Tashi Lama in his summer palace



(Below) Workers in the garden of the summer palace

*(Right) From the fort,
looking across the roofs of
Shigatse*



*(Right) The fort or
Dzong, where the
Civil Governor re-
sides*



*(Below) Regiment in
Shigatse on dress
parade in honor of
the expedition*





PEOPLES

(Left) Rakyabars, disposers of the dead



Beggar women of Shigatse



High Lamas, Drepung Lamasery

Professional dancers, Lhasa



A famous painter of Lhasa



OF TIBET

(Right) A family of high degree



Lama police in Drepung



Noble ladies from Shigatse and Lhasa



Northwest entrance to Lhasa. Being a holy city, the expedition consulted the Tibetan almanac and

(Right) Looking over the roofs of Lhasa toward the Potala



(Below) Guards at the entrance to the Dalai Lama's summer palace. The uniforms and rifles are from India





it can be entered only on a lucky day. The expedition planned their arrival accordingly



(Left) An avenue in the summer estate of the Dalai Lama at Lhasa

(Below) The expedition's headquarters in the forbidden city, a comfortable house in an enclosure of poplars and willows





PALACE-MONASTERY



(Top) The famous Potala. A building seen by few explorers, but one of the most beautiful structures in the world

(Right) A stairway leading to the section of the Potala which is the official winter palace of the supreme ruler of Tibet. The enclosed courtyard shown directly above is on the very top of the building





OF THE DALAI LAMA

(Above) A lower stairway of the Potala

(Right) An impressive building in all its majesty and mystery. The Potala was begun perhaps in the tenth century, but renovations in the early seventeenth made it what it is today





Tibetan coracles on the Tsang Po (Brahmaputra) River which conveyed the expedition ten miles down stream



(Center) Yaks grazing on the shore of Yamdrock Tso, "the Lake of the Nomads' Upper Pastures"



(Left) A young groom who tended Mr. Cutting's horse during a halt

Bird Voices in the Southland

Making "talkies" with an all star cast of native American birds

By ALBERT R. BRAND

*Associate in Ornithology,
American Museum of Natural History*

PHOTOGRAPHS BY ARTHUR A. ALLEN, P. PAUL
KELLOGG, AND JAMES S. TANNER

*Magellan braved all seas that roll,
Commander Peary found the Pole,
Leander swam the Hellespont,
But I have tramped across Vermont.*

THUS did Arthur Guiterman sing of the explorer who stays at home. Strange as it may seem, it is not always necessary to travel great distances to foreign lands to bring back interesting and valuable results. Right here in the United States there are treasures to be sought; treasures that in a few years may be past obtaining. The frontier is gone, but even today there are areas of no inconsiderable magnitude practically unexplored; and one need not even go so far as our newer west, for, though they are becoming scarce, little-explored regions still exist on the Atlantic seaboard and in the Mississippi Valley.

In February, 1935, a joint expedition of the American Museum of Natural History and Cornell University set out on such an intramural undertaking. The object: photographing native wild birds and recording their voices. Particular attention was given to species that, because of the fast development of civilization or for other reasons, are becoming rare.

Dr. Arthur A. Allen, professor of ornithology at Cornell University, led the party, his special province being bird photography, both still and motion pictures; he also directed the ornithological observations, and arranged the itinerary; the writer, whose major interest for several years past has been recording sounds of native birds, accompanied the group on the journey into the southland; Paul Kellogg, in-

structor of ornithology at Cornell, was the technical expert in charge of sound recording; Dr. George M. Sutton, a distinguished bird artist and curator of birds at Cornell University, joined the party in Florida and Louisiana, and contributed a number of water color sketches of the rarer and more unusual species; and lastly, James S. Tanner, a graduate student, accompanied the expedition as camera-man assistant, sound recording helper, cook, and general handy man.

The sound equipment

One bleak morning in mid-February, two small Ford trucks loaded with cameras, sound recording paraphernalia, and camping equipment pulled out of Ithaca, New York, headed southward.

The trucks, besides transporting the party, served two other purposes. They sheltered the men for at least half the time afield, and proved that one can rest quite as comfortably in a truck as one can, let us say, in the more conventional Pullman berth. In addition, one Ford was especially adapted for sound recording. In it were mounted amplifiers, sound cameras, and several hundred feet of cable with which to connect the microphone in the field and the equipment in the truck; also this vehicle carried the sound mirror and its tripod.

The sound mirror or reflector is a large circular disc—a section of a parabolic curve—some three feet in diameter. At the focal point of the parabola the microphone is set. The result: when the combined microphone and parabola is focused upon a singing bird, the song is greatly amplified. All other sounds not directly in the beam, however, reach the microphone in only normal volume. The object of this device is to reduce outside or ground noises, which frequently ruin otherwise excellent out-

door recordings. The mechanical ear, as the combined microphone and parabola has been called, is set on a tripod, and hooked up to the amplifier and sound camera in the truck. Most of the recordings are made using the microphone in combination with the parabolic reflector, but occasionally it is expedient to use the microphone alone.

On the prairies of Florida a six-foot diamond-back rattler was encountered. In this case the microphone was dropped close to the subject—closer no doubt than the recorder would have dared to be himself—and the snake rattled directly into the recording device; and again in a heronry in Louisiana the microphone was set among the nesting birds, and the various raucous honks, rattling croaks, and peculiar squawks were faithfully recorded.

The photographic equipment

The second truck was used for photography. The Akeley camera and its substantial tripod, kindly loaned for the duration of the expedition by Mr. Duncan H. Read, was most useful and brought beautiful results; but it was a bulky affair, requiring much room, and was no joy to lug a half mile or more through virgin forest and swamp. In addition, there were several other moving picture and "still" cameras. The roof of this truck was fitted with a collapsible platform or tower, similar to those used on public service corporation repair trucks; and often the photographer stood his camera on the top of the truck, and did his "shooting" from there. Occasionally, when we were photographing birds that nested well up in the trees, the roof was not sufficiently high; then the platform was extended to its full height. This enabled the camera-man to operate from a point about twenty feet above the ground.

Outfitted in this manner the group was ready for a powderless hunt, where camera and film supplanted rifle and shot. The trophies were not to be bird skins, for the expedition was interested in preserving, not decimating, the rare species that are already all too near extinction.

It might be well to consider for a minute what we mean by rare birds. The term "vanishing birds" hardly needs explanation; generally it refers to those species that once were plentiful, but for certain reasons, persecution or hunting or what not, are now on the point of extinction. Every so often we hear of such cases. The wild turkey has all but vanished from a

large part of its former range, and the final disappearance of the last lone heath hen in Martha's Vineyard, little more than a year ago, reminds us that, do what we will, if a form becomes exceedingly scarce, all our powers are futile. Protection is of no avail. Fortunately those interesting and beautiful birds, the white herons or egrets, which were becoming extremely rare a generation ago, are again abundant.

One of the most outstanding examples of what one individual can do for the preservation of birds is Mr. E. A. McIlhenny's "Bird City." He has made an artificial pond on his estate so attractive for snowy egrets that, from a small beginning, the birds have now increased to more than 10,000. Through Mr. McIlhenny's courtesy and hospitality the expedition was able to record the curious calls of these birds, and to secure many excellent photographs.

It is to the credit of such individuals as Mr. McIlhenny and of the National Association of Audubon Societies and other conservation groups that these interesting birds are alive today. Through their efforts the birds have been saved for posterity. Not so with the passenger pigeons, however. Hardly a hundred years ago flocks were encountered so large that they literally darkened the skies. The last known specimen of this beautiful bird succumbed in captivity in 1914. Over-hunting—the bird was large, unwary, and toothsome—brought about its destruction; and almost before most people were aware that the species was getting rare it had vanished from the face of the earth.

Rare camera subjects

But what about rare though not necessarily vanishing species? Not all rarely seen birds are on the verge of extinction. There are, we are glad to say, comparatively few forms that are actually close to the border line; but, on the other hand, there are many birds that are commonly called rare. Rareness of a bird often depends upon the locality of the observer. Birds that are very rare in one place, if followed to their breeding grounds may well be as common as English sparrows at home. Others, if not common, are at least of usual occurrence.

Consider for instance Audubon's caracara, a vulture-like hawk, which though common in Mexico and to the south, is found only in a few favorable localities in our southern states. On the Kissimmee Prairie of Central Florida the

bird is a common resident, however, and it was not difficult to find nesting birds. This region, perhaps eighty miles long by forty wide, is practically uninhabited. The only signs of civilization are occasional herds of scrawny cattle that eke out a meager existence on the sparse prairie grasses.

The trucks were driven over the pathless wastes to a hammock—a prairie oasis, where a few hardwood trees and cabbage palms manage to exist on the comparatively dry, sandy soil. There, in a large cabbage palm, twenty or more feet from the ground, a pair of caracaras had built their bulky nest. It sheltered two nestlings almost ready to fly; and when a member of the party donned climbing irons and shinnied up the tree, one of the young birds fluttered out. Then followed a chase through scrub palmetto; but the bird was finally captured and induced to pose before the camera. Eventually it was returned to the nest. On this occasion the collapsible tower was most useful, for when extended, the photographer was enabled to work within ten feet of the nest.

Some of the larger birds

Another bird, not uncommon on the prairie, is the Florida or sandhill crane. These large birds are true cranes, not herons; the wing spread is six or seven feet, and when standing erect their height is equal to that of a ten-year-old child. Nervous and wary as they are, photographing them was a matter requiring consummate patience and skill. The voice can be described as a loud trumpeting, rather musical and startling. Toward evening and at dawn these mighty birds fly over, trumpeting as they go. There is something awesome about their loud voices ringing over the otherwise hushed prairie; the peculiar light, the unending, flat, rolling seas of grass and palmetto, give one a feeling of reverence in the presence of powers far greater than those of insignificant man. But the sound recorder has little time for such thoughts; he must be alive to his opportunities. It was at such a time, with the prairie bathed in eerie sunlight and the cranes trumpeting overhead, that the loud stentorian calls were recorded.

Persecution has made the bald eagle a rare species in all but a few of its former haunts. At one time this bird, our national emblem, was common over most of its range. Its great size made it an easy target and, although rarely

destructive, it receives protection in less than two thirds of our states. Fortunately on the coast of Florida, eagles are still fairly common, and it was on the east coast that the expedition secured photographs of these spectacular birds.

Wild turkeys also are large birds, and in addition, furnish excellent food. They have all but disappeared except in the wildest and most inaccessible regions; their future is indeed precarious. However, in Georgia, thanks to the coöperation of Mr. Herbert L. Stoddard and Col. L. H. Thompson, a flock was baited up before a blind, and sound and pictures of both male and female birds were secured.

Free from the fear of man

However, there is another side to the picture, and, in certain parts of Florida, birds that are generally credited with being wary and shy, have, to a large degree, lost their fear of man. In central Florida, in the heart of the city of Orlando, is a small lake. Here scaup and ring-billed ducks, coots, cormorants, and gulls congregate during the winter season. The ducks arrive in the autumn, after having migrated from their northern nesting ground. On their journey southward they are subjected to a constant barrage of lead; and on arriving at winter quarters, one would expect them to be cautious itself; yet that is not so; they seem to sense that they are protected on this city lake. Here the park attendant feeds them daily, and they have become so tame that they will take food out of his hand. The residents also feed the birds, and it is really amazing to see these usually wary creatures with apparently no fear of their arch enemy, man. Hold a piece of bread in your hand above your head, and gulls will fight for the privilege of grasping it from between your fingers; while coots and ducks will churn the water at your feet in their attempts to get you to hand them a titbit.

At St. Petersburg, on the gulf coast, conditions were similar, and several species of gulls and ducks partook of the festivities. In addition, the brown pelicans have become so tame that on the municipal pier it is not uncommon to see a number of these comical, ungainly birds standing next to the fishermen patiently awaiting a handout. If a fish is caught too small for the fishermen's creel, it is deposited in the waiting pouch of an attendant bird. It was not difficult to get the pelicans to pose for their pictures. A can of live bait, bought on the pier and fed

to the birds by the hand to mouth method, lasted but a short time. The sound apparatus could not be used, however; pelicans are one of the few voiceless birds, almost as silent as that silent mammal, the giraffe.

Recording the ivory-bills

The most protracted stay was made in the country of the ivory-billed woodpecker. This, the largest native woodpecker, is a truly glorious bird. Slightly larger than a crow and almost as black, the ivory-billed is much more unusual and startling in appearance, especially if seen on a tree trunk as it works in typical woodpecker fashion. Both sexes have prominent crests; that of the male is a flaring red; the female's is black. When the bird is at rest, great white patches on the wings suggesting white coat tails sharply contrasted against the greenish black of the rest of the body are strikingly prominent. The large bill is ivory-colored, as the name suggests. The species has always been uncommon; of late years it has become so rare that it is on the verge of extinction.

Ivory-bills were sought in several Florida regions, and much time and energy was expended running down every clue and rumor. Professor Allen had observed the bird ten years previously in one of the wilder regions of central Florida; and a local observer reported having seen an individual in the identical region no longer ago than the preceding Christmas. However, sight records of this bird must be taken with caution, for the other large native woodpecker, the pileated, inhabits similar regions. Confusion is all too common, and a trained observer and close observation are necessary for positive identification. Many of the casual reports of ivory-billed no doubt refer to pileated. Nevertheless there seems to be good reason to believe that a few ivory-bills still inhabit the Florida region; but actual specimens were not seen.

In a dense southern swamp, however, the birds are making their last stand. The large waste area is in private hands, but the birds, fortunately, are receiving the protection they so sorely need; and even visiting the region is discouraged. In fact, the expedition spent a full day of valuable time on the long distance 'phone and telegraphing, before permission was granted to enter.

The warden, J. J. Kuhn, acted as guide; he is guarding the birds' last stand and, with-

out his aid, finding the birds would have been well nigh impossible. But the difficulties were not over, even with the granting of permission to enter, and with the enlisting of Warden Kuhn's aid. Miles of virgin swamp and partly submerged lands had to be navigated. As means for transporting the sound equipment and cameras, the trucks were useless; and an old farm wagon and four mules were pressed into service.

After much searching, a pair of ivory-bills was eventually located. Here, twelve miles in, camp was pitched, and for a week or more, notes were taken, photographs made, and sound recorded of America's rarest bird. Almost exactly a hundred years ago Audubon studied this bird in the same region. It was rare in his time; little careful work had been done since, and many facts of the life cycle of the bird remain unknown. All during the daylight hours, from a distance of about seventy feet, a twenty-four-power telescope was focused on the nesting hole and careful observations were recorded. One or another of the group was on duty with the telescope during the entire stay.

Will the ivory-bill survive, or like the Carolina parakeet, the only native parrot, and the passenger pigeon, is it also doomed? Time alone will tell; but "while there is life there's hope," for several species that had almost disappeared, with changed conditions have later revived. It seems apparent that ivory-bills are having difficulty in bringing their nesting activities to a satisfactory conclusion; and, of course, there is no hope for a species that cannot raise progeny. As yet we do not know the exact cause of nest destruction, but the days of continued study and recording were fruitful, and furnished several clues as to what is causing the decrease. If the causes can be established definitely, it may be possible so to control them that this most interesting form, now almost extinct, can be saved for posterity.

Instead of the skins of birds, more than fifty thousand feet of film—twenty thousand feet of sound, and thirty thousand feet of motion pictures—were taken from the field, to be preserved for future study. It is hoped that the rarer birds may be saved for the benefit of future generations: if that is impossible, at least we shall have pictorial records of them; we shall know what their vocal attainments were—a poor compromise at best—but far superior to a record consisting of only written words.



These laughing gulls were unusually tame, as are many Florida birds. The northern visitors feed them. A minnow thrown into the air in front of the photographer made this picture possible. The minnow never reached the ground

Bird Voices in the Southland



THE IVORY- BILL

The ivory-billed woodpecker, one of the last of his kind, poses for his portrait. This bird, the rarest in the United States, is larger than a crow. Why he is so nearly extinct is a puzzle. The data accumulated on the expedition may throw some light on the subject

(Right) To transport the delicate sound-recording apparatus into the ivory-bills' country it was necessary to dismantle the automobile sound truck. The apparatus was transported through the swamp in a farm wagon and re-assembled at camp. Mr. Kellogg, during a take, carefully keeps record in a notebook, as well as on sensitized film



The mechanical ear, in a swamp in the deep South, recording the sounds of the ivory-bill. The microphone is set at the focus of the parabolic disc, and the apparatus is then centered on the bird. This device greatly amplifies the desired sound

GOES ON RECORD



(Left) Professor Allen studies the ivory-bills. Continuous observations were made for five days; one or another member of the expedition watched the nesting hole through the twenty-four-power telescope during all daylight hours and kept a log of the birds' activities



(Left) Wild turkeys are still to be found in sections of the South, though they are scarce everywhere and much in need of protection

(Left Center) A limpkin watches from the opposite shore as one of the party climbs to the nest. The bird is oblivious of the fact that it is being photographed from behind



(Lower Left) Lesser scaup ducks spend the winter season in a lake in the heart of the city of Orlando, Florida. Many other residents of the North do likewise. Protection and feeding have made the birds so tame that they will come almost within reach if offered a little bread

ON LAND

ON WATER

IN THE AIR





(Above) A quizzical old pelican flaps past at close range. Beautiful he is not, but graceful and admirably adapted for his special mode of life



(Upper Right) The ospreys or fish hawks make a huge nest which they inhabit year after year, adding to it and repairing it from time to time. Fine recordings of their voices were obtained



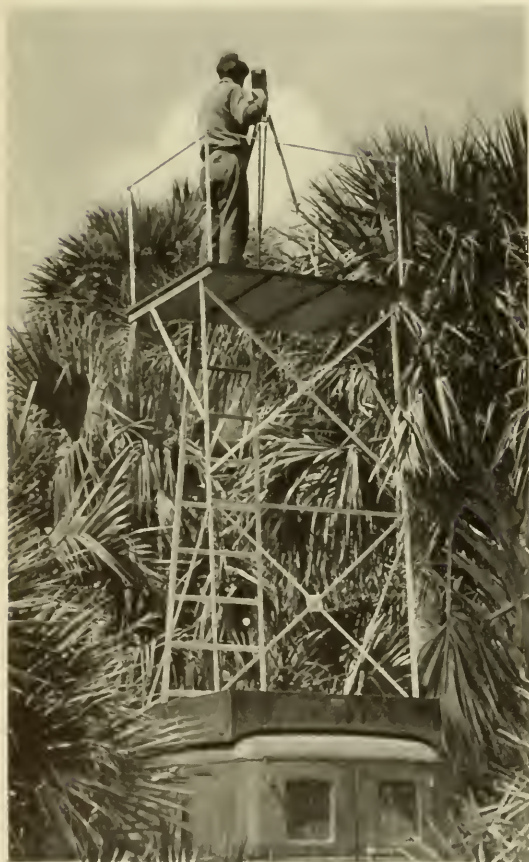
(Lower Right) In order to listen in on a little snowy heron gossip, the operators set the microphone among the nesting birds. Excellent recordings of their peculiar squawks and honks were made which, though faithful, are anything but lovely. Herons should be seen, not heard



(Left) On Gandy Bridge between Tampa and St. Petersburg, Florida. Pelicans benefit from the sun's rays. At rest and close at hand these birds look most ungainly, but in flight and when diving, they are grace personified



(Above) The wood ibis is becoming extremely rare, and the expedition considered itself fortunate to come upon this rather large flock of these ungainly birds



(Left) Here Mr. Kellogg is using the collapsible tower on the truck as a point of vantage in photographing Audubon's caracara

(Below) The loud speaker was set in the territory of this mockingbird, and film of an earlier recorded mocker was played. The bird seemed quite upset; a loud speaker rival was a new experience



(Right) *A Florida diamond-backed rattler poses for camera and "mike"*



(Below) *A Louisiana heron swain presents his lady love with a twig. During the whole period of incubation and even after the young are hatched, the old birds continue to bring nesting material to enlarge and improve the nest*





(Above) The Kissimmee Prairie from one of its hammocks—home of the Florida sandhill crane, Audubon's caracara, vultures, American egrets, and many smaller and less rare birds



(Above) Thirty feet up in the top of a cabbage palm was a caracara's nest containing two nestlings almost ready to fly



(Left) The young caracara hopped out of its nest when one of the expedition party approached too close. The bird was pursued through the scrubby palmetto undergrowth and finally "induced to pose before the camera"

On Safari in America

A woman's story of a dinosaur hunt in the wilds of her native land

By MRS. BARNUM BROWN

SEEING America last has opened up horizons in my native land that the ordinary traveler or stay-at-home little dreams exist. Sometimes the farthest mountain shines the brightest, and the moon in Mandalay may seem the softest, but here within our reach are scattered scenes of beauty to be had for the seeking. A safari in America can offer as many thrills as one in any other part of the world.

Sometimes the Hunter and I followed the elusive trail of the dinosaurs with pack and saddle, pitching our tents beneath the stars, along the old "hoss" trails of the golden west.

Again we rambled by motor through the flaming glory of the Grand Canyon, the soft pastels of the Painted Desert, or the shadowy beauty of the Black Hills.

Today finds us hunting "dinos" with a Stinson plane, covering in one week the horse and motor journeys of an entire year. The methods vary, but the end's the same—bigger and better dinosaurs for the American Museum.

Short scouting trips can yield rich treasures, dinosaurically speaking, and several of our prospecting parties consisted of just three: Doctor Brown, his assistant, and myself. The first two were the prospectors, while I constituted the party.

A rare find

One day the dinosaur hunters returned to camp with the glad news that they had found a rare carnivorous dino, which might have been cause for alarm, save for the fact that his flesh-eating days had been numbered some hundred million years or more ago.

On Beauvais Creek, in the Crow Indian country, the pursuers found a new, low-plated

dinosaur, the only one with a skull known from this age. Day by day the solid sandstone hill was chipped away from the skeleton, until another strange beast came to light—a huge, horned-toad-like creature that resembled the modern lizards of today.

A kangaroo-shaped freak, with long hind legs, short front ones, very long tail, and duck-like beak, also fell to the lot of the dino hunters on this trip, and this, together with the "Dreadnaught," joined the parade of queer animals headed for the halls of the Museum. And the Hunter's name is Barnum.

Wanderers

"Where my caravan is resting" could not be sung of these short trips, because we seldom stayed more than a day or two in one place, and camp equipment for these one-night stands must vary with the individual. There are, however, three items of great help to the wanderer. They may be found everywhere, and do not constitute excess baggage. These are tolerance, love of beauty, and a sense of humor. With these three requisites in the old kit bag, one can journey to the ends of the earth.

While the Doctor is in the field hunting big game of other days, my hours are filled from sun-up till sun-down; for a woman in camp must often play the various rôles of secretary, photographer, cook, camp-wrangler, as well as wife. Perhaps the most important is the secretary's job, for camp records must be kept to date, as an impression once lost is difficult to remember accurately.

Domestic duties vary with the expedition, as does the camp menu, which usually consists of the all inclusive American can, and a side of ham or bacon, mixed with a generous supply of creative instinct, cooked on a gasoline stove,

and served with a dash of imagination. Again the methods vary, but the end's the same—ham and—

On large expeditions where we have a cook, I still must plan the meals, keep records, and manage supplies, which is sometimes more complex than doing things myself.

Along camp trails

Since I cast my lot with the Dinosaur Hunter, we have pitched our tents on far-flung trails—in distant India, Burma, Egypt; on the golden Isles of Greece. Wherever the ghosts of the dinosaurs have beckoned, I have tramped along with the Hunter, and I learned about camp life from him. Camps may come, and camps may go, but the expedition must go on, despite personal vicissitudes and discomforts.

Along American trails there are conveniences not to be found in foreign lands, except perhaps in India, where the spacious government (dak) bungalows vie with our tourist camps. Our camps are more numerous and elaborate, however, and the weary wayfarer gladly seeks these havens of rest, where the hardships of setting up tents at night fade into dreams in a comfortable bed, with bath.

The most beautiful camps I found in the Black Hills of South Dakota, where we spent several days searching for dinosaurs near the classic ground where later roamed the great titanothere, the saber-tooth tiger, and the three-toed horse, their bones now turned to stone, entombed in solid rock.

One night my cabin nestled in the trees, where the night wind, murmuring through the pines, mingled with the quavering notes of the poor-will.

Another night was spent on the banks of beautiful Sylvan Lake, a gem of crystal water, where the moon sank to sleep in silvery splendor on the soft bosom of the lake, guarded by the stern sentinels of Needle Rocks.

Around a bend in the road one is suddenly startled by a face silhouetted against the clouds, and the colossal head of Washington gazes serenely over the trees from the granite top of Mount Rushmore. By his side are Jefferson, Lincoln, and Theodore Roosevelt, with heads sixty feet from crown to chin. This gigantic memorial is one of the greatest sculptures of all time, exceeding in size the famous sphinx of Egypt—an inspiring monument to America's

ideals of life, liberty, and the pursuit of happiness.

The Black Hills, in the heart of the west, form a little mountain kingdom, within whose pine forests may be found surpassing beauties of nature. Here the wondering tourist may explore to his heart's content along roads that wind through towering granite walls and woody canyons; petrified forests; hot springs; and subterranean labyrinths that burrow hundreds of feet beneath the earth.

The most fascinating of these underground wonderlands is Wind Cave.

Long ago in the eighties, a hunter, stalking deer, heard the wind roaring on a still day, and traced the sound to a hole in the rock where the wind was rushing out, blowing the grass in all directions. Most people thought his story was imagination, but he finally interested another man, and together they sank a shaft into the cave, and with ropes and torches they explored several miles of passages, later opening up the wonders to tourists.

As one descends, the cavern opens into a labyrinth of passages lined with shining crystals of various forms and color; some of these passages are so narrow that one has to squeeze through; others are of huge dimensions like cathedral halls.

Crystal fairylands

In "The Queen's Drawing Room," festoons of crystal draperies adorn the walls, hanging in shimmering folds from the ceiling, while the floor is carpeted with opalescent gems. "The Garden of Eden" is a maze of shining light, where trees, and flowers, and frozen dewdrops glitter like sparkling jewels. Foamy white crystals, like summer clouds, adorn the walls of a secret passage known as "The Pearly Gates," as though one had suddenly awakened in the heaven of imagination.

In this wondrous cave, now a National Monument, one can wander through a hundred miles of crystal fairyland, entombed beneath the surface of the earth.

Surrounding the Black Hills are rocks formed in ocean beds of long ago, where we found the remains of a swimming reptile, or prehistoric sea serpent, whose twenty feet of serpentine body once glided through the waters of an ancient sea.

As we leave the beautiful Black Hill country, a pillar of volcanic rock, known as "The

Devil's Tower" is seen for many miles, rising like a monument to forgotten time. Geologists tell us it was a volcanic plug that was pushed upward and cooled, forming a basaltic column while still under cover.

But the Sioux Indians have a different explanation. According to their legend, two Indian children were chased by a bear. To save them, the Great Spirit pushed the earth up where they stood, and as the column rose, the bear left claw marks on the sides of this pillar of rock.

Contrary to popular opinion, the dinosaurs which we search were not all large creatures. One of the smallest known was located in this region—a pygmy no larger than a hen turkey, with a huge head, and dagger-like teeth; probably a small tyrant of those early days before the dawn of human kind.

Our caravan rolls on, until one day, on a lonely hillside in Wyoming, when the purple haze of evening is veiling the valley, we come upon an unknown burial ground of the dinosaurs, where thousands of bones are crossed and crisscrossed in a common grave; those of mighty monarchs fifty feet in length mingled in death with others of more lowly size. Thus was discovered the Howe Quarry, second in size only to the great Dinosaur National Monument at Vernal, Utah.

The Howe Quarry

In 1934 the Sinclair Refining Company championed the cause of the dinosaurs by financing the American Museum-Sinclair Expedition, and the first crew left for the Howe Quarry in April to start uncovering the bone yard.

Tent City was aptly called "Dinosaur Camp," where a handful of tents, clustered together in a little green valley, sheltered the personnel of the expedition. Some called it "Question-mark Canyon," possibly because of the eternal queries that hovered about like wraiths over the dear departed.

Old-fashioned education depended on one's knowledge of the three R's, but our experience in the dinosaur quarry led us to believe it should be the three H's. "How big were the dinosaurs?" "How long ago did they live?" and "How did they come to die out?" The hills must still echo with the many answers.

Camp was never lonely, because news of the great discovery had been broadcast by one Hans

Adamson, the expedition publicist. Verily, hundreds of visitors came from all parts of the United States, and some from Europe, to stare, and question, or sit for hours on the bank watching the preparation of this wonderful mass of bones.

A woman's work

My days were divided between conferences with the cook and doing the secretarial work, which in itself was a full time job, and occupied most of my time. Replies must be sent to hundreds of letters, for it seemed as though everyone had suddenly discovered a skeleton in his closet that demanded investigation. The specimens included a petrified flapper's foot, an Indian moccasin turned to stone, fossil snakes and flying fish, as well as numbers of supposed dinosaur eggs.

The letters were sometimes followed by hurry calls for the Doctor, who would jump into his car at the earliest opportunity, and dash perhaps a hundred miles to the scene of the discovery—only to find a distorted rock, or the skeleton of some old horse or cow.

My spare moments (if any) were spent in the quarry, where I could watch, as never before, the complete story of the preparation of dinosaurs from the time they are unearthed until they are exhibited in the Museum.

So delicate is the work after the bones are uncovered, that the final cleaning is done with small paint brushes and awls, after which the uppermost bones are shellacked and hardened to keep them from breaking.

The blocks are then braced with wooden splints, and covered with strips of burlap that have been soaked in plaster. When this hardens, the entire block is turned over, and the same process applied to the other side; thus, when it is ready for shipment, the whole specimen is encased in a protective cast.

Before the bones are removed, the entire collection is elaborately charted, sketched, and numbered, so that when the bones are unpacked, they can be definitely placed in their exact relationship as they were found in the quarry, and parts of detached animals can be associated. Some of these blocks weigh one thousand pounds.

Socially we are the pets of the neighborhood, and make ourselves at home on all the "dude" ranches. Nearest to us, in beautiful Shell Canyon, is the Quarter-Circle Ranch, the spacious

home of Bill and Rowena Paton, where "dudes" can live in ease and comfort despite their riding togs.

Camp news

Dippings from the "Dino Digest," our camp news bulletin, give some account of daily topics of interest.

"August 12 was a gala day in camp, when President Davison honored us with a visit. Even the bones were on their best behavior, and showed off very well in their new coats of shellac, and plaster of Paris jackets.

"Young Trubee Davison was so thrilled by the daily doings of Dino Camp that he would gladly have stayed and helped in the quarry."

"Dinosaur and Dinorette (the Browns to you) attended the Old Time Picnic at Hyattville, where the whole country-side turned out, well equipped with lunches. The Doctor and wife were called upon for speeches, which were summed up in the local paper as follows: 'Doctor Brown gave a very interesting talk on his work. His daughter gave a short talk on foreign affairs.' The speeches were followed by acrobatic stunts, and solos, until the saxophone player tooted the final horn. A good time was had by all."

"Carl, assistant manager, had a surprise birthday party. The cake was a delicious sawdust and excelsior 'layer,' with plaster icing. 'Happy Birthday,' in raisins, put the finishing touch to the chef's masterpiece."

"Flash! Fuzzie, our mascot (suspected cross between a sheep dog and a porcupine) presented the camp with quinpuplets. Mother and quins are doing well."

In the early evenings, by way of diversion, the Hunter and I stroll up to the quarry to rest on the bank overlooking the "dinos."

It is easy to roll back the curtain of time 140,000,000 years, to the days when these creatures lived, fought, and died in the shallow

lakes that dotted the verdant valley. Heroes or villains of their day, here they were lying together in their last round-up.

This is the spot we love the most at the close of day. The hills are beautiful in the twilight, fading from gold to rose, and into the purple dusk of night. A million stars are in the heavens when we stumble down to our camp beds.

One day Ma, our trusty cook, poked her head out of the tent and cried, "We're snowed in!" We were. For three days and nights the blizzard howled, and when it was at its height, two horsemen appeared on the horizon bearing the sad news that Ma's son-in-law had met with a fatal accident, and she must leave at once. She did. Clad as she was in her blue overalls and leather jacket, her feet encased in gunny sacks to keep them from freezing, she looked like a Chinese refugee; while I, left alone, felt like one. Alone indeed, for the Hunter was flying somewhere up in the blue, on the first lap of his aerial expedition, and I was alone to keep camp for the men.

The gumbo ridge road to our camp when wet was impassable, and the time I was snowbound in Canyon Camp can only be outdone by the time I was rainbound in the selfsame place—another adventure in my life with the Dinosaur Hunter.

The end of the flight

After six weeks the expedition plane, like a weary bird, sank down to earth again, and the flyers returned to camp to help finish work in the quarry.

They had ended a hazardous flight of 20,000 miles over the mountains, canyons, and Badlands of seven states. They had blazed a new trail of dinosaurs from the air.

So passed the days on the old camp ground.

Many have asked which country holds most thrills for the Dinosaur Hunter. For romance, beauty, and adventure, give me a safari in America.



"Dinosaur Camp" in a clump of cottonwood trees a stone's throw from the Howe quarry near Shell, Wyoming—the only approach a perilous drive over the rim of the hills

On Safari in America

(Right) The Browns start on a dinosaur hunt in the expedition's Ford truck

(Center) Anxious moments in camp. Ted Lewis gives "first aid" to Ma Denniger



(Left) Busy moments for the camp secretary. Mrs. Brown kept the camp records, an important job, in addition to her many other duties



(Upper picture) The dangers of dinosaur hunting. In a hazardous location on a steep hillside in the Painted Desert of Arizona the hunters excavate a rare crocodile-like skeleton previously unknown in America

(Lower picture) The sandstone wall near Vernal, Utah, where various museums removed several carloads of dinosaur skeletons. Here the Government Commission is planning the Great Dinosaur National Monument



Personal instruction in the Dinosaur Quarry. Mrs. Brown learns from the Dinosaur Hunter how to clean skeletons—and still live. No one unfamiliar with dinosaur hunters and their regard for fossil bones can appreciate the extreme

care and reverence with which they handle their precious finds. Everything must remain as discovered until it can be studied and prepared, and no one dare remove a broken fragment, for it might be important



(Above) Distinguished visitors in camp. From left to right are Mrs. Shea, Mrs. Brown, President Davison, Mr. Lewis, Mr. Shea, Trubee Davison, Jr., Doctor Brown, and Fuzzie, camp mascot



(Left) Mr. Bird collects a cowboy outfit from Mrs. Paton, owner of the popular "dude" ranch near Shell, Wyoming

In Camp

September Snow

(Right) A September blizzard cripples Dinosaur Camp, and delays work in the quarry



(Left) An important event in camp life. A clanging cow bell calls visitors and crew to meals beneath the shady cottonwood trees

(Below) After the storm the men are kept busy repairing the tents





Photograph by Maude Shea

Along the Way

(Above) Majestic peaks of the Grand Teton Mountains, bordering Yellowstone Park

(Left) These weird, fantastic Badlands are the graves of ancient creatures that long since have ceased to roam

(Below) The Grand Canyon near Bright Angel Trail, Arizona



How About the Tent Caterpillar?

An illustration of the Balance of Nature. To what extent is it wise for Man to interfere?

By FRANK E. LUTZ

*Curator, Department of Entomology,
American Museum*

IN THE vicinity of New York City the year 1935 was a tent caterpillar year. What that meant for the office force of our department of insect life only those can know who have been at the receiving end of letters, telephone calls, and visits about some insect that has aroused public interest.

It would have been much easier for us if we had been willing to give the simple old advice: burn the caterpillars in their webs and, when winter comes, collect and burn the egg-masses. In fact, not knowing any better, that was the advice we gave, say, fifteen years ago. Since then our doubts about its wisdom have been growing until now we venture to say: "Kill, if you wish, the tent caterpillars on your orchard trees and ornamentals but let Nature take care of the wild trees and *by no means cut down wild cherries*." This called for patient and repeated explaining. Let me try once again, this time in print.

"Balance of Nature"

The tent caterpillar, *Malacosoma americana*, is a native American insect and this fact has an important bearing on the question of what to do about it. If we were considering a foreign insect that, like the Japanese beetle, has been recently introduced without its natural checks, the story would be quite different. But the tent caterpillar has been here for hundreds of thousands—possibly millions—of years; and long before garden clubs and Scouts were organized, or ever man took thought of managing out-of-doors, Nature herself had so arranged things

that both the tent caterpillar and natural vegetation, including wild cherries, can live together. The tent caterpillar has been bound by a "Balance of Nature" between it and its environment, including its diseases and insect enemies, in such a way that in any given district the years of caterpillar abundance have been followed by years of scarcity with astounding regularity. If recent organized human interference with natural processes has not thrown the balance out of adjustment, the New York regions that had a peak of abundance of tent caterpillars in 1935 will soon have a scarcity of them for several years. On the other hand, if the balance has been disturbed—well, the result will be interesting scientifically but possibly not pleasing to the wayside committees of garden clubs. When Man interferes with Nature's biological set-up, he is very apt to make a mess of it.

Interference risky

Of course it is true that human civilization necessarily interferes with Nature. The first settlement of white men in America started a whole series of changes in American out-of-doors and the more the country is built up the less "natural" it will be. However, although it seems necessary that we interfere, it is certainly not wise to act blindly or to go too far. The cutting down of wild cherries, the normal food of tent caterpillars, is a case in point.

It has been rather clearly shown by recent work in Europe that when a leaf-feeding species is deprived for several generations of its normal food and is reared on the leaves of some other plant, it will adopt the new food as "normal" and will not go back to the old kind of food

except under compulsion. Adult females of the tent caterpillar now place their eggs almost exclusively on wild cherry, but a small percentage lay on apple and related plants, more rarely on unrelated ones. Now, if the moths find no or few wild cherries, all or most of their eggs will be laid on apple and related plants and many will be laid on other kinds of trees. In some not clearly understood way a preference for the new food-plants would almost certainly be passed on to succeeding generations and the result would be that Man's misguided actions would have changed the tent caterpillar from largely an eater of wild cherry leaves to an eater of other leaves, particularly of apple and related plants.

Wild cherries are safe

Man would have "burned down the barn to get rid of the rats only to find that the rats had moved into the house." Not only is this true of the tent caterpillar, but it is true also of scores of other species of wild cherry insects that, if it were not for the wild cherry, might conceivably become feeders on other trees.

Furthermore, many people want the "barn." Therefore, when I have told these people that the tent caterpillar is not as yet a really injurious species, partly because it so largely confines its attention to wild cherry, I have been asked why I place no value on wild cherry. I do. I regret that my own yard is too small to accommodate a patch of them and, were it only for the charm they add to the wayside, I would encourage their preservation along the borders of fields. However, the tent caterpillars, even at their peaks of abundance, do not seriously injure the wild cherries. Three weeks after complete defoliation these trees or bushes are in full leaf again and complete defoliation occurs only in years of caterpillar abundance.

But, should we not do something to prevent even this temporary defoliation? Perhaps we might if we knew more about it and thought that the gain justified the cost. However, we do not yet know enough to be prepared to take over Nature's care of out-of-doors; and some of the things that we have done in the case of the tent caterpillar do not now seem to be wise. This brief article can do no more than hint at the complexity of the situation and the meagerness of our knowledge concerning even this common insect.

Probably most of you have seen the rather motherly-looking brown adults of *Malacosoma americana* but possibly many of you have not recognized them as grown-up tent caterpillars. They appear in early summer, and each female, if in good health, places a band of eggs, laid one against another, around a twig. These eggs are smeared with a frothy material that dries into a shiny, dark brown protective cover, as is shown by the accompanying photographs.

Development of caterpillars starts at once and, if no disease or insect parasite is present, each egg will within a few weeks contain a perfectly formed caterpillar doubled up so that its head and tail are together at the outer end of the egg. Here progress usually stops until the following spring. Occasionally a few of the young caterpillars break through the eggshell and protective covering in August, and more rarely still, whole families hatch; but this precociousness does not seem to be an advantage to them.

Birth to death

When wild cherries begin to break into leaf in early spring, the tent caterpillars that have spent the winter, each in the cramped confines of its own eggshell, come out as though at a signal. Brothers and sisters huddle together on the deserted egg-mass for a while, straightening out their bent bodies, and then they move to their first meal of tender, new leaves. As they go they spin a thread of silk. In fact, a large part of the lives of these caterpillars consists of eating leaves and spinning silk. When clustered together after eating, they move from side to side, spinning the silk that forms the "nest"; when going from nest to food and back again, they spin threads of silk on the bark until the family has delicate carpets on which to walk.

Family life is abandoned when the caterpillars have become fully grown and each strikes out for itself to find some sheltered place in which to spin its cocoon. In the privacy of this cocoon it changes to its pupal form, looking somewhat like a small, fat, brown torpedo. Then quickly follows the marvelous transformation that results in the winged adult.

That, briefly, is the story of a lucky tent caterpillar's life, but by no means all tent caterpillars are lucky. In all of their stages they are in danger of attack by the natural agents that control their abundance. It would be well for Man to learn more about these natural controls and to avoid interfering with them.

There are thousands of kinds of insects that live by eating other kinds of insects. Some catch their prey, kill, and devour it at once. Good examples of these "predacious insects" are the caterpillar hunters, moderately large beetles of the genus *Calosoma*. Others, not very aptly called "parasitic insects," go about their predatory missions in a more leisurely and often complicated manner. Typically, the mother of a "parasitic insect" lays her eggs in her victims. The larvæ that hatch from these eggs live in the victims until they, the parasitic larvæ, are fully grown. Then they may pupate there or they may crawl out to pupate. In either case the victim, rather ironically called the "host," dies.

Helpful parasites

Many of these parasitic insects are wasplike creatures and some are so small that their entire larval and pupal life is passed within a single egg of their host. For example, in the latter part of July Mrs. T. S. Homans kindly sent us tent caterpillar egg-masses from Long Island. Although these eggs had been laid only about a month before they were received, and the caterpillars would, for the most part, not hatch until the following spring, tiny adult wasps were already emerging from them. Twenty-five or 50 were crawling about in the packing box when it was received, and 183 more emerged from 100 of the caterpillar egg-masses during the next month. In nature these wasps would probably have laid their eggs in the eggs of some other moth, the resulting young wasps would have passed the winter in the despoiled eggs of that moth, and adults would have been ready next summer to attack the eggs of a new brood of tent caterpillars. Suppose there had been an organized campaign last summer to collect and burn tent caterpillar egg-masses. The burning would have destroyed thousands of these wasps that Nature uses in her control of not only the tent caterpillar but also of the other caterpillars. We do not, as yet, know what those other caterpillars are, but we may be reasonably certain that, from the human viewpoint, they are undesirable. One of the troubles with Man's interference with natural processes is that its bad effects do not stop with the matter immediately in hand but involve a whole complex of delicate balances.

To be sure, most of the organized campaigns for collecting egg-masses wait until winter,

when the egg-masses can be more readily seen. By that time the wasps just mentioned would be out of the egg-masses and escape burning. But that is not the whole story. There are other kinds of parasitic wasps that pass the winter in the egg-masses and emerge very early the next spring along with the tent caterpillars that have not been eaten.

Nature's forces rally

For example, Miss Olsen, secretary of our department, kept a careful record of 100 egg-masses from each of four localities near New York City. About 62,000 tent caterpillars and about 2000 tiny wasps came from these 400 egg-masses in the spring. It is true that destroying egg-masses in those localities the preceding winter would have killed about thirty caterpillars for each destroyed wasp, but we must remember that this was near the peak of caterpillar abundance and that Nature was just building up her forces to control the species. Furthermore, we do not know what good work these tiny wasps do between the time that they emerge from tent caterpillar eggs in early spring and the time that their children parasitize the next laying of tent caterpillars in mid-summer. On the other hand, it is also true that a careful study has not yet been made of these parasitic wasps that spend the winter in the tent caterpillar egg-masses. There is a possibility that at least some of them were "secondary parasites" living at the expense of the wasp larvæ that had earlier eaten eggs of tent caterpillars. Clearly, "secondary parasites" that kill the "primary parasites" that kill the tent caterpillar are friends of the caterpillar and it might be to Man's advantage to get rid of them. Quite as clearly, however, the situation is so complex that, without more knowledge of the facts about insect life in general and about the natural history of the tent caterpillar in particular, we are not ready for drastic interference with Nature's balance.

But what about the tent caterpillars that do succeed in hatching? In years of caterpillar abundance caterpillars are certainly abundant. Miss Olsen's figures showed an average of 155 caterpillars per egg-mass last year, even including the parasitized masses. As an example of occasional abundance, Mr. A. Klein brought me a prize twig having eight such egg-masses on less than a foot of twig. Before considering

Nature's further checks, let us look at the simple matter of starvation.

Natural control

Suppose the wild cherry bushes or trees in a given area could support an average of 500 tent caterpillars each. In a peak year there might be an average of ten or more egg-masses to each wild cherry. Taking 150 as a rough average of the number of tent caterpillars hatching from each egg-mass, there would be 1500 or more caterpillars to be fed by trees that could feed only 500. In such a case the only caterpillars that would not starve before they were able to mature and leave progeny for the next year would be the few that were lucky enough to be on isolated bushes upon which only two or three egg-masses had been placed by the previous year's moths.

Now suppose that well-meaning people had encouraged children to gather egg-masses in the previous winter and that the children had been so thorough that they got eight or nine out of every ten egg-masses. That would leave an average of one or two egg-masses or about 200 caterpillars on each 500-caterpillar wild cherry and, so far as food supply is concerned, all could come to full-fed maturity in an area where few would have done so if the well-meaning people had let Nature alone. Furthermore, those 200 caterpillars per average bush would not suffer from other effects of overcrowding such as contagious diseases.

The working of disease when the caterpillar population is dense was very vividly illustrated in a waste field near my home last summer. Before the caterpillars were half-grown, dead individuals were seen here and there, and a week later there was scarcely a nest in the whole field that was not festooned with the limp skins of dead and dying. There will be very few tent caterpillars in that field next spring.

This epidemic of caterpillar diseases was not so striking in my own yard but it was there. I had purposely allowed several families of tent caterpillars to remain on each of my two apple trees and did not spray the trees. (If the owner of apple trees wishes a crop of good apples he should spray to kill the larvæ of the codling moth—a foreign insect—plum curculio, and other pests. These sprays also kill tent caterpillars. Therefore, when a tree-owner complains that tent caterpillars are eating his apple leaves, we need not feel very sorry for him, because it is evident that he was not taking

good care of his trees at any rate.) Long before the usual time for the tent caterpillars to leave the trees in their search for a protected place in which to spin cocoons and pupate, many of the caterpillars became restless and crawled to or near to the ground. Most of these were sick, some of them apparently having the same disease that caused the wholesale deaths in the waste field, others apparently having something else wrong with them. From time to time I caged samples of tent caterpillars that were leaving my trees. Of 880 such caterpillars only 117 lived to spin cocoons; and of these only about 50 emerged as moths; and most of these adults were so deformed and sick when they emerged that they were in no condition to perpetuate the species. Natural control was certainly acting in my yard.

Nature's time-tested technique

As was discovered some years ago by Mr. Brown at our field station for the study of insects, another important disease affects the ovaries of the adult moth, preventing her from laying eggs. The importance of parasitic insects in controlling the abundance of plant-feeding ones can scarcely be overestimated. How important in comparison with diseases they may be in controlling the tent caterpillar we do not know. It is quite possible—indeed, it seems almost probable—that, in the case of a gregarious species such as the tent caterpillar, diseases may be the more important. Possibly if we knew more about these and other diseases affecting insects, we could keep cultures of the various diseases on hand and spread them in places and at times that would be to our advantage; but at present, not having the knowledge, it would seem wise to avoid doing anything that might interfere with Nature's time-tested technique.

I have already referred to the insects that parasitize the eggs; but caterpillars that succeed in hatching are by no means free from their insect enemies. The majority of parasitic "wasps" and flies wait until their "hosts" have hatched. The list which the U. S. Bureau of Entomology and Plant Quarantine kindly sent me records 6 kinds of wasps reared from the eggs and 37 kinds of wasps and flies reared from the larva and pupæ of the tent caterpillar. From the relatively few cocoons of the tent caterpillar that we collected last summer we reared scores of these parasites. They emerged in mid-summer and, since the next chance they

could have at tent caterpillars would be about ten months later, they undoubtedly attack some other kind of caterpillar in the meantime.

Nature's cycle

Well, I have given you a very sketchy account of some of the troubles that beset tent caterpillars. In my own neighborhood they were so abundant last year that the death rate from starvation, disease, and insect enemies was extremely high. As a result, I expect far fewer tent caterpillars there next season. And, since both diseases and insect enemies increased last year and will probably be carried over the winter, I expect that such tent caterpillars as there are next season will have a very hard time. Consequently, there probably will be still fewer two years from now. Eventually the diseases and insect enemies will largely die out, because families of tent caterpillars will be relatively few and far between. Then the number of tent caterpillars will increase again to a peak, completing the cycle. Meanwhile, the wild cherries will not have suffered serious injury and, with a little care on our part, neither will our orchard trees and ornamentals.

Unknown factors

It is for such reasons as these that we now discourage so far as we can Man's wholesale

interference with Nature's control of the tent caterpillar. Let Man take care of his cultivated trees but let Nature take care of the wild cherries.

If I have given you the impression that we know very little about the life of this common insect and its complex relations with other living things, I shall not be disappointed. A realization of ignorance is the beginning of wisdom! As a matter of fact, we know even less about the lives of thousands of other kinds of insects in our neighborhood than we do about the tent caterpillar. The study of insects is still in its infancy. We are still largely in the preliminary but fundamentally important stage of describing and naming the species. One of the greatest needs in biology today is intensive work on the biology of insects. For this work we need field laboratories equipped with capable research men. The search for the "unknown factors" in the biological equations involving human affairs is a matter for pure science, but it is extremely practical as a necessary foundation for applied science—in this case for finding solutions to the problems involving our relations with insects. Until these factors are known, we can have no satisfactory solutions of the problems, and, unless they are found, it may well be that the "insect menace" will become a real one.

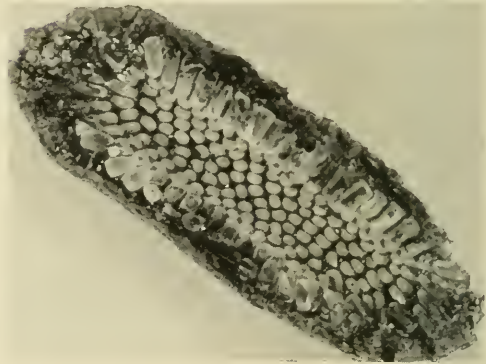


*A parasitic wasp—
an enemy of caterpillars, a friend of
Man*

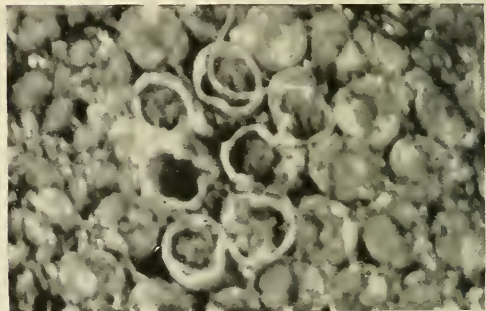


(Above) Each egg-mass is laid in a band around the twig and smeared with a protective sheath (Half of band removed)

(Below) Here the twig has been removed. (About four times actual size)



(Below) Eggs enlarged about fifteen times. Tops of seven are removed, showing caterpillars in six



In a peak year. On less than a foot of twig shown above there are eight egg-masses. Under such crowding none of the caterpillars will mature

Tent Caterpillar?



(Above) A group of newly hatched caterpillars on egg-mass

(Below) A fully grown caterpillar



(Above) A silken cocoon spun by a fully grown caterpillar about to pupate



(Above) The same cocoon opened. The larva has molted and become a pupa. The old larval skin may be seen at the lower end of the cocoon



(Above) The adult stage of the tent caterpillar, a brown moth, shown here about four times natural size



Beetles known as caterpillar hunters (Calosoma) are among the caterpillar's natural enemies

(Below) A healthy family of tent caterpillars. A large part of their lives is spent in eating wild cherry leaves and spinning silk



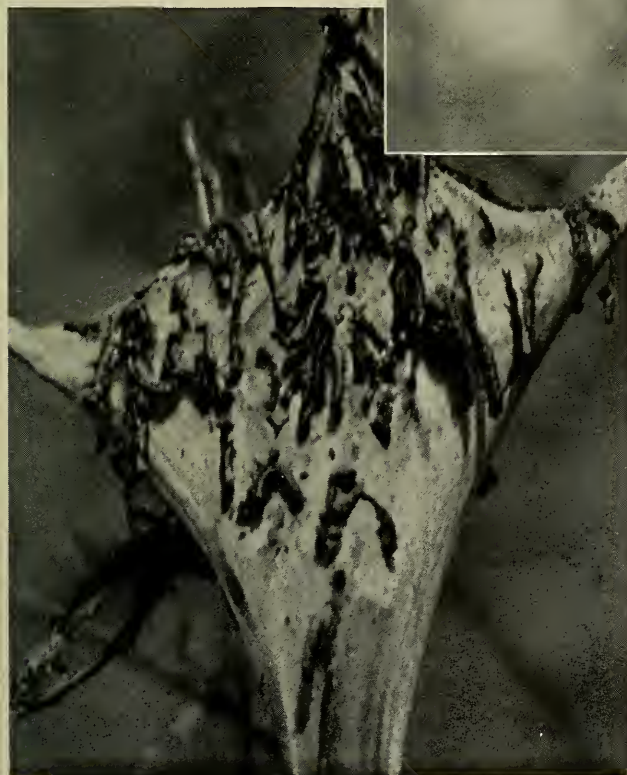
(Above) Tent caterpillars following their silken paths spun between food and rest

Healthy

Diseased

Disease has started in the tent caterpillar family shown at the right. The caterpillars have reached their periodic peak and Nature is restoring her "balance"

(Below) The family has been exterminated by disease



(Below) A tent caterpillar dying of bacterial disease



Before



After



(Top) A wild cherry defoliated by an over population (three nests) of tent caterpillars

(Bottom) Three weeks later. The caterpillars have starved but the wild cherry

has not been injured. "Kill, if you wish, the tent caterpillars on your orchard trees and ornamentals, but let Nature take care of the wild trees, and under no circumstance cut down wild cherries"

Rhineodon at New York's Front Door

*The whale shark's farthest north by 335 miles. His capture off
Fire Island Light, August 9, 1935*

By E. W. GUDGER

Associate Curator of Fishes, American Museum

JUST as I was locking my desk preparatory to leaving my office on Friday, August 9th last, the telephone rang and an excited voice asked if this was the department of fishes in the American Museum. On being answered affirmatively, the voice said:

"We've just brought in to Islip a mighty big shark. Do you want it?"

Not dreaming what marvelous fortune was in store for me, I answered "Not at 5 P. M. after eight hours work on a hot August day."

Indignantly the voice said "This is no ordinary Long Island shark, it's a whale of a fish."

I then asked for its size and the answer came back "thirty-five feet." Whereupon I sat up and took notice.

Just another basking shark?

I knew that in our waters only two sharks reach this great size—the whale shark, *Rhineodon typus*; and the basking shark, *Cetorhinus maximus*. The whale shark, a tropical fish, had never been known to come in any ocean so far north by 335 miles. On the other hand, the basking shark is a cold-water form which on our coast ranges as far south as the North Carolina capes. Hence I thought this Islip fish must be a *Cetorhinus*. Furthermore, since we had obtained and had mounted a thirteen-foot specimen of the basking shark taken on the New Jersey coast a few years ago, I was not particularly interested.

However, to make sure I asked what kind of nose the shark had and was told that it was square cut. A question about the mouth brought the answer that it was at the front end of the square-cut head. My next query was about teeth, and the answer came that they were so small that they could hardly be seen.

Surely not a whale shark!

Was it possible that my informant had a whale shark before him? I queried:

"Did you ever see a Long Island shark that did not have the snout pointed, the mouth underneath the head and filled with large sharp teeth?"

Quick as a flash came the indignant answer: "Man, I'm telling you just what I see as I look out of my window at the head of this giant."

I was now almost convinced but, to establish the identification positively, I asked and was told that there was a median ridge on the center of the back, that there were three ridges on each side and that the lowest ran out on to the tail. Inquiry as to color brought the statement that it was dark with vertical yellow bars and that in the checkerboard squares made by these with the ridges were large yellowish-white spots. This made me absolutely sure of the identity of this great fish.

As wildly excited as the man at the other end of the wire, I shouted "Man alive! you've got a *whale shark*, the only one that ever came so far north not only in the Atlantic Ocean but in any ocean."

As it was now closing time, my colleagues, John T. Nichols (of the department of fishes)

and Harry C. Raven (of the department of comparative anatomy) had foregathered in the next office preparatory to leaving for their homes on Long Island. With ears assaulted by the "thunder of the captains and [especially] the shouting," they had come in to see what it was all about, and to suggest that if I would open my window, the man in Islip could probably hear me without the intervention of the telephone. But on hearing the words "whale shark" they too (knowing how rare this fish is) became almost as excited as I was.

The speaker at Islip then asked "Can't you come out and see and identify our fish? We want to exhibit it."

I answered that I did not know where Islip was nor how to get there. Then Nichols said, "Gudger, you must go. You will never again have such a wonderful opportunity to see a whale shark in the flesh. You must not miss this chance." And Raven spoke up—"Come out with me on the train to Baldwin and I will get my car and drive you out to Islip." Whereupon I shouted to the man at the other end of the wire "I'll be out about 7:30 and I'm on my way now. Good-bye!"

After twenty-three years' pursuit

In July, 1912, at Miami, Florida, I had seen hanging over a long pole under a shed, the skin of the thirty-eight-foot specimen of the whale shark, *Rhineodon typus*, taken some weeks earlier at Knight's Key. I had and I have never seen a whale in the flesh, but this skin, big enough to cover a medium-sized whale, was the most enormous that I had ever beheld. Three years later I saw this skin after it had been (poorly) mounted, and then I began to realize the enormous bulk that this largest of sharks attains. But I had to see the fish in the flesh to get an adequate idea of its colossal size, of its mastodonic proportions.

In the twenty-three years since that sight of the skin at Miami, I have hunted *Rhineodon* not in the "seven seas" but in the warm and warm-temperate waters of the three great central oceans—in books and scientific journals and in a world-wide correspondence. As a result of this long drawn out search and correspondence, I was able as of January 1, 1935, to list 76 recorded specimens plus an indefinite number which had been seen but not recorded by scientific men. Of the 76, as a result of the far-flung correspondence and by virtue of my

(self-constituted) position as official recorder of the occurrence of the whale shark, I had myself put 32 specimens on record. And in all these twenty-three long years, I had never seen *Rhineodon*.

Four disappointments

Four times I have missed seeing whale sharks in Florida waters and have lost the opportunity to get a skin for the Museum. (1) In May 1912, on my way to the Marine Biological Laboratory of the Carnegie Institution of Washington at Tortugas, last far-flung outlier of the Florida Keys, by being two days too early, I missed the capture at Knight's Key of a 38-foot "sea monster." No one knew then what this great animal was. But as noted above, I saw the skin late in July and identified it as that of the whale shark.

(2) On June 11, 1919, a telegram to the American Museum announced the capture on the previous day of a 31-foot whale shark in the Bay of Florida near Cape Sable. But I was chained to Volume III of the *Bibliography of Fishes* (of which I was editor) and could not go.

(3) On June 9, 1923, a 31.5-foot *Rhineodon* was captured at Marathon, near Long Key, Florida, and next day word of it came to the Museum. Again I could not go. I was just out of hospital and it would have been suicidal to have made the journey and undergone the fatigue necessary to get the skin. However, Mr. L. L. Mowbray, now of the Bermuda Aquarium, was at Miami and went at once to Marathon. Of his heroic but futile efforts to tow the fish to Key West where it could have been skinned, the story has been told in *NATURAL HISTORY* for March-April, 1930.

(4) On January 18, 1932, an 18-foot specimen was taken in the Gulf Stream off Miami. On the 19th, a telegram came to the Museum which simply read "Huge shark captured here. Do you want it?" This was referred to me, but as all other Florida whale sharks had been taken in summer, I judged that this winter-captured fish was a huge hammerhead (a gigantic specimen of which I had had word at Miami) or else a huge tiger shark whose kind abounds in those parts. A wire of inquiry as to what the fish was was sent but, when the answer came twenty-four hours later, the fish had been disposed of and the skin removed.

What a saga of ill fortune and hard luck!
But the tide turned that evening of last August.

The whale shark in the flesh

Raven and I reached Islip about 7:30 P. M. and were directed to the plant of the Sunrise Fish Company. The shipping room had double doors back and front and was about thirty-five feet deep. When I stepped up on the loading platform in front, the mammoth fish lying on the concrete floor seemed to fill the whole room from door to door. The gigantic head and gill parts, looking somewhat like a huge collapsed crate with one end gone, seemed to fill the whole doorway. From this, the huge body, as large as a great oak in a primeval forest, stretched back and back to a vast tail within the spread of which a tall man could stand with room to spare. The whole thing was unbelievably enormous.

For the first time in my life I beheld a whale shark in the flesh, the hugest thing that I ever saw come out of the sea. I looked at it head on, I walked around it, I climbed on its broad head, and I walked down its great back. It was the most enormous, the most colossal, the most gigantic sea animal I had or have ever seen. I am drained dry of adjectives. What is needed is the vocabulary of the advance press agent of a circus.

I have no standards of comparison for this fish. I have caught and dissected 10- and 12-foot hammerhead and tiger sharks at Beaufort, N. C., and at Key West and Tortugas, Florida. These probably weighed 600 to 800 pounds and to get them up on the dock with a derrick and tackle had required the help of all the loafers on the dock. But here was a fish three times as long as any of these and seemingly ten times as big, whose weight must be estimated in tons and which would require a power-operated derrick to lift. I was simply overwhelmed.

When I recovered somewhat from the mental paralysis induced by the shock of seeing this "monster," Raven and I measured it. The details of sizes and structures will be left for a technical paper. But a few of the measurements may be given here sufficient to make clear that the adjectives applied are justified.

The fish measured 31.5 feet in total length. The width of the head over the curve between the eyes was 5 feet. The same measurement over the curve at the first gill-slit was 6 feet

5 inches. The width of the mouth straight across from corner to corner was 44 inches—just 4 inches short of 4 feet.

The teeth forming a broad band in each jaw, were only about one-eighth of an inch high. It was impossible to get girth measurements since the huge fish had flattened immovably on the concrete floor. However, we measured the fins. The breast fin measured 5 feet long in a straight line. The corresponding pelvic fin was 3 feet 9 inches long. The huge dorsal fin was 4 feet long on its base and 2 feet 4 inches high, and the measurement along the curve of its edge from base to tip was 45 inches.

The tail fin was almost as big as the propeller of a steamer: 7 feet 3 inches + along the curve of the upper lobe and 4 feet along that of the lower lobe. The + sign for the measurement of the upper lobe is inserted because some visitor had cut off the tip of the tail and had carried it away as a souvenir. The spread of this gigantic tail fin was 9 feet.

The extraordinary capture

Friday, August 9, 1935, was literally "Fish Day" for the Schaper Brothers who operate the Sunrise Fish Co. of Islip, L. I., for on this day was captured the whale shark, "the most valuable fish we ever caught." Its manner of capture was unique. With one exception all other specimens that have come into the hands of man, have either been left dead on shore by tides and waves, or have been caught with harpoons and have been killed with bullets. This *Rhineodon* (a male) captured himself in a pound net or trap off Fire Island Light on the south shore of Long Island. One other whale shark is reported to have been found in a fish trap—in the Gulf of Siam many years ago.

The Schapers operate a pound net fishery of four pounds or traps off Fire Island and when with their crew they went out early on the morning of August 9 to fish these traps, they had no premonition that this was to be a day of high adventure for them. The weather was moderate, the sea quiet with only a slight swell, and there was hardly any breeze.

They first hauled their three nets to the westward (the Long Island shore trends nearly east and west) and then last of all went to the east to fish No. 1—and as the sequel shows this was fortunate. Thus all unsuspecting what unusual contents it might hold, they ran up to trap No. 1. But for the fact that Fire Island

is not wooded, the photograph on page 169 of an ordinary pound net will show what the Schapers saw on this memorable morning.

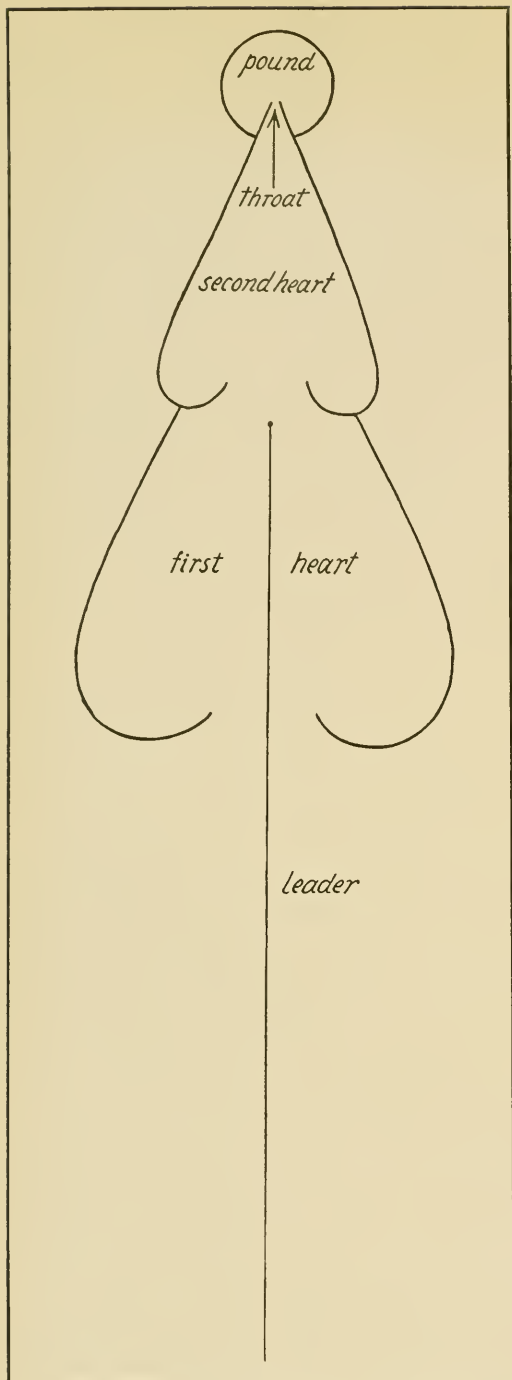
The net that caught the fish

However, the Schapers' pound net is not of the ordinary kind, but is one which is the outgrowth of their experience. Hence it is well here to refer to the drawing on this page and to give a description of their pound net or trap with a brief explanation of how it works.

This huge trap is supported on poles as long as a ship's mast. First there is the 1800-foot "leader" which begins inshore in water 40 feet deep and ends out in water 56 feet deep and everywhere reaches from bottom to surface. This leads into the first "heart," which measures 230 feet around each curve. The first "heart" leads into the smaller second one (195 feet around each curve), and it into the "pound" or pocket. The first heart has at the base on each side of the "lead" openings 60 feet wide and about 50 feet deep, while the "doorway" at the tip is 40 feet wide and 52 feet deep. The second heart opens into the "pound" by a channel which at the base or rear is 15 feet wide by 56 deep, but which narrows to 4 feet wide and 49 feet deep at the front end in the pound. The pocket is a bag 60 feet in diameter and 56 feet deep, suspended on long poles set several feet outside the pocket, so that the net will swing clear of the poles and about two feet above sea bottom. At the tops of the poles are pulleys through which are rove ropes attached to the bottom of the pocket. By these the bottom is brought near the surface so that the captured fish can be easily removed.

Here is how this trap and its parts work. Fishes going east or west along the shore strike the leader and working toward deeper water find their way into the first heart. Their tendency is to still go forward into the second heart and from it into the pocket. The fish seem little inclined to come out through the doorways, but are always nosing against the net. So the whale shark got in and so he behaved.

When, early on August 9, the fishermen reached their net, everything appeared normal, the great fish being invisible. The crew presently began to lift the pocket, working on the "throat" first to close that way of escape for the fishes. When the throat had been hoisted half-way up, the great tail of the huge fish came into view. Arie Schaper from his low (18-foot)



HOW A POUND NET WORKS

This diagram illustrates just how the 1800-foot leader guides the fish until they reach the pocket at the other end. This particular pound trap was perfected by the Schaper brothers, who operate a pound net fishery off Fire Island.

power boat cried out "What is that in the net? It must be a whale." And Richard from the higher pound boat (a 45-foot Seabright dory with a heavy-duty engine) answered "Something enormous! It must be as long as the pound boat." Arie then went aboard the pound boat, got a better look, and said "Let's get this thing ashore, exhibit it and make some money."

Leviathan in the net

Fortunately Nicholas Schaper had brought out this day a power-operated lighter to replace some poles in the leader which had been loosened by heavy tides. This had on it a derrick and block and tackle operated by a gasoline engine. And now Nick was invited to bring his lighter and derrick and "get this whale." The lighter came up and all hands took part in sizing up the situation. When the magnitude of the task was realized, to make sure of the fishes already caught, the pound boat with the merchantable catch was sent off to Islip while the lighter and seven men stayed behind to catch the "whale."

Then came the question as to who would "bell the cat," as to how this great monster was to be captured. Well might the fishermen have asked the questions propounded in the Book of Job and weighed the statements therein.

Canst thou draw out leviathan with a hook? or . . . with a cord which thou lettest down? Canst thou put a hook in his nose? Wilt thou play with him? . . . or wilt thou bind him? Canst thou fill his skin with barbed iron? or his head with fish spears? He esteemeth iron as straw and brass as rotten wood. The arrow cannot make him flee. Darts are counted as stubble.

However, the hardy fishermen were determined to finish the capture of their prey and get him ashore. And since there was no harpoon on board wherewith to secure the shark, Nick called for volunteers to take one of the 18-foot power skiffs and go into the pocket and get a line around the tail of the animal. Everybody volunteered, and Nick and three other men in their boat entered the net and tackled the whale shark.

The effort to get a line around his tail was futile. The great tail swung back and forth in 15-foot arcs and kept men and boat dodging. Once the fish came up under the boat and lifted it a foot out of water, but it slipped off his broad back. Next *Rhineodon* took up the old shark trick of rolling and twisting. All this

time the other men were hard at work raising the pocket, making it shallower and restricting the space in which the shark could maneuver. The weight of the net plus the weight of the huge shark made the tips of the long poles lean inward. This brought the edges of the net (ordinarily about one foot above water) under the water and the shark seemed about to slip over the edge of the net and get away. A bow-line noose made of a stout manila rope was lowered in front of the shark as he was endeavoring to get over the edge of the net. When he did come over, the noose was so manipulated that the line slipped over his head, and when line and knot had slipped behind the fish's breast fins, the slack was taken in and the shortened line made fast to a pole. The tired fish being now fairly quiet, another line (technically a "strap") was rove around his tail, and both lines were taken to the lighter and made fast.

A heavy wire from the winch was now rove through the block at the end of the derrick boom and hooked into the "strap." The power was put on and the tail of the whale shark hoisted ten feet above the water. Then the lighter began her journey home, towing the shark tail foremost. But as the water caught the great breast fins, the fish would roll in such fashion that it was feared that the wire would twist in two, so a heavy chain was substituted. Once inside the Fire Island Inlet, it was decided that faster progress must be made if they were ever to get home. So a looped wire was put around the fish and it was lifted on board the lighter and secured. And so into Islip, seven miles away. The fish was first seen at 9:30 A. M., the start made about 12:30, and Islip was reached at 4 P. M.

On shore at last

The lighter was tied alongside the dock and the fish unloaded by means of the derrick and winch. Boards were then laid into the back door of the fish house. A Mack truck was backed up to the front door and harnessed to the whale shark. Slowly with much puffing and backfiring the truck dragged *Rhineodon* up on to the concrete floor where I found him as described above.

This whale shark, like all others for whose capture there is any data, at no time put up any fight. At no time did it attempt to bore through the net as a basking shark had recently

done when caught in the same trap. It contented itself with rolling and twisting. Had it exerted its great strength, it surely would have torn its way out or maybe would have carried part of the net with it. This is undoubtedly the most unique capture on record of a whale shark, for the Siamese fish referred to above was not captured but died in the trap.

The most northerly record

The whale shark is a tropical fish which rarely departs from its normal habitat and then ordinarily only for a comparatively short distance in a friendly warm ocean current. It is such a rare fish that its capture is in the way of being an event at any time. And when one is taken 1180 statute miles from the tropics and almost at Father Knickerbocker's front doorstep, and when this great fish catches itself in a trap, it is an occurrence so unusual as to call for its recording.

Until this specimen was caught its "farthest north" was in the Pacific Ocean at Cape Inubo, just east of Tokyo, on the great Japanese island Hondo, in latitude $35^{\circ} 39'$ North. Its most southerly station is off the southern end of Africa in Table Bay near the Cape of Good Hope—latitude $33^{\circ} 55'$ South. Thus its northern limit is about 2452 statute miles from the equator, its southern range about 2333 miles from base line. These extremes are far outside the tropics in both cases: 837 miles at Cape Inubo, and 717 miles at Table Bay.

The explanation is essentially the same in both cases. The whale shark is relatively abundant in the Philippines and has been carried from these waters to Cape Inubo by the Kuro Siwo or Japan Current. *Rhineodon* has been known for 65 years to be not uncommon in the western Indian Ocean, around the Seychelles Islands. Thence it is carried south to the Cape by the warm Agulhas Current and its components. So the first specimen (15 feet long) ever recorded was carried to the Cape in 1828 the year of its first discovery. And so was brought the last specimen (20 feet "over all") taken in those waters—in 1934.

In the Atlantic Ocean, eight specimens (the last in the year 1936) have been recorded from what may properly be called the Straits of Florida region. The most northerly of these was an 18-foot specimen which came ashore in 1902 at Ormond Beach in about 29° North Latitude. This record stood for 32

years until one was stranded in June, 1934, on the southern side of the mouth of the Cape Fear River, in about the latitude of Cape Fear, N. C. (34° N.) some 325 miles north of Ormond Beach. This new northern record for the Atlantic is surely to be credited to the help of the Gulf Stream.

And now comes the capture by the Schaper Brothers of a 31.5-foot whale shark off Fire Island Light-house, Long Island, in latitude $40^{\circ} 38'$ North—the most northerly record not only for the Atlantic Ocean but for the world. This isolated individual, undoubtedly carried hither by the Gulf Stream, had strayed far from its tropical habitat—2786 miles from the equator and 1180 from the Tropic of Cancer, and about 450 miles farther north than the specimen recorded from the mouth of the Cape Fear River. Furthermore the Fire Island fish breaks by 335 miles the northernmost record previously held by the Cape Inubo rhineodons, and by these 335 miles it sets a new record for the greatest distance from equator and tropic.

This specimen, moreover, has another distinction—it is the eightieth *Rhineodon* on record as will now be shown. It may interest the reader to know that as of January 1, 1935, I had listed 76¹ whale sharks definitely recorded from the three central oceans. Since then I have recorded a new capture (the sixth) at Acapulco, Mexico, and another (the third) from Havana, Cuba. Then Brimley has listed the specimen (referred to above) from near Cape Fear, N. C. These make 79 records of the occurrence of *Rhineodon typus*. That from Fire Island Light is No. 80 for the whole world.

The fate of this whale shark

The captors and owners of the whale shark, Messrs. Arie, Nicholas and Richard Schaper, showed the finest possible spirit of coöperation with Raven and myself as representatives of the American Museum and told us on Friday that ultimately we might have any parts of the fish that we desired. However, they wished to exhibit the fish on the Saturday and Sunday following and thus recoup themselves for the expense to which they had been subject in capturing the great shark and bringing it in to the fish house. They then said that by Monday

¹ Proceedings Zoological Society of London (for 1934), 1935, p. 882.

afternoon or Tuesday morning the fish might be expected to be in such condition that it could no longer be exhibited and that we could then have what parts we wished.

Now it had happened some four months before this that a member of the American Museum, Mr. Charles T. Wilson of New York, had presented to the Museum the skin of an 18-foot whale shark taken at Acapulco, Mexico, and that this skin was in process of preparation for mounting. Here then was an embarrassment of riches. However, even if we could have had the skin of this giant, we had in our restricted exhibition space in the Museum no room for a 31.5-foot specimen. Hence we reluctantly asked for the head and gill-arches, for the eye, the heart and certain of the hard parts of the skeleton for the department of comparative anatomy in the Museum. These with great good will were promised to us, and in return Raven gave helpful advice about the use of ice and other preservatives to keep the mastodonic shark in condition for two days' exhibition. He and I then came away with promises to return on Monday.

A stream of visitors

On Friday, while Raven and I were examining the shark, making measurements and notes, a constant stream of visitors was passing through the fish house. The New York papers on Saturday morning (August 10) carried pictures of the great shark, and the enterprising fishermen sent out hundreds of handbills. As a result there was on Saturday and Sunday a great and constant stream of visitors to see the whale shark, and the small admission fee charged brought in a large aggregate return to the Schapers. Among the visitors was Mr. W. K. Vanderbilt, who was so much struck with the great fish that he negotiated for the skin on the shark, this to be removed at his expense.

On Monday, August 12, Raven went to Islip about 11 A. M. and found a smaller but constant stream of visitors still viewing the prize of the Schaper Brothers. He was told that Mr. Thomas Rowland, the well-known taxidermist of New York City, representing Mr. Vanderbilt, would that afternoon begin to remove the skin, and that about noon the next day we could get the parts we desired. These matters Raven communicated to me by

telephone, and I at once requisitioned for a Museum truck for early next morning.

August 13, a lucky day

On Tuesday, August 13 (a lucky day for us), Raven was early on the scene and early telephoned to me that *Rhineodon* had been dragged out on to the lighter and that the skinning had been begun the day before, that it was progressing satisfactorily, and that I should bring the truck out about noon. About that hour I reached the scene of activity and found that Mr. Rowland and his men had got the skin from the body up to the gill and head parts. The removal of the exceedingly thick skin offered many difficulties, and trebly so in the gill and head region and it was not until about 3 P. M. that the skin was free from the whole body and the Brobdingnagian task ended.

Since the rubber-like skin was about 4 inches thick, and was 25 feet long (to base of tail fin) and about 15 feet in full breadth, its stiffness and weight made its removal a problem. Indeed, the skinning was made possible only by dragging the fish out on the dock and lifting it on to the lighter above referred to with a block and tackle from the yard-arm of the mast, the power being supplied by a gasoline engine. A line was then looped around the tail portion of the skin and as fast as it was cut free from the flesh (one cannot husk the hide off a shark as one can from an ox), it was lifted up so that the skinners could advance farther headward.

Finally about 3 P. M. the skin was freed from the head, and Raven went into action. With an axe he cut off the head and by means of the derrick we loaded this on the Museum truck. He next got an eye, some of the gill-arches, the heart, and a section of the curious tubercle-lined oesophagus. The fish being a male we were unfortunately debarred any opportunity of deciding whether the whale shark voids its eggs out in the sea water or whether it brings forth its young alive as most of its kind do and as there is fair reason to believe *Rhineodon* does.

As for the other viscera, they were too mastodonic for anything to be done with them. For instance the left lobe of the liver was 9 feet long and as large around as a man's body. Let the reader look at a 6-foot man standing

against a wall, let him mark off 3 feet (half the man's height) on the wall above his head, and he will have the length of the liver—9 feet, the height of the average ceiling of the ordinary house. We might have brought in the 10- or 12-foot long spiral-valved large intestine but we had no container to put it in and our truck was loaded.

Back to the deep

With the skin removed, there remained the matter of disposing of the carcass. Frank Buck (of *Bring 'Em Back Alive* fame) wished to purchase it to feed to the carnivorous animals at his Long Island station, but was deterred on finding that some formaldehyde had been poured on the skin as a preservative. So the

Schapers had to carry the carcass out to sea, attach heavy weights and sink it.

What we all got

The fishermen got a large return from exhibiting "the most valuable fish we ever caught."

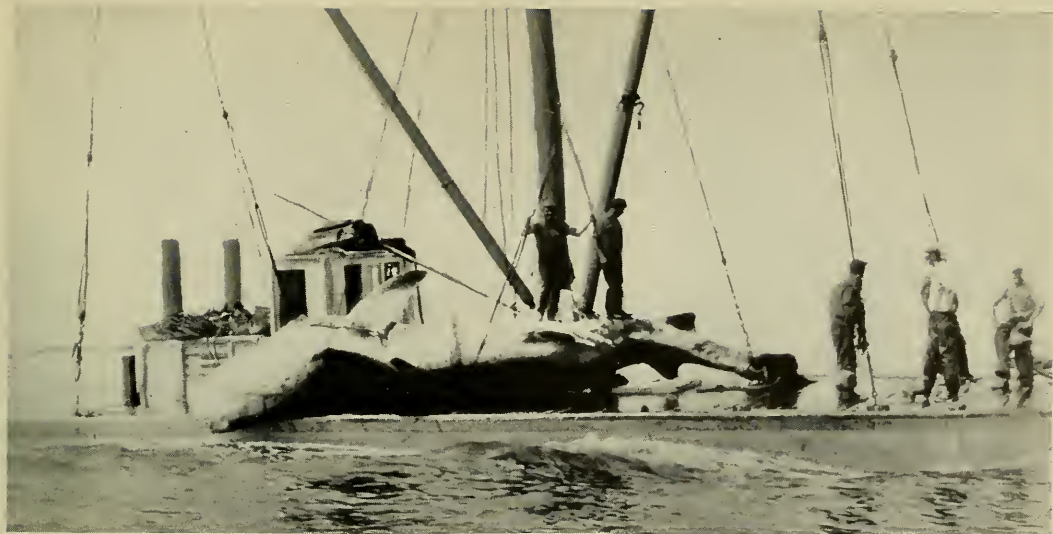
Mr. Vanderbilt got the skin of a full-grown whale shark for mounting and display in his museum at Northport, Long Island.

The American Museum got the skull and other precious material for future study.

The sharks and other fishes, and the crabs out in the ocean got a great feast that lasted for days.

And the writer (after twenty-three years' search) got a vivid memory of a whale shark seen in the flesh.





Rhineodon at New York's Front Door

(Above) Bringing in the prize. As soon as the lighter was inside Fire Island Inlet, the whale shark was lifted aboard by means of a wire looped around its body; the boat then made good speed to Islip

THE PHOTOGRAPHS
USED IN THIS SERIES
WERE PRESENTED
TO THE AUTHOR
BY THE SCHAPER
BROTHERS, WHO
CAPTURED THE
GREAT FISH



(Right) The gigantic tail fin had a spread of nine feet. Along the curve of the upper lobe it measured seven feet, three inches plus, and four feet along the lower lobe. The tip of the upper lobe had been snipped off by a souvenir hunter

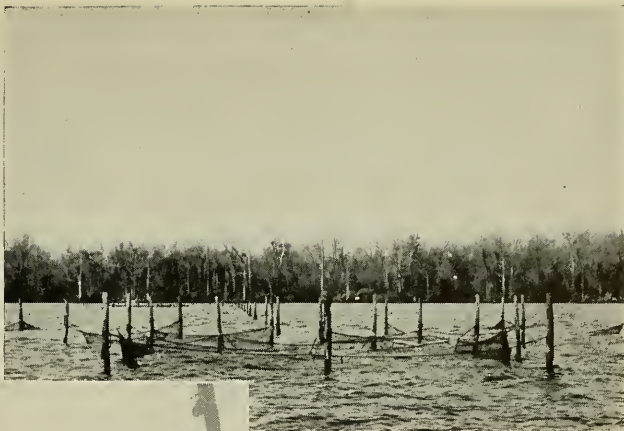


UP FROM THE SEA

Derrick and winch were used to unload the whale shark on to the dock. An admiring throng stood by and gaped as the huge

dimensions of the fish were fully revealed to their astonished gaze. Note the wide mouth and on the body the three ridges

At the right is a pound net as seen from above the surface of the water. This photograph is reproduced by courtesy of the U. S. Bureau of Fisheries



(Left) Here the carcass of the whale shark is being dragged on to the lighter preparatory to skinning.

In the picture below, the skinning is under way and is progressing satisfactorily despite the many difficulties presented by the exceeding thickness of the hide



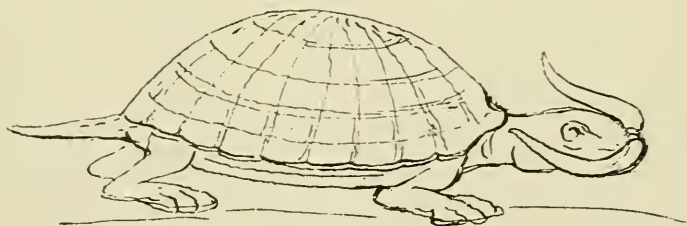


© by the American Museum. Painted by C. R. Knight under the direction of Henry Fairfield Osborn

THE MASTODON AS IT REALLY WAS

Mastodon americanus as it appears in the restoration painted by Charles R. Knight (above) is an amazing contrast to the Pedder interpretation shown below. (Below) James Pedder's restoration of the "Missourium," 1841. Impossible as it may seem, this restoration was based

on bones of a mastodon. The mustache-like "horns" are the tusks, and the legs have been folded down to make them look like those of a tortoise. The shell is wholly imaginary. This copy of Pedder's sketch was made by the English anatomist William Clift



Misconstructing a Mastodon

When misguided imagination was applied to some of the first mastodon bones ever found, an amusing freak of nature was created

By GEORGE GAYLORD SIMPSON

*Associate Curator of Vertebrate Palaeontology,
American Museum*

ALMOST everyone now knows what a mastodon looked like, thanks to the numerous skeletons mounted in museums and the many careful paintings and drawings made by artists under the direction of capable scientists. We know that it appeared very much like an elephant, differing only in some details of proportion, such as its relatively longer body and shorter legs. Now that this knowledge has been acquired, it is hard to conceive of the great difficulty that earlier workers had in interpreting the more scanty remains known to them and to realize that even intelligent and learned men at first did not see the resemblance to elephants. Even elephants were half-mythical beasts to many of them, and few Americans or Europeans had then seen one in the flesh.

Early "discoveries"

One of the earliest attempts to restore a mastodon is contained in some papers which Mr. C. D. Sherborn of London generously gave to me a few years ago for preservation in America. These papers are so amusing and so valuable for the sidelight that they cast on early discoveries of mastodons and on the history of science in America, that their most interesting passages are here published.

One of the first mastodon skeletons to be discovered, and the one referred to in these papers, was found by one Albert Koch in 1838 in Gasconade County, Missouri. Not recognizing its true nature, Koch dubbed his fossil

skeleton "the great Missouriium." He set up the bones after a fashion and exhibited them in America and later in London. During the London exhibition, the *London Times* for December 31, 1841, published the following notice of the beast:

THE MISSOURI LEVIATHAN

We are not disposed to place the most explicit confidence in anything that comes from our American friends. They deal too much in the marvelous, and, speculating on the good-natured credulity of the English, they often narrate to us strange stories, and exhibit for our amusement still stranger animals. A person by the name of Koch has recently imported from America the fossil remains of a gigantic animal between whose legs, it is said, the mammoth . . . may have strutted with ease . . .

The animal is supposed to be aquatic in its nature. This we should have inferred from the anatomical structure of its neck.

While the specimen was still in America, it had been seen by a worthy Philadelphian, Mr. James Pedder, the editor of *The Farmer's Cabinet and American Herd Book*. This gentleman had an original turn of mind, and he soon concluded that current ideas of the "Missouriium" were very erroneous, and felt it his duty to correct them. He therefore wrote to the man most qualified to judge the matter, Prof. (later Sir) Richard Owen, at that time the ablest anatomist in England. His letter, dated November 20, 1841, included the following passages:

May I trouble you on a subject, which, however, I presume you will feel interest in. By this time the Bones of the Missouriium are arrived amongst you:—they have made much noise in this part of the world, for there has been considerable "shaking amongst them, which is not yet entirely stilled . . . I have taken up the Idea that the Animal was of the Tor-

toise Tribe, and is therefore, improperly erected in its present shape And first, I would call your attention, particularly, to the bones of the Elbow-joint, and say, if the leg were to be carried out so as to form a junction whether the feet would not be spread out so as to bring the breast down to the ground? Then again the *front* of the bone of the arm at the Elbow-joint shews, by its smoothness caused by friction, that it must always have been carried in a bent or angular position, like the fore-leg of the Tortoise.

To publicize his opinion still more widely and to be sure of its receiving proper consideration from the British savants, Mr. Pedder also wrote on the same day to Petty Vaughan, Esq., of London, enclosing a detailed argument to be read by Mr. Vaughan to some scientific association. Not being very clear as to what association might have authority, Pedder seems to have left a blank in the last paragraph to be filled in by Vaughan as seemed best. The most interesting of Pedder's arguments were as follows:

THE MISSOURIUM

After minute investigation, and repeated opportunity for examination of the Skeleton of the Missouriium, I have been led to conclude that the animal was a Monster of the Tortoise Tribe 32 feet long and correspondent width, with the power of withdrawing its head within its shell; the tusks then forming a mail of defense around its edge to ward off obstruction

3rd. The order of the Neck-bones; the longer placed first, giving the power of withdrawing the head suddenly, and at a jerk, as it were.

4th. The Ribs, so small, short, and widely spread, with so little curve, and withall so weak, and placed edgewise to the body or *half reversed*, by no means calculated to give strength and support to a four-footed animal, 15 feet in height

6th. The short and flat tail: That of the Tortoise likewise

8th. The feet armed with Claws. Those of the Tortoise also:—too weak and small in their articulations for the support of the body; the weight of whose bones is near 3000 lbs—Their position also, being like those of the Tortoise, turned outwards; and in all probability, partially webbed

12th. The size of the Teeth, to appearance much too small for an animal as he appeared on exhibition

15th. With this view, the difficulty which has been felt with regard to the position of the Tusks, more properly *Horns*, is done away; they always having been carried near the Earth, and resting upon it, at the will of the animal

17th. In the Ancient Asiatic Mythology, the

Earth is supposed to rest on the back of an enormous Tortoise—from whence came the Idea, if not from a knowledge or hearsay of an Animal of the monstrous proportions here exhibited?

In accordance with these Views the inclosed Drawing has been made, and is submitted to the Examination and Consideration of the
with deference and respect by

Their obedient Servant
JAMES PEDDER

With this communication Mr. Pedder sent a sketch showing his idea of the tortoise-mastodon, which is here reproduced.

It now hardly needs to be pointed out that Pedder's argument and restoration are wrong in every detail, although all his mistakes were natural enough in that day when so little was known of prehistoric animals. Even at that time, however, the more progressive English anatomists were well able to see the absurdity of Pedder's views.

The preservation of these notes is due to William Clift, who copied them carefully and filed them away. He was at that time Conservator of the Museum of the Royal College of Surgeons, and was Professor Owen's father-in-law. On his notes Clift had added a satirical comment which is an appropriate last word on the subject:

Can it be possible that Jonathan Pedder has racked his brains, and wasted his Time, (and Time means Dollars in America) in concocting this beautiful and philosophical view of his subject, in sober sadness? or does he imagine that his friend and father John Bull's gullet and gullibility are so capacious and accomodating as to *swallow* the World, the Elephant and the Tortoise? by way of opening a passage for receiving fifty miles, or so, of Sea-Serpent?

The later history of these bones must have annoyed Mr. Pedder greatly. His suggestions were discarded with no more attention than they deserved. Owen examined the skeleton as exhibited by Koch, identified it as being a mastodon and of the elephant tribe, and pointed out many errors made by Koch, who, nevertheless, was much nearer the truth than our compatriot Pedder. Later the British Museum acquired the specimen. Completely and carefully reassembled, it still stands in a gallery of the natural history division of that great institution.

Eskimo Dogs—Forgotten Heroes

Showing the intelligence, loyalty, and strength of the Eskimo dog, and the thrills and hardships of dog-driving in the far North

By W. ELMER EKBLAW

THE day of the dog sledge in Arctic exploration seems to be past. That century or more of courageous travel over ice field and glacier which closed with the introduction of the airplane to polar research, constituted a period of brilliant exploit and daring survey of new land that remains unparalleled for hazard, for hardship, and for human perseverance. It was a period of romantic research that pushed back toward the poles the Arctic frontier until there was no "farther north."

A passing mode of travel

The sacrifices, the service, the noble deeds that characterized that period will continue to inspire and challenge youth and manhood until the last record of that glorious past is lost. The lure of the Arctic trail, the mystery of the midnight sun, the majesty of the aurora borealis will ever remain, but that most thrilling phase of polar activity, sledging with dogs over snow field and sea ice, which added so much to the fascination of Arctic exploration in the century past, cannot persist as a means of transport for seeking out new lands, new seas, in competition with the airplane. For the airplane can cover as much territory in a day as the dog sledge can in a whole season.

Yet the passing of the dog sledge marks the end of one of the most delightful, most impelling elements in the lure of the Arctic. Many things will always make the Arctic glorious and attractive: the freedom from petty responsibilities of civilization; the pure air; the healthful food; the freedom from illness and epidemic diseases; the invigorating activity of the chase

by land and sea; the majesty of the landscape; and the sublimity of colorful skies. But the exultation of dashing over new ice, of hearing the rhythmic beat of furred paws and the vibrant ring of steel runners upon frost-felted ice, and of seeing the mirage ever painting new pictures upon the horizon, was lost when dog-driving in exploration ended.

The peoples resident within the polar realms, however, they who make their homes along the desolate Arctic shores, and wrest their living from the niggardly north, must ever cling to the dog, the dog sledge, and dog-driving for getting about on their broad hunting and fishing grounds. They depend upon the dog as their only draft animal, their only means of getting from village to village, from one habitat of game to another, or from the haunts of one kind of game to the feeding grounds of some other kind.

The Eskimo's chief asset

Among the Polar Eskimo of Thule, or Northwestern Greenland, most dependent of all upon their dogs, there is no such thing as wealth, no system of land tenure, of property, or of possession except of a few personal belongings, but prosperity and welfare may be measured in terms of dogs. If a hunter have an adequate number of dogs in good condition, he can sledge far to the haunts of game, wherever they may be, and having made his kill, haul home on his sledge a heavy booty of meat for food, blubber to light and heat his igloo, and skins or furs for clothing his family. His folk are well fed, happy, and healthy; they are dressed warmly and comfortably; their igloo is well lighted and well heated. He is prosperous,

a good hunter. His dogs remain strong and powerful.

On the other hand, if his dogs be so few or so under-nourished as to be inadequate, either through accident or disease, then the Eskimo, no matter how energetic and skillful a hunter he may be, is doomed to poverty until he can rebuild his dog team to sufficiency. While his dogs are few or weak, he cannot travel far, and must confine his hunting to grounds where game is scarce or hard to kill because of over-hunting. When he makes a kill, he cannot overload his sledge because his weakened dogs cannot pull it. His family suffers want—his wife and children and other dependents are under-nourished, their clothing becomes worn and depleted, and his igloo remains cold and gloomy because of lack of blubber for heat and light. His dogs remain half-starved. He is poverty-stricken.

Thus the dog team rigorously determines the economic status of the Polar Eskimo. The resources of his land are sparse and monotonous. He must live by game alone, for meat is his only food, skins and furs are his only clothing, blubber is his only fuel and source of light. He must hunt. He cannot farm, he cannot trade. He cannot engage in the hundred and one businesses of the Southland. He has no grass to feed cattle or sheep or horses, no grain for hogs or poultry.

Supreme in the Arctic

Camels or llamas could not endure such a land as Thule. Cattle of any variety, horses and their kind, and even reindeer, would be of no use on glare sea ice. They could find no footing, and thin ice would not bear their weight. They could not eat fish or flesh. They could not survive without frequent feeding. Even the best of them are not so obedient, so tractable, so sensible, so companionable, and in many ways so self-sufficient, as is the dog. The Arctic decrees that the Eskimo may have no other draft animal than his dog.

For the Eskimo dog is a marvelous adaptation to Far Arctic conditions of terrain and food supply. He is light enough to travel over ice so thin that even man may not venture upon it, and yet he is strong enough to pull a heavy burden by sledge. He lives by flesh alone, the only food available in the Arctic, and because of his wonderful reserve strength, he can go without food for several days and yet draw the sledge

to which he is hitched. He wears a heavy coat of warm hair, warm enough and heavy enough to keep him active and comfortable at temperatures of fifty or more degrees below zero; as long as he is fed regularly about once every three days he can endure the most bitter cold—in fact, revels in it—for weeks on the hardest kind of trail.

Best of all he is intelligent enough to turn every advantage to his own good. He has sense enough to coöperate with his driver in every way that he can. He makes the most of every opportunity for comfort, or rest, or food, whenever it appears. He is loyal, and affectionate, and gentle, happiest when in the harness and on the arduous hunting trail. Though he quarrels constantly and interminably with his fellows in the team, the quarrel is a semi-friendly rivalry, and he never seriously injures his team mates; when occasion arises he pulls together with them as a unit.

Eskimo dogs differ

The dog of the Polar Eskimo is not a true husky. The pure strain of dog which the Polar Eskimo possessed when Parry first encountered them has since been crossed with strains brought into the land by whalers and explorers, and particularly by Peary, who introduced the Newfoundland dog with the deliberate and expressed intent of increasing the size and strength of the Eskimo dog, and accentuating his aptitude for the water environment upon which so much of the driving is done. The resultant breed is a powerful issue of the two strains. Whenever the *singarnok*, as the Eskimo call the dog whose marking and characteristics are typical of the old original strain, appears in a litter, his size and strength are appreciably increased over those of his primitive ancestors, and he is a better dog.

The outstanding attributes of the dog of Thule, the dog of the Polar Eskimo, are his devotion to his driver or master, and his gentleness as compared with the dogs of the Labrador, the Hudson Bay region, and even with the native Alaskan and Aleutian dogs. Very rarely does a Polar Eskimo dog bite or attack any person, or attempt to do so. Much as he quarrels and struggles among his fellows, the dog rarely or never sets upon either children or adults. He dies of starvation and overstrain in the harness, lapping the hand of the driver who is suffering with him and who must desert him

when there is no other course. His driver is his God, and he knows no other.

Maximum efficiency in the team seems to be achieved with eight or ten dogs. Fewer dogs reduce the strength of the team more than proportionally, whereas a larger number of dogs demands more time for hunting to provide sufficient food to keep them in health and fine fettle. The best balance between dogs, efficiency, and food seems to limit the team to eight or ten.

"The king dog"

In every team one superior dog, superior because of strength, intelligence, and fighting ability, establishes his right to supreme authority over the rest of the dogs, and thus becomes "the king dog," by soundly and indisputably trouncing every other male dog in the team. Having once established this authority, he maintains it by going through the team periodically, not over a period of weeks but several times a day, and reasserting his sovereignty by forcing every male dog to turn over on his back and subject himself to the king dog's punishment. The king dog knows no allegiance, no obligation to any but his master, or driver, and to his liege master he is leal and true to the death.

Arrogating to himself the responsibilities as well as the prerogatives of authority and leadership, the king dog maintains order and discipline in the team, and as far as he can interpret them, carries out the wishes and commands of his driver. When a king dog has served long under one driver, he becomes uncannily wise in the ways of the trail and the game, and in anticipating the wishes and purposes of his master. Little driving is necessary on the part of an Eskimo who is blessed with a skillful and intelligent king dog. The king dog keeps the team going.

Among the Polar Eskimo the dogs in a team are driven fan-fashion, that is, with an individual trace back to the sledge from every dog in the team. The traces are of the same length or nearly so, sixteen or eighteen feet long, so that the dogs form a semicircle before the sledge as they pull the sledge forward. The traces are of thong of bearded seal or, when occasion requires, of walrus skin, cut to a surprisingly uniform thickness of about three-eighths or one-half an inch.

Such a system of driving is necessitated by the rough sea ice of the Thule coast, over which by far the greater part of the driving is done,

whether on the fixed icefoot along the shore, or on the broad expanses of the open sea. If the dogs were driven tandem, either singly or in pairs, stretched out in a line of greater or lesser length before the sledge, some of the dogs would be crushed down over a hummock, or swung up over a hollow as the case might be, and the whole team would be stopped. By the Greenland fan-fashion of hitching, each dog picks his own trail, and though a dog or two might be temporarily held up by the traces catching on a block of ice, the rest of the team would keep the sledge moving.

The disadvantages of the fan-fashion hitching are that the dogs on the wings of the team cannot pull forward with their maximum power, and some of their strength is lost; and despite all the efforts of the driver, and with all the skillful and willing coöperation of the king dog, the dogs do weave in and out somewhat among the traces, the traces become tangled, and the sledge must be delayed until the driver succeeds in untangling them. The period of delay is never wholly lost, however, for on salt sea ice, which is never quite dry, the dogs must be permitted occasional opportunity, every hour or two, to bite out from between their paws the balls of packed ice which form there, and, if left, spread the toes so wide as to break the skin, and more or less seriously lame the dogs.

Guiding the team

The driver uses a long whip, many feet in length, with a handle not over one and one-half to two feet long, and with a lash about half an inch thick at its attachment to the handle and tapering down well nigh to wrapping cord thickness at the last yard or two—the cracker. The lash is skillfully cut and prepared from the finest tanned skin of the bearded seal, and the fine cracker thong is as smooth and uniformly thin as the best braided textile cord. In windy weather, or with a poorly disciplined team, when the whip must be used rather constantly, the cracker snaps off, a foot or more with each lash of the whip, and must be frequently replaced.

"Huk, Huk," and cracking the whip over the dogs is the signal for starting the dogs. The team is turned to the right by calling "Atch-ook, Atch-ook" and cracking the whip to the left. It is turned to the left by calling "Howie, Howie" and cracking the whip to the right. It

is stopped by an indrawn whistle and cracking the whip before the dogs—they do not always stop, when a bear or seal is in scent!

An ingenious arrangement of strips of ringed seal skin, generally with the hair left on, forms the harness. A band passes about the dog's neck and from that band strips run over his back, and between his front legs and up along his sides to the place where the trace is attached. The dogs never chafe from this harness, and seem never to be choked or in any wise affected by the band about the neck. The harness must be kept fairly soft and pliable and lasts many months. Because, when dog feed is scarce, the dogs sometimes chew their harnesses and traces, a supply of thong and skin for repairs must be carried on long trips where the finding and killing of seal is uncertain.

The sledge

Before the white man came to Thule, the Polar Eskimo made his sledge of bone and ivory because he had nothing else to employ for it. Necessarily then his sledge was small and primitive and three or four dogs sufficed to draw it. The prosperity of the Eskimo then was strictly limited by the tiny size of his sledge, and his standard of living was correspondingly lower. When the white man brought lumber for runners and iron or steel for shoes on the runners, the sledges quickly became larger. Today they are from six to eight or ten feet in length, two or more feet wide, and capable of bearing large loads. Heavily laden sledges require more dogs, but they permit longer hunting trips and larger loads of the necessities of life. Consequently, the standard of living has been much improved.

The enlargement of the sledges and the increase in the number of dogs in the team has not, however, resulted in commensurate advance in the standard of living. The extra time and effort required to kill additional game to feed the dogs imposes upon the Eskimo a regime of hunting that occupies almost every moment of every day when weather and ice are favorable for hunting. The need and capacity of the Eskimo dog for food are well known, and the hunter may not neglect any opportunity for making a kill. Much of the supply of dog-food comes from walrus. Seal hunting supplies a secondary supply of dog-meat; while only relatively insignificant stores of dog-food are obtained by the chase of the bear, the caribou, and the smaller creatures.

On the trail in terrain where game is abundant the Polar Eskimo makes a kill and feeds his dogs about every third day. If the quantity of meat from each kill is sufficient, the dogs thrive on such a program, but when game is scarce, they soon show the effects of overtravel on insufficient nourishment. In country with little or no game the Eskimo carries a supply of slabs of frozen walrus meat, the dog-food *par excellence* for the early spring trail over long distances.

Frozen food

The frozen meat is chopped into pieces about as large as a man's fist, and fed to the dogs frozen solid. The dogs gulp it down, as they do all their food, with little or no chewing. When the feeding is over, the projecting corners of every frozen lump can be felt through the skin over the dog's stomach, and the dog lies and shivers for an hour or more until the meat is thawed out and begins to digest. It seems like hard, cruel fare, but the dogs remain healthy and retain their strength best upon such a diet.

The season of sledging ends when the ice becomes rotten and unsafe. During the summer, when the hunters are out on the open sea hunting the much desired walrus, the dogs wander about the tupiks, or sealskin tents, seeking such waste food as the Eskimo cast away. Only occasionally are they fed. They need little food then, for the sun is warm, and they have no work to do. They laze about the sun-warmed rocks and sleep most of the time. Nevertheless, they receive too little food to keep them satisfied, and most of the time they are ravenously hungry. Yet, even so, they are playful though mischievous, never ugly or treacherous, as are similarly half-starved dogs on the Labrador. Fortunately the so-called summer season is brief—it lasts from about June 20 or July 1 to August 20 or September 1.

Most of the puppies are born in the summer, and the Eskimo begin selecting new specimens for replacing old or lost dogs. Training of a dog begins when he is but a puppy. If he develops greater size and strength, or if he shows more than average intelligence, he is even earlier selected for the team and given preference in food and care. He is hitched into the team with older, trained dogs, and in a very short time learns the rudiments of his task and his position. If he measures up to his promise as a puppy, he requires but a few weeks to gain

knowledge of what he must do and what he must refrain from. After taking part in the first kill, he realizes that sledging means the excitement of the chase, and food. Thenceforward he delights in the trail, awaits the harness and his hitching with eagerness, and works co-operatively with his driver and his fellows of the team.

Ancestry of Thule dog

One reason the Greenland dogs are not so vicious as those of the Labrador, and elsewhere, is that they are farther removed from their wolfish ancestors, and do not bear so strong a strain of wolf blood in their veins. For many decades, perhaps for a century, the wolf has been extinct in Thule, and mating between dog and wolf is no longer possible. On the Labrador, and on other parts of the Arctic coasts where the Eskimo live, wolves are still common, and admixture of wolf with dog is a frequent phenomenon. As a consequence, many of the dogs on the Labrador are so treacherous and vicious that it is almost unsafe for a stranger to enter a village there without a club in his hand, or a native escort beside him.

Another reason for the relative gentleness and loyalty of the Polar Eskimo dogs is their undoubted partial Newfoundland ancestry. Altogether the Polar Eskimo dog on his native heath is a most friendly and devoted companion even under the most trying conditions, and not to be feared at any time or season.

Occasionally a particularly attractive puppy is selected as the house, or igloo dog, and becomes the household pet. He is accorded exceptional care and privileges, and though he rarely develops into a good sledge dog, he is given a generous part in the food supply, and treatment as one of the members of the family. Some hunters have little sentiment or sympathy for such pets, feeling that they add an unnecessary burden upon the family larder, and in times of stress, the household pet may find his way into the food supply as readily as any other dog.

In the autumn hunting season women as well as men are too busy to visit other villages, but when the winter season comes and the sun has set below the horizon for the full twenty-four hours of the day, there is a lull in the hunting. Then the sledges are repaired and relashed, the runners are repolished, the harnesses and traces are replaced, the dogs are fed well again, and everybody starts upon a program of neigh-

borly visits from village to village along the whole coast.

And for the dogs, as for the people, it is a time of excitement, of meeting old acquaintances, of seeing new sights, hunting new game. With their tails curled over their backs in the best of health and spirits, the dogs fight gaily and indiscriminately among themselves, apparently reveling in the chance for physical threat and encounter. Such snarling and gnashing and showing of teeth only the wolf packs could equal.

The women are proudly decked out in the new garments they have made through the summer, the hunters boast new whip lashes, new field clothes, and perhaps new hunting equipment. The women have spared enough time from their summer duties to tan very carefully their best furs and skins and sew them into comely costumes for the envy of their relatives. Vanity is as widespread as femininity, it would seem. It is a season of feasting and gossip, of interchange of plans and experiences, of song fests and hunting parties.

Huskies have individuality

The Eskimo dogs vary significantly in their individual qualities and traits. Some are much more conservative and poised than the general run; on the other hand some are so vivacious and excitable that they become difficult of discipline and lack dependability. Very few are surly. Most are responsive, particularly when on the trail. Some are selfish; some greedy. Some are lazy, and they are soon discarded from the team. Some are more quarrelsome than are others. Some are much more courageous and confident of their prowess and ability to care for themselves.

The dogs share with their driver the skill of the trail and chase, but in varying degree. Some dogs are so superior for seal-hunting or for bear-hunting, as to achieve high repute throughout the Polar Eskimo group. A good bear-dog is much to be desired and, when found, is given every consideration. The dogs are trained from puppyhood to hunt bear, and once they have taken part in the excitement of the chase, they are not to be restrained.

When the team crosses the fresh track of a polar bear, the whole team turns as a unit to take up the scent and, no matter how worn and fatigued, dashes off in pursuit. The driver has little choice but to hang on to the sledge with

all his strength, without attempting to control his dogs; for woe betide him if he is tumbled off.

The mad dash for bear

The dogs dash on in wild and eager chase with no thought for their driver. If he fall off, so much lighter the sledge! And it may be a matter of ten, or fifteen, or even more miles before the dogs finally drive the bear into the open water or "tree" him on an iceberg. The driver who does not hang to his sledge may have to trudge all those miles over rough ice, or deep snow, or both, before catching up with his team.

The dogs cannot kill the bear; they merely bait the poor beast and keep him from escaping until the driver despatches him. Usually the dogs are not hurt, for they evade the bear's clutch or the heavy blow of his paws; but occasionally a careless or overdaring dog gets too close to the bear and then he is pretty likely to suffer injury. The driver, when he makes the kill, always gives the dogs a share in the flesh of the bear. Much of the flesh, and of course the heavy pelt, fall to the driver's portion.

The period of a dog's active service in the team depends in part upon the driver. An Eskimo who is considerate of his dogs, who ably looks after their food supply, their health, their comfort, loses but few of his dogs, and drives them five or six years, but rarely more, before they fail him. A poor driver or poor hunter loses his dogs through accident or starvation much more quickly.

Yet even the best of hunters may sometimes lose his team or most of it, despite his utmost care and precaution. Epidemic rabies sometimes invades Thule, and then the good dogs, the good teams, suffer as severely as the poorest. Heavy and unexpected fall of soft snow may catch a hunter hundreds of miles out on the trail, and before he can get back, most of his dogs may have succumbed. A sudden change in the wind may break the ice away and carry both dogs and driver out to sea; the driver may return, for he may feed on his dogs, and await the drift of the ice back to land, but the dogs rarely survive.

Man's best friend

The history of the Polar Eskimo is a long record of dependence upon his dog. Hunting upon the ice rather than in open water is the chief activity of this group and for this pursuit, as for the hunting of bear, musk-ox, and caribou, the dog and sledge are essential.

The dog constitutes the final, and perhaps the most important link in the long chain of environmental factors that make human life possible in Thule, a thousand miles within the Arctic circle, and enable the Polar Eskimo to maintain his permanent residence and to live happily within the very shadow of the Pole, on the ultimate frontier of the Arctic.

Perhaps nowhere else in the world is the bond of inter-dependence and loyalty between man and dog stronger than among these people of the North and their dogs!



*Over pack ice.
From Rasmussen's
"People of the
Polar North,"
courtesy of Lippin-
cott*

Eskimo Dogs— Forgotten Heroes

The Eskimo dog of North Greenland is loyal, affectionate, and gentle, happiest when in harness and on the arduous hunting trail



*Photo by
E. M. Weyer, Jr.*

(Below) These dogs are fresh, as their up-curved tails indicate, but if necessary they would die of starvation or overstrain, lapping the hand of their master who suffers with them





EATING (*Above*) Large chunks of frozen walrus meat are gulped down whole. Until they are thawed out in the stomach, one can feel the projecting corners through the skin

WORKING (*Below*) "Huk! Huk!" and a crack of the whip above them is the signal which starts the team. The Polar Eskimos drive their dogs in fan-shaped formation

Photo by E. M. Weyer, Jr.





FIGHTING (*Above*) Every team has a "king dog," which periodically trounces every other male dog in his gang. To his master he is true to the death

RESTING (*Below*) On the salt sea ice. The dogs must be allowed frequently to bite out from between their paws the lumps of packed ice which form there





The dogs weave in and out, causing the traces to become plaited and tangled (insert left). Then the driver must halt, unhitch the sled, and take the necessary time to untangle the lines

(Below) When the team crosses fresh tracks of a polar bear, it dashes off in pursuit. The dogs keep the bear from escaping until the driver brings him down



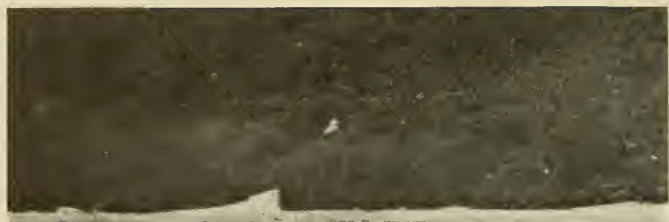


In springtime, lakes appear upon the sea ice. Then there is great splashing, and the driver must watch the depth or he and his load may get soaked. If a line becomes fouled (insert right), one has to go wading in ice-water



(Below) The puppies, like all young dogs, are playful and friendly. Occasionally one of them wins a place as an igloo pet instead of a sledge dog





"What is the man with the box doing?" The dogs at the left are registering curiosity, which is one of their prominent traits



(Right) Training in harness generally begins when the dogs are scarcely more than puppies



(Below) In the lee of a pressure ridge. A heavy coat of warm hair keeps the husky comfortable at fifty below



Science in the Field and in the Laboratory

*The Roosevelt Memorial, Astronomy, Lectures, Health, Meetings
of Societies, New Members*

Edited by A. KATHERINE BERGER

The Roosevelt Memorial Dedicated

The New York State Theodore Roosevelt Memorial Building, perpetuating the life and work of Theodore Roosevelt, was dedicated in the City of New York on Sunday, January 19, 1936, at two o'clock, and its administration delegated to the Trustees of the American Museum. A complete description of the Memorial and the dedication ceremonies will appear in the March issue of NATURAL HISTORY.

Amateur Astronomers Association

On Wednesday, February 5, at the regular meeting of the Amateur Astronomers Association, Dr. Robert I. Wolff, of the department of physics of the College of the City of New York, will speak on the subject "Nebulae."

On Wednesday, February 19, Dr. Jan Schilt, head of the department of astronomy at Columbia University, will talk on "Stars of High Density."

These meetings are open to the public free of charge and are held in the large auditorium of the American Museum at 8:15 P. M.

Planetarium Special Lectures—1936

The first series of special lectures in the Planetarium was received with so much enthusiasm that a second series has been arranged. The six special lectures of the second series are to be given on the second and fourth Wednesdays of each month at 6:00 P. M. in the Planetarium dome, illustrated by means of the Zeiss Projection Instrument with lantern slides and motion pictures. They include: February 26—Earth and Neighbor Worlds

March 11—The Midnight Sun: The Sky at the North Pole

March 25—Spring Constellations of Our Home Sky

April 8—Comets and Meteors

April 22—The Precession of the Equinoxes—
Looking Backward and Forward in Time

May 13—Our Place in the Milky Way Galaxy

These lectures will be given by Dr. Clyde Fisher, curator of astronomy and the Hayden Planetarium. The subscription to the series is \$2.50. Admission to any individual lecture can be had only by subscribing to the entire course.

Lectures at the American Museum

The lectures for the spring season for children of members will be held on alternate Saturday mornings at 10:30 o'clock, as heretofore. The two for February are:

February 15—Thrilling Words and Ways of Birds. By Mr. C. C. Gorst. February 29—Neighbors of Sand and Sea. By Dr. George H. Sherwood.

The lectures for members Thursday evenings at 8:15 o'clock are: February 13—Ethiopians and Their Stronghold. By Dr. W. H. Osgood. February 27—Soil-less Plant Culture. By Mr. Arthur C. Pillsbury.

The spring courses for teachers, given in cooperation with the College of the City of New York, New York University, and Hunter College, open the first week of February. The subjects covered at the College of the City of New York are "The Museum in Elementary Social Studies," "Nature Study," "Health Education," "The Museum in Economic Geography"; at Hunter College, "Nature Study for City Teachers," "The Museum in Elementary Social Studies," "Astronomy"; at New York University, "Astronomy for Teachers."

Full information about these courses may be obtained by addressing Dr. George H. Sherwood, curator of education, at the American Museum.

Six lectures for students in elementary biology and general science will be held on Tuesdays at 3:40 P. M., beginning March 3, with a talk by Dr. Walter Granger on "Exploring for the American Museum". Others are March 17—Penguin Personality. Dr. R. C. Murphy. March 31—Meshie, the Child of a Chimpanzee. Mr. Harry C. Raven. April 21—Audubon, the Bird Lover. Mrs. Grace Fisher Ramsey. May 5—Wild Birds and Their Human Appeal. Mr. Paul B. Mann.

May 19—Are You Going to Camp This Summer? Miss Farida A. Wiley. Five lectures on the "Biology of Man" for students in general and advanced biology are scheduled, viz: March 10—The Thinking Machine. Dr. G. K. Noble. March 24—The Gland Regulating Personality. Dr. G. K. Noble. April 7—Prehistoric Life. Dr. G. G. Simpson. April 28—The Human Machine. Dr. H. J. Clausen. May 12—Heredity and Environment as Factors in Life. Dr. G. C. Wood.

In the Museum Auditorium, Saturday afternoons at 2 o'clock there are free motion pictures. During February these will include: February 1—Vincennes. February 8—Bottom of the World. February 15—Abraham Lincoln. February 22—George Washington. February 29—Wolfe and Montcalm.

Health Instruction for Nurses

For four years groups of nurses from all the outstanding hospitals in New York City and from towns as far away as Middletown, N. Y. have been coming to the American Museum for instruction in Health, Comparative Anatomy, Hormones, etc. Dr. William Lord Smith has been conducting these classes, illustrating his talks with motion pictures on "How Life Begins," "Water Supply," "Pasteurization of Milk," and "Human Circulation and Digestion." The requests for this instruction have been steadily increasing, and in the last six months twenty-four hospitals have sent 578 nurses to the Museum.

The Malvina Hoffman Bronzes

The legends under the two bronze figures of African natives by Malvina Hoffman that appeared on pages 88 and 89 of the January issue of NATURAL HISTORY should have included the fact that these figures were reproductions of originals owned by the Field Museum of Natural History, through whose courtesy Mr. George A. Pratt purchased the bronzes.

The American Polar Society

The first annual meeting of the American Polar Society was held on Monday evening, November 25, at the American Museum. Mr. Paul A. Siple, president of the Society, presided. In addition to telling briefly of his experiences in Marie Byrd Land, Mr. Siple discussed some of the problems Lincoln Ellsworth would face if he landed before reaching Little America on his latest Antarctic flight.

Mr. Joerg of the Executive Board, the polar expert of the American Geographical Society spoke on the Arctic work of the late General A. W. Greely.

The entire membership then spent some time seeing the polar material in the Museum.

Just about one year ago (November 29, 1934) a group of friends and relatives of men who were then exploring in the Antarctic with Admiral Byrd and with Dr. Lincoln Ellsworth, formed the American Polar Society to band together all persons interested in the exploration of the polar regions, in order to act as an American clearing house of polar information, to be of aid to organizers and members of polar expeditions, and to spread knowledge of the polar regions.

Toward this end the American Polar Society is collecting books, reports, maps, photographs, etc., relating to the polar regions. The Society keeps in close touch with the Scott Polar Research Institute in Cambridge, England, the New Zealand Antarctic Society, the Arctic Institute at Leningrad, and other groups throughout the world interested in polar matters.

The Society has among its members, who live in twenty-two states and seven foreign lands, men who served in the polar regions under Admiral Robert E. Peary, Capt. Robert Falcon Scott, Sir Ernest Shackleton, Admiral Richard E. Byrd, Dr. Lincoln Ellsworth, and Dr. Jean B. Charcot. Doctor Charcot, himself a member, is the sixty-nine-year-old French polar explorer who sails to Greenland each summer in his sailing vessel, the "Pourquoi Pas?" in which he led two Antarctic expeditions in 1908 and 1910.

In addition to Mr. Siple, the president, the officers of the Society are: Russell J. Walrath of Westfield, N. J., chief cartographer of *The New York Times*, who is vice-president; August Horowitz of New York City, editor of the Society's twice-yearly publication, *The Polar Times*, secretary, and Marshall S. Delavan of Mt. Vernon, N. Y., treasurer.

The Society's Executive Board consists of Dr. Lincoln Ellsworth, who was co-leader with Roald Amundsen in the dirigible "Norge" on its successful flight from Spitsbergen to the North Pole and thence to Alaska (in 1926) and who last fall flew about 2100 miles with his pilot, Herbert Hollick-Kenyon, across the Antarctic Continent from Dundee Island on the Weddell Sea to a point twenty miles from Little America on the Ross Sea; W. L. G. Joerg, polar expert of the American Geographical Society of New York; Dr. Hugh Robert Mill, Great Britain's eminent Antarctic historian; Prof. Frank Debenham, director of the Scott Polar Research Institute of Cambridge, England, who in 1910-1913 was geologist on Captain Scott's last Antarctic expedition; Henry Woodhouse of New York, president of the Aërial League of America; Fred E. Meinholdt, director of Communications of *The New York Times*; Charles Gill Morgan of Dallas, Texas, geologist of the recent Byrd Antarctic Expedition; B. A. Heim binder, Miss Lorene K. Fox, and C. Walter

Seamans, all of New York, and Donald H. Cooper and Miss Margaret McGrain, both of Washington, D. C.

August Horowitz besides fulfilling the duties of secretary of the American Polar Society, is editor of *The Polar Times*, official organ of the Society, which is published twice a year. Associated with August Horowitz on *The Polar Times* as art editor is Herbert R. Loges of New York City. For eighteen months during the recent Byrd and Ellsworth Antarctic Expeditions these two men published a monthly newspaper, the *Little*

America Times, for friends and relatives of the explorers with the Byrd and Ellsworth parties.

The Society holds its meetings at the American Museum of Natural History, its official mailing address. At least two Society meetings are planned each year, in addition to the annual meeting. The membership fee is one dollar a year.

Paul A. Siple, of Erie, Pennsylvania, nationally prominent in the Boy Scout movement, and chief biologist of the recent Byrd Antarctic Expedition, was elected president of the Society in October, 1935.

RECENTLY ELECTED MEMBERS

A REPORT from the membership department lists the following persons who have been elected members of the American Museum:

Life Members

Messrs. William A. Chryst, Otto H. Hafner, Arthur S. Litten, Wesley W. S. Mueller

Sustaining Members

Mrs. Wortham James

Dr. J. C. Burnett

Messrs. William A. Aycrigg, Robert H. Thayer.

Annual Members

Mesdames Miner D. Cray, W. G. Elmslie, W. D. Gregory, Stoddard Johnston, Dean Mathey, R. E. McCormick, C. P. Meadowcroft, James C. Rea, Hannah T. Vosper.

Sister Mary Oswin

Misses Elizabeth Achelis, Frances Achilles, Ruth T. Fitzell, Ella E. Geughof, Johanna M. Topkins, Margaret A. Lindquist, Esther C. Olsen, Charlotte C. Pardee, Charlotte C. Swan, Eleanor Tobias, Evelyn van Duyn, Mildred S. Wolf.

Doctors David C. Bull, Glenn H. Whitson.

Messrs. Hilton E. Alexander, Thomas Barbour, R. C. Bergmann, Harry Templeton Birney, Arthur Bodenstein, Ben Branch, H. Vinton Coes, Jr., Langdon Davis, Lewis L. Eldred, Howard Gillespy, Morrill Goddard, Jr., David Goodale, William M. Kern, Alfred M. Lindau, John J. McDonald, Thomas McGivern, William Maul Measey, Charles E. Merrill, Charles Cobleigh O'Boyle, Frank L. O'Connell, G. E. Prentice, Esle F. Randolph, W. Maxwell Reed, William A. Saunders, J. Louis Schaefer, F. D. Sparre, Robert E. Strawbridge, Howard L. Tiger, Leo Van Uittenbroek, John B. Warnock, Carl Weisl, Jr., Frank D. Whalen, Roger B. Williams, Jr.

Associate Members

Mesdames William H. Arnold, George C. Barclay, Horace Binney, Austin Dunham Boss, W. D. Bostick, William H. Button, Jr., W. E. Capron, Fred L. Chapman, Clarence N. Cook, Esther Cory, Helen V. T. Duvinage, Henry C. Foster, Germaine Ga Nun, Matilda K. Gilbreath, B. J. Graham, Suzu Hospbori, Charles Kingsley, Frederic M. Langdon, Enard Leach, Helen G. Leonard, Edward G. Love, Rose V. Lowell, George Lueders, Walter Lyons, A. J. Manville, A. Hyatt Mayor,

Ronald McCall, Velma Moore, E. J. Mordick, Lucile Wakefield Neuswanger, Alice L. Palmer, Jessie L. Pape, Hattie Pascual, Jessie B. Patterson, Frederika P. Phillips, Palmer Rogers, Charles Schmaling, Feron Shannon, Alfred L. Shapleigh, Julia K. Shauer, Anthony Smith, Peter Smith, John N. Tonnele, Lawrence Tower, Rawson C. Tukey, Thomas A. Turner, Charles B. Voorhis, Brinton L. Warner, Wm. J. Wickes, Margaret S. Wiggin, W. O. Winston, C. H. Woodruff, T. R. B. Wright.

Sisters M. David, M. Sylvia.

Misses Anne Alexander, M. Laura Anderson, Sylvia V. Anderson, Cecily H. Barker, Eleanor M. Bauer, Helen Baxter, Betsey Bean, Sarah E. Blanchard, Anna E. Brobson, Helen Miller Bunce, R. C. D. Burger, E. Alva Campbell, Amalie Castro, Irene W. Chappelka, Elizabeth Cheetham, Jean Childs, Margaret D. Chubb, Grace Coe, Mary Cummings, Florence Dandridge, Edna M. Deats, Jeanne de Lanux, Alice Bunner Dimock, Frances A. Duncan, Elizabeth Eiselen, Gloria Eksergian, Mabel A. Farnsworth, Abbie Flaherty, Ellen A. Freeman, Sarah March Freeman, Ellin Frowenfeld, Sallie Frowenfeld, Edith M. Godfrey, Mabel C. Graham, Catharine R. Griswold, Marion Hall, Mary Winona Hill, Lucy M. Howard, Lois M. Hutchings, Mary E. LaBour, Olive Larkin, Adelaide I. Lawrence, Sylvia H. Lee, Marion L. Leonard, Jane E. Luckings, Margaret F. Madden, Mabel Florence Martin, Isabel W. McCarty, Jennie McCutchan, Ida V. McDonald, Matilda J. McKeown, Marion McMaster, Florence Middleton, Charlotte A. Moore, Madeleine M. Munn, Patricia Munson, Ann Murphy, Lucinda Netting, Rosamunda B. Nonnenmacher, Anna Marie Oaskowska, Helen J. Paine, Vera Pinnelli, Elizabeth Pullman, Louise Riedell, Ethel Rispin, Agnes Robinson, Grace Rotzel, Bessie E. Rowe, Reba Stone, Lilian E. Terry, Katherine M. Thomas, Virginia Thomas, Jenny Torriore, Martha Townsend, Mary D. Uline, Anne Van Santvoord, G. Anna Ver Planck, Charlotte Feng Veshi, Resia Vincent, Betty Waldbauer, Elizabeth Watson, Helen Field Watson, Dorothy E. Wheatley, Blanche R. Williams, Emma Williamson, Ida F. Wright.

Dean Bertha Richards

Reverends George G. Bruce, R. L. Carson, William A. Dumont.

Colonel A. P. Shirley

Majors John V. Bouvier, Jr., George H. Foster.

Captain M. C. Moore

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Reviews of New Books

Animal Photographs, American Trees, Exploration, Birds and the War

WILD ANIMALS. Edited by Helen Sidebotham. *Life and Art in Photograph*, No. 6. Oxford University Press, \$2.00. 100 plates.

THIS is a volume composed entirely of half-tones pictures which carry short captions. There is a brief introduction by the author who states "The aim of this book is to give a glimpse of life in the wild and to show how animals look in their natural surroundings." The difficulties of photographing wild life in its natural environment are contrasted with the ease of securing photographic records in the Zoo. The net result of a careful reading of the introduction is to prepare one for unusual and bona fide photographs.

There are a number of very excellent illustrations in this volume and the names of well-known photographers vouch for the authenticity of many of these. The selection is world-wide in its scope, and the subjects are all mammals, the author apparently preferring the popular designation of "animals" to the more precise terminology of "mammals" which would exclude the birds, reptiles, fishes, etc.

It is to be deplored that this volume has not lived up completely to the high standard set by the work of some of the contributors, and that the departure from this high standard goes so far as to bring in faked pictures. Plate 11 (Puma leaping on prey) is such an illustration, and the history of this photograph was given in *Nature Magazine* for December, 1934. It is quite obvious to any one who has studied or photographed wild life that a photograph of a puma launched in mid air upon unsuspecting deer must by the very nature of things be a "fake."

Plate 96 of the Himalayan Goat which, by the way, is our own North American Rocky Mountain goat, not only discloses a lack of knowledge of mammal life on the part of the editor, but also shows what can be done by posing a mounted specimen in a naturalistic surrounding. Plate 61 is captioned "Young Moose or Elk (America and Europe)" which is very misleading to an American audience since the animal obviously cannot be both. The Duck-bill Platypus is given New Guinea as a homeland, where it has never been taken, and the veriest tyro in nature study should know that this is a classic representative of Australian wild life. Plate

64 purports to show a herd of reindeer or caribou, but the animals are obviously wapiti or, to the American sportsman, elk.

Some of the photographs have all the appearance of having been taken in zoölogical gardens. To attempt to go into these in detail might create an impression which would be unfair to the many interesting and bona fide wild life photographs in the volume. The reader of this book is cautioned to employ his powers of discrimination and not to take too much for granted.—H. E. ANTHONY

SOME AMERICAN TREES. By William B. Werthner; *The Macmillan Company, New York, 1935, 398 pp.; \$5.00.*

THE majority of books relating to botanical subjects are designed as technical references and not as pleasant reading material. This is inescapable, of course, for the study of botany presents endless ramifications wherein a single family of plants often demands volumes of descriptive writing to aid the student.

Doctor Werthner possesses the faculty of successfully combining definite information with delightful reminiscences of hours spent in forest and park, among his friends, the trees. His book will open the eyes of many to the recreational and educational values of objective walks through the woods.

Trees will become friends to be greeted anew upon successive open-air excursions. Shagbark hickory, with its ragged coat of bark, and the wild plum, covered with lacy white blossoms, will abandon their place in the landscape and step forth to be acknowledged. Various beauties will meet the trampler's eye as he seeks the orange and red berries of the bittersweet, and the robins and cedar waxwings in the hackberry at different seasons of the year.

Detailed descriptions of buds, twigs, leaves, and fruit are interspersed with sketches of the commercial values of trees. One learns of the farm boys' use of woodland products, too. The author recalls his mother's rose-colored sassafras tea, the ingredients for which he collected in the woods at the edge of town. Then there is the colorful touch given by flowering dogwoods to a green hillside,

the smouldering red and yellow torches of the maples bursting into flame at the coming of frost.

Doctor Werthner died before his book was completed. Readers will owe a debt to his wife who carried on the work and succeeded in having it published. The vicinity of Dayton, Ohio, is the region included in the book, though many of the trees range throughout the country. The author evidently had his friends and neighbors in mind, for he mentions numerous definite Ohio localities. However, the descriptions are so vividly written that readers in California and Maine will enjoy and visualize them.

A summary condenses recognizable features of each species into a few easily recalled "earmarks," as Doctor Werthner expresses it. This is an excellent book for the identification of trees in winter and summer and for its three hundred photographs by the author to show numerous details of structure. Nature workers in all fields will appreciate *Some American Trees*.—KENNETH M. LEWIS

THIS BUSINESS OF EXPLORING. By Roy Chapman Andrews; G. P. Putnam's Sons, New York, 1935. 288 pages, 31 photographs, and a relief map of Mongolia. \$3.50.

DOCTOR ANDREWS here adds another book to his already rather long list of volumes on exploration and adventure in various parts of the world. Here again we find his stories told with the same simplicity, directness, and enthusiasm which have characterized his other books and made them such good reading and which, through the spoken word, have made him one of the most popular men on the American lecture platform during the past ten years.

The present book is divided into two sections; the first half is made up of various stories drawn from the author's rich experience. Some of these stories are new and some are reprinted from magazines in which they first appeared. The second half deals entirely with the explorations of the Central Asiatic Expeditions in Mongolia during the years 1928 and 1930, and supplements and completes the account of these Expeditions begun in the book *On the Trail of Ancient Man*, which dealt with the earlier years of that exploration.

The first chapter, entitled "Exploritis," deals with the generalities of exploration. There are, the author says, but few areas left on the face of the earth which have not been visited, written about, and mapped, but there are vast areas which are still open to intensive scientific exploration—the exploration of the future. Not only has the type of work changed, but the methods of doing it are changing rapidly. The motor car and the aeroplane are in many regions taking the place of the camel caravan, the canoe, and the native carrier.

Doctor Andrews takes occasion in this chapter to answer the often made inquiry by boys and

young men "How can I be an explorer?" and his answer is "Train yourself for a technical or scientific job which fits into exploration," and he wisely adds the caution that the glamour of exploration is usually dispelled as soon as the party takes the field and there must be something back of the successful field man besides a mere desire for adventure.

The dangers of exploration are treated in another chapter, and while the author is the last man in the world not to make the most of any unusual or exciting incident, he sums up his real attitude on this subject by the statement that he always feels much safer in the heart of the Gobi than on the streets of New York City—a feeling shared by the present reviewer.

Other chapters in this first section include an excellent dog story—the story of the police dog "Wolf" who accompanied the party into Mongolia on three occasions; and there is a touching tribute to MacKenzie Young, who, as chief of motor transport of the Central Asiatic Expeditions for four years, piloted us through many difficulties and who had more real exciting adventures and suffered more real hardships than anyone else in the party, only to meet a mysterious and untimely death in northern California after it was all over.

The second part of the book is a straight narrative of the last two years of exploration in Mongolia by the Central Asiatic Expeditions. It tells of the ever increasing political difficulties encountered in Peking, difficulties which finally became insurmountable and brought this great exploratory work to a close at the end of the 1930 season. Here again are stories of sand-storms, of the menace of bandits, of the reaching out into new territory, both to the East and the West, and of those daily happenings both on the trail and in camp which made life in the Gobi anything but monotonous. There are also accounts of the new discoveries of creatures which inhabited Mongolia in the geologic past including those two extraordinary animals—the battering-ram-nosed titanotherium and the shovel-tusked mastodon, and one chapter is devoted to additional finds of that giant of all land mammals—the *Baluchitherium*.

The volume closes with two appendices: one of them tells briefly the story of those Neolithic inhabitants of the Gobi known as the Dune Dwellers, and the other summarizes the results of the Central Asiatic Expeditions over its ten years of work in China and Mongolia.

Most of the stories in this volume I have heard before, in fact I have lived many of them with the author, and yet I have read them all again with keen and renewed interest because they are told with that vitality and enthusiasm which makes Doctor Andrews an inspiring leader as well as a virile writer. It is this spirit which has created in so many of the youths of the country a burning desire to go and do likewise.—W. G.

IN *Birds and the War*, Mr. Gladstone has given us numerous stories regarding the effect of war upon the bird life within the region of conflict in France and in other countries where fighting took place during the great war. We often read of the use of the homing pigeon to carry messages, particularly in times of war. Thousands of them were used for this purpose during the World War. At the beginning they were thought to be obsolete as conveyors of messages. It was soon found that there were numerous times when a pigeon succeeded in reaching its loft with an important message after telephone and telegraph had failed or could not be used. The information, when written and folded, was placed in a little metal capsule which was attached to the bird's leg. When the bird reached its home loft, it crept inside. Its weight pressed on the platform within, which completed an electric current, ringing a bell that announced its arrival. Some of them have been known to fly as far as three hundred miles. They usually were allowed to make only one flight a week. If they were wounded they were immediately pensioned off, fed well, and became great pets.

The Pigeon Service was used on sea as well as on land. At one time an English seaplane was forced down in the North Sea and was in danger of being dashed to pieces by the heavy waves. A pigeon was released and in twenty-two minutes it had flown twenty-two miles; help was sent at once, and the airmen were found clinging to the wreckage of their ship.

Pigeons were not the only birds used during the war to convey various kinds of messages. Parrots proved to be very sensitive to noise and would set up a chatter announcing the approach of aircraft fully twenty minutes before human ears could detect it. They could not, however, note the difference between the hostile and friendly airplanes, so their use was not so extensive. Canaries, we know, are used in mines today to detect the presence of gas. They were almost unfailing in their warning on the battlefields, and they were used in large numbers. Their limp little bodies would be lying at the bottom of the cage before a man was scarcely affected by the enemy's poisonous gas. They were also taken along when tunneling was being done to detect any subterranean gas. The soldiers made great pets of them and kept them in the safest places possible.

Many soldiers found great interest and comfort in watching the wild bird life about the trenches

on the front lines. One would surely think that wild life of all sorts would flee from such a dangerous zone. This was not true, however, of the birds. They seemed for the most part plentiful and unconcerned. They arrived in the spring, nested, cared for their young, and departed in the fall as was their usual wont. They seemed indifferent to the noise of battle. In "No-man's Land" birds were everywhere, even more numerous than before.

It was noted that nightingales sang even more sweetly, if possible, in the war zone than ever before. In spite of the deafening noise of a violent cannonade one night, a nightingale sat in the shelter of a hawthorn bush and sang gaily through it all, never pausing till the dawn. It was found that his mate had a nest in the bush and was sitting on her eggs, apparently undisturbed by the uproar.

Warblers and other birds built their nests with calm indifference amid heavy firing, and reared their little broods as usual. Sparrows were especially fond of building in old wagons not in use. Swallows placed their nests comfortably in dugouts. Little chaffinches considered wire entanglements ideal places to nest when their briar hedges had been torn away. They could be heard singing whenever there was a lull in the almost incessant firing. Storks also seemed indifferent to the guns and returned to old nesting places on the ruined buildings as usual. Wild ducks and swans followed their usual habits of feeding and nesting with no regard for bursting shells.

The soldiers were generally kind to birds, proving that all was not brutality in the war. An officer once stood for half an hour beside a plover's nest to prevent the eggs from being damaged by the passing troops. They were often heard comparing notes on their observations of birds and they cared for nests they happened to find.

Similar reports of bird reactions to the war came from other battle fronts, Italy, Palestine, and Macedonia. Some claim has been made that the migration routes of various birds were changed to avoid the areas over the battlefields. The author believes, however, there is sufficient evidence in the presence of all sorts of birds in the battle regions that this contention is not true. He believes the birds throughout the war followed their usual instinctive habits as always, with slight adaptations to the changed local conditions.

—LENA MAE POOLE

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PUBLICATION OFFICE: 461 Eighth Avenue, New York, N. Y.

EDITORIAL: Edward M. Weyer, Jr., Editor;
A. Katherine Berger, Associate Editor; Dorothy L. Edwards.

Manuscripts should be sent to the Editor,
The American Museum of Natural History,
New York, N. Y.

SUBSCRIPTIONS. NATURAL HISTORY is sent to all members of the American Museum as one of the privileges of membership. Membership Supervisor, Charles J. O'Connor.

ADVERTISING: Sherman P. Voorhees, The American Museum of Natural History.

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ROLAND

On December 30, 1935, Roland, the three-ton sea elephant who was the pride of the Berlin Zoo, died. German children who had developed a particular affection for the mighty creature mourned

him throughout the land. Many believed that the sea colossus passed away because of a broken heart, for the Berlin Zoo could not afford to provide him with a mate

Kent's Island—Outpost of Science

An expedition of Bowdoin College undergraduates establishes a scientific station on a lonely island in the Bay of Fundy

By W. A. O. GROSS

*Field Director,
Kent's Island Research Station*

IT was during the eighteenth century that a certain John Kent, a British subject freshly arrived from England, settled on the island in the Bay of Fundy that today bears his name. John Kent prospered; both the sea and the island's rich soil were good providers. Stark tragedy, however, was to be the fate of many of his successors.

A changed island

Indeed, natives of the region will tell you that Kent's widow had once prophesied that no one would thrive on the island after her death. She was a strange old woman, that widow of Kent's. From another anecdote we gather that she must have been of frightful appearance during her last years. An English brig, according to the story, was making its way up the fog-bound bay. The vessel's captain, who had been over-indulging in Jamaica rum during the course of the day, took over the helm as the little ship neared the "graveyard of the Bay of Fundy," the Murr Ledges. In his stupor the captain claimed he saw a witch guiding him and telling him that with her protection he could sail *through* the dangerous reefs. He took the "witch's" advice, and it was not long before the ship was on the rocks and sinking rapidly. The mariners lowered their small boats and made for Kent's Island near by. Entering the old homestead of John Kent, the captain espied the old widow

and swore that there was the very "she devil" that had betrayed him. It never occurred to him that the rum was the real traitor, and he would have brought the old lady to a violent end had not his shipmates stayed his hand.

Today the tombstones of the Kent family are gaunt reminders of other days. The fertile acres have given way long since to weeds and undergrowth. Even the island's shape has changed. Storm and tide have left their mark. A reconstruction of the island's former geographical features exhibits a harbor and a great extent of land that is non-existent today. An old lime kiln is slowly marching to the sea as soil erosion narrows its distance from the water's edge.

New land for naturalists

The years passed, but prosperity had evidently gone with the death of Kent's wife. The house was burned, a Frenchman was killed, and a ship was wrecked on the southern end. It seemed that the island was a fit home for nothing save the wild life. While offering little inducement for would-be settlers, Kent's and other near-by islands attract to their shores many species of birds including forms that generally nest much farther north. Such types as the petrel, a mysterious wanderer of the ocean; the puffin, a "feathered clown" with a gaily colored, parrot-like bill; the razor-billed auk, surviving cousin of the extinct great auk; guillemots, a doughty tribe of the rocks; and the eider duck, whose down has filled many a feather bed, have thrived on these outer sea islands.

During the summer months of 1934 I camped on Kent's Island with three fellow-students from Bowdoin College. For three months we reveled in the great bird rookeries, in the teeming life of the lagoons offshore, in the beauty of the region, and in our discovery of a land that the naturalist had apparently overlooked. We had many exciting experiences. One time the Canadian Coast Guard boat had to go to the rescue of two of our number when our canoe capsized several miles offshore. At the end of the summer the schooner "Bowdoin" with the Bowdoin-Mac-Millan Arctic Expedition stopped at the island on its return from the north and gave us transportation back to Portland, Maine.

A new enterprise launched

Our preliminary survey had proved so satisfactory that we believed sufficient support could be aroused to establish a permanent research base at Kent's Island. The infant enterprise got a good start through the generous gift of Mr. J. Sterling Rockefeller, who offered to the college both the island and much of the necessary equipment for a field laboratory. With such an excellent beginning, it was easy to rally many friends to our cause. Under the leadership of two Bowdoin alumni, Messrs. Sumner T. Pike and Albert T. Gould, funds were raised to begin the project. The growth of our plans hardly kept pace with the increasing interest in the new station. Support came from everywhere: from scientists, from the alumni and undergraduates of the college, and from many business houses. Burnham and Morrill of Portland offered us food supplies. Gasoline came from the Standard Oil Company. The Collins Radio Company lent us the finest medium-power transmitter available, and other concerns also gave us invaluable assistance.

It was finally decided that the expedition should consist of ten undergraduates and someone familiar with the Bay of Fundy. The latter would be the permanent year-round warden of the station. For this position we were fortunate in securing the services of Mr. Ernest Joy, a native of Grand Manan Island and one who had a remarkable knowledge of bird life as well as extensive navigating experience. The type of students selected were those who had

supplemented their technical training derived from classrooms with actual field work. A highly organized scientific party must have a diversified personnel, a personnel that could carry on studies in many branches of science besides filling the various offices of the self-sufficient field party. Our roster included such positions as commissary officer, cook, radio operator, and boatman, in addition to those that were devoted mainly to research. Such specialization demands that every man carry out the work for which he is personally responsible.

Our main supply depot was located at Lubec, Maine. Through the kindness of Messrs. Alger and Radcliffe Pike, the facilities of their extensive wharf, including storage and office space, were secured for our fitting out in that port. Lubec is a neighbor of Eastport, which is the base of the famed Quoddy Dam operations. We found that the effect of the great undertaking was being felt in full measure. Government employment has made local wages soar; good times have indeed returned to a region that has seen little of prosperity in recent years.

Preparations forged rapidly ahead, and we decided to sail as soon as our last truckload of supplies arrived from Brunswick. In order to have smooth waters for our heavily laden boats we set our sailing time for one o'clock in the morning. Our supplies arrived late at night and, with floodlights playing on the wharf, we finished loading the two forty-foot launches that were to take us to Kent's Island. As the tide was just beginning to come in, we found that our boats were some twenty odd feet below the top of the wharf! Already we were in the throes of Fundy tides.

The great tides

The great tides of the Bay of Fundy are famed throughout the world. At the head of the bay there is a rise and fall of forty-two feet. The rise and fall at Lubec is about twenty-five feet. Such a great range in the ocean's level is equalled only by the tides in Gallegos Bay on the Patagonia coast. It is difficult to appreciate what such a great ebb and flow of the ocean means to the mariner. Imagine having your boat hung up on the wharf by its bow and stern lines when the tide recedes. Imagine anchoring in forty feet of

water and six hours later finding yourself on the dry bottom. Imagine being carried out to sea by the current that nullifies your efforts to row against it. Such experiences, however, are often the lot of the Fundy fisherman.

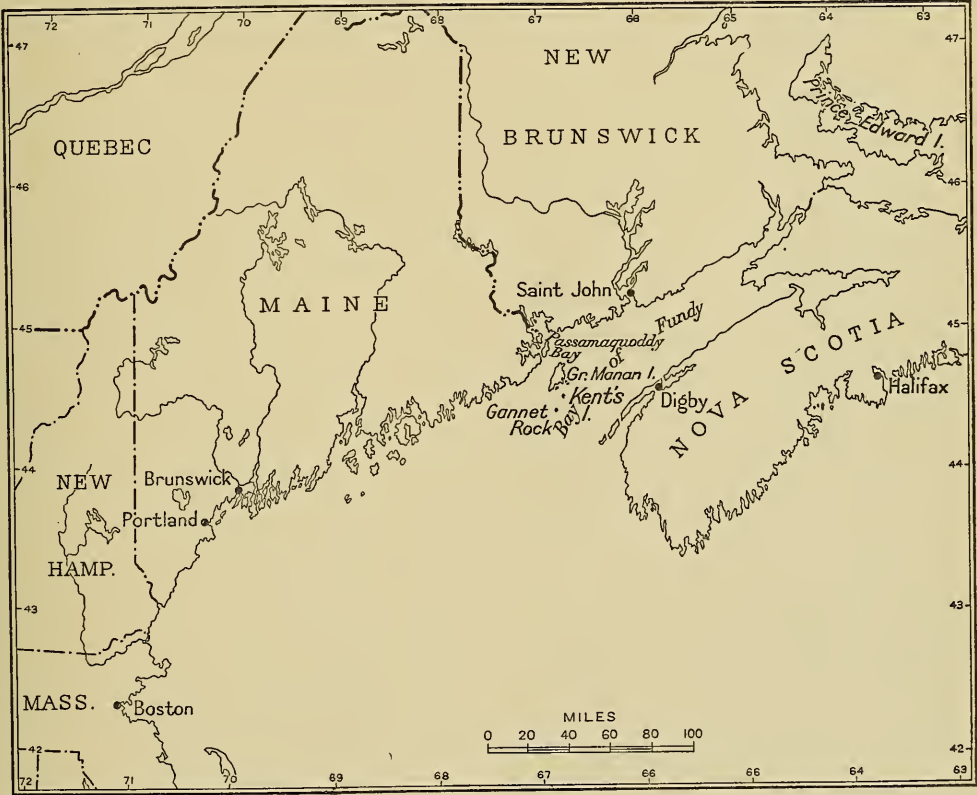
First away was the "Zacatecas," a forty-two-foot, specially built cruising boat which has recently been presented to the station by Mr. Alger W. Pike. At the helm was a skilled skipper who was well versed in the waters of the lower bay. The "Zac" would lead the way; the "Bowdoin II" in the hands of a student crew was to follow. The six-knot tide rushing by the wharf soon spelled plenty of trouble. As soon as we had let our lines go, we swung with a splintering crash into a near-by vessel. After ascertaining that we had done no harm, we manned the boat hooks and put off again. Finally we crept out of the narrows and joined our convoy in midstream.

With our motors roaring a steady note, we

sped down the roads to Quoddy Light and out into the waters of the bay. When we said good-bye to the light at Quoddy Head, we were saying good-bye to the United States for three long months. That dash across the Grand Manan channel was a memorable trip. A brilliant moon rode the sky, and the light on the lead-ship's masthead shone like a star. During half the voyage a great display of the aurora borealis kept us company. The joy of adventure and exploration lived in our hearts that night.

A unique summer home

Only too soon the great three-hundred-foot precipice that flanks the western side of Grand Manan loomed up in the darkness. The very mass of the great cliff, which extends to the south for several miles, almost takes one's breath away. I thought of the poor fishermen who had been wrecked on the ugly rocks at



THE BAY OF FUNDY

Separating Nova Scotia from New Brunswick, is the inlet of the Atlantic Ocean known as the Bay of Fundy. The tides here rise from fifty to seventy feet, and are the highest in the world

the base. We were glad when a few hours later we left this bleak shore and dropped anchor in the peaceful harbor of North Head. After a visit from the Canadian Customs officer, we again headed out to sea, this time for Kent's Island. The island was only a dot on the distant horizon, but excitement was keen. For the first time nine members of the expedition were looking upon what was to be their unique home for the entire summer.

Comfortably settled

As we neared the island, we received a royal reception from the great bird rookeries; the air was soon filled with vast numbers of herring gulls who literally shrieked a welcome. Or was it a challenge? The eider ducks and the guillemots were a pleasant sight. They bobbed below the water as we approached and popped up again after our little flotilla had passed. On occasional rocks seals could be seen basking in the sun. This was God's world; the frontier lay behind us.

From our visit of last year we knew that it would be best to effect our landing at high water and we had timed our arrival accordingly. This would enable us to make use of a tidal basin for unloading. The basin had only one entrance, a narrow passage through which the tide rushed like a mill-race. It was an anxious moment as we eased our boats into the turbulent waters of the channel. With all eyes on the lookout for dangerous rocks, we were virtually swept along by the swift current. The boats maneuvered up to the shore—the first lap was over; we had arrived.

Kent's Island is located about six miles due east of the southern head of Grand Manan, mother isle of the Bay of Fundy archipelago. It is a member of a group of islands that are known on the Government charts as Three Islands. Together they create a perfect natural harbor with three entrances. The largest of the islands—Kent's—measures nearly two miles in length while it is often less than a thousand feet wide. From the water its long flat shape gives it the appearance of a huge airplane carrier. Its strategic position on the great circle route may well make it the location of an emergency landing field of the future; the extensive area in the central portion provides the only suitable landing surface

in the entire bay. The northern end of the island is covered with a heavy growth of virgin spruce, but in the southern sections the inroads of gulls have killed off the forest growth.

We established a temporary camp near the wharf while the headquarters building and dormitories were being made ready for occupancy. There was much to be accomplished. As soon as the electric light plants were operating, we worked until late at night. All of our equipment and food stuffs were carried on a diminutive hand cart over the rough ground to the new quarters. We were favored with good weather, however, and within the course of a few days we were comfortably settled.

Radio masts were erected, and the transmitting equipment was installed without delay. To the delight of the operators the delicate equipment had withstood the rough trip in good condition. The success of the Collins transmitter was immediate; it soon made itself an integral part of the expedition. By the first of July, VE1IN, the expedition's call letters, was a familiar signal to many a short-wave listener.

A link with home

Radio served as our only means of daily communication with the outside world during the entire course of that summer. In one instance the transmitter did valiant service in determining the whereabouts of a fog-bound field party by contacting the Canadian Coast Guard. To facilitate the handling of messages with the United States, daily traffic schedules were arranged with two strategically located stations: W3SN, the army signal corps at Baltimore; and W1JL at West Acton, Massachusetts. Besides handling traffic between members of the expedition and American amateur radio stations, the transmitter, which was used with both voice and telegraph, enabled operators George Cadman and Thomas Gross to have pleasant contacts with stations as far away as Hungary and Russia.

Radio contributed greatly toward maintaining morale. When the island became fog-bound for long periods, the radio "shack" was undoubtedly the most popular room at the headquarters building. Though swirling tides and heavy fog banks might cut off access to

the coast, we could talk at our ease to friends back home.

On the "Bowdoin II," the forty-foot boat attached to the station, a small portable transmitter was installed. The efforts of our active communications department thus enabled us to keep in contact with field parties no matter how far from the island their work might take them.

The expedition's station was probably the only Canadian-licensed, American-operated radio station in existence. This unique permit was granted by the special kindness of the Canadian Government, which has given the greatest coöperation to the new research base.

It seemed to me that Kent's Island had almost been transformed overnight. The simple life of the previous summer was no more. We had such things as electric lights, radio, communication with the mainland, interconnecting telephones, gas stoves, and a substantial library. We could, if we so desired, be entirely self-supporting for at least three months. Our larders were filled with canned foods, and the beach was lined with fuel drums. With three motor boats and our stalwart cruiser in the little harbor—the island's isolation was no more.

Little time was wasted in getting into the field. Blinds were immediately set up in the bird colonies, and daily observations were begun. Since the birds were already nesting, ornithology, for the time being, took precedence over the rest of our scientific projects.

The herring gull

We hoped to throw some light on the status of the herring gull, a sore point with every Maine, Maritime Province, and Labrador fisherman. This species has increased its numbers to such an extent that it is often a nuisance. Formerly faced with extinction, the gulls have profited enormously by government protection. The birds used to be able to secure a sufficient food supply by scavenging, and their economic value in that capacity has been highly praised. Since over-population has set in, they have been forced to resort to such tactics as stealing bait from fishing boats and raiding blueberry fields. They have warred on smaller and weaker forms of life. I have seen such birds as savannah sparrows, petrels,

and eider duck chicks attacked and eaten by half-starved gulls.

Believing that the very balance of nature had perhaps been upset, the United States Biological Survey has taken definite steps to control the herring gull. Their field parties are now making annual cruises along the Maine coast for this purpose. Some fifty thousand gull eggs are being destroyed by piercing the shell with a needle. In these instances the adults continue to sit on the nest although the eggs are sterile. If the eggs are broken or removed from the nest, the bird immediately lays another set. This particular race is able to lay three complete clutches, if necessary, in one season.

A rarity in the bird world

At the southern end of the island, we found the nest of an albino herring gull, a real rarity. This unusual bird had been reported on Kent's Island seven years ago! It is apparently returning each year to its old nesting ground and is today a very conspicuous member of the bird colony. Mating with a normal bird, it had two offspring: an albino and a chick of ordinary color.

Howard Miller, one of our ornithologists, spent most of his efforts in studying another gull species, the black-backed gull. The inroads made by it along our coasts are of great interest to the naturalist. Formerly a bird associated primarily with more northern regions, it is beginning to extend its range to the American seaboard. The black-backed is the king of the gull clan. It is supreme in size, strength, and beauty. Certain individuals often tipped the scales at nearly three pounds (herring gulls average about two pounds), and we have found many birds with wing spreads of more than sixty-five inches.

Despite the fact that on Kent's Island the black-backs are greatly outnumbered by other gulls, they are easily holding their own and are even making yearly gains. We found that no other bird dared encroach upon their nesting territory; the transgressor of this sacred ground is immediately the object of a spirited and effective attack. At the approach of a human being, however, the wary bird stays more aloof than any of the other gulls in the rookery. Courageous but no fool, the

black-backed gull commands the respect of every naturalist that knows him.

Howard Miller kept one of the black-backed chicks at the laboratory for the purposes of study. It soon became the pet of the entire company, the official mascot of the expedition. Mr. Ernest Joy, the good-natured warden of the station, became the unwilling godparent of the awkward youngster, for it was named "Ernest" in his honor. At the end of the summer "Ernest" was crated and taken back to Miller's home in Massachusetts. By that time the young gull had become very large and was a good flyer. One day it made its escape and was given up for lost. A month later, however, a well-known newspaper carried a feature article about a strange bird that had been picked up and that had been made a pet. Miller instantly recognized it for old "Ernest," and he recovered his long-lost bird.

Scouting for guillemots

Meanwhile, Latimer Hyde was engaged in locating the nests of the black guillemots. The homes of these birds were in the recesses of the great rock masses at the southern end of the island. By steering close to the shore in a small boat, we could locate the nests by noting from what places the frightened birds flew. It was impossible to do this from the land because the gulls would cry the alarm if we came within half a mile. The gulls are the sentinels of the bird colonies. The guillemots know by their cries that danger is in the vicinity, and they leave their nests immediately.

Guillemots lay their clutch of two eggs during the first part of July. After twenty-eight days of incubation, a diminutive coal-black chick emerges from the egg peeping the news of its arrival to the world. But it is not always so simple. Storms often wash their way into the home of the guillemots with tragic results. After one particularly strong blow, Hyde found that one-fourth of the colony had been destroyed. In 1934 we built a number of guillemot nests from rocks in the hope of attracting the birds to safer nesting sites. The occupation of these nests was so universal that we are undertaking the construction of a large number in the hope of establishing a larger rookery.

Kent's Island boasts of one of the finest

eider duck colonies along the entire coast. These birds appear early in the spring and begin their courtship performances on ledges near the shore. To film this phase of their life history, it was decided to erect a blind on a large offshore rock, a favorite nesting place of the ducks. Since the surface of this ledge is submerged at high water, the construction of the shelter taxed our ingenuity. But in the due course of time all was in readiness.

We chose a warm day with an incoming tide for photographing as it was more likely that our quarry would be enticed to the rock under those conditions. Two of us went down to the blind, but I alone remained inside. This was a little plot to satisfy the curiosity of the herring gulls. If we had not taken this precaution, they would have realized that somebody was in the blind and would have informed the entire colony of the fact. Being poor mathematicians, they did not appreciate that, whereas two had entered, only one person had left.

I did not have long to wait. As soon as the tide was high enough to make the rock accessible from the water, a large flock of eiders swam up and began to perform nobly in full range of the camera. The striking appearance of the drakes in their full nuptial plumage occupied my rapt attention. I failed to notice that the tide had reached the bottom of the blind! I had to beat a hasty retreat. The ducks had been utterly unaware of my presence, so that when I stepped out, they made a simultaneous dash for the water. Holding my camera on my shoulders, I waded ashore on the slippery, submerged rocks.

"Mother Carey's Chickens"

The petrels, commonly known as "Mother Carey's Chickens," have found a place in the folk lore of many peoples. Sailors in past centuries claimed that, as the birds were never seen near the land, they must lay their eggs at sea and hatch them under their wings. Admiral Byrd found snowy petrels nesting in the antarctic. Alaska is the breeding range for other members of this cosmopolitan family.

Our study of Leach's petrel uncovered many secrets of their lives. The facts which had been unknown proved to be unique. Early in June the male petrels fly in from the ocean,

from journeys that have taken them all over the vast expanse of the Atlantic from the equator to Iceland. This first contingent arrives to construct nesting burrows. These subterranean nests represent considerable engineering skill and industry. They are in tunnel form and often approach a length of three feet or more. This is a remarkable fact because the frail little birds seem to be but poorly equipped physically for such work. After three days of digging, the nest is completed and made ready for occupancy. Courtship follows, and the petrels have a unique one. In the middle of the night the colony, which has been dormant during the day, teems with activity. Females flying over the islands are enticed by the calls of would-be mates from below. By answering each other, they finally effect a union. The pairs of mating birds trill a warm rhythmic series of similar notes during the actual mating. One bird utters the call and the other joins in as soon as its mate has stopped. The calls sound like "mmmmm-mm, mmmmm-mm, mmmmm-mm." These beautiful, contented purrings leave an unforgettable impression with everyone who has heard them.

The incubation of the single white egg occupies both birds for more than forty days. Each bird sits upon the egg for its turn of four consecutive days. During this time it receives no food, sees no light, is not visited by its mate. The newly born chick is an awkward, helpless, little mass of down. It will be at least sixty days before it can leave the depths of the burrow and take to flight. Finally, it is a matter of more than one hundred days of intense effort on the part of each pair of adults to bring a single petrel chick into the outside world!

Persecuted petrels

Petrels seem to be losing ground. Besides having very difficult breeding habits, they are the object of great persecution by natural enemies. Their latest rival in the struggle for existence is the gull, a foe created by the food supply crisis that the latter is facing. One can pick up the regurgitated remains of dozens of birds along the shore after a night of full moonlight. The awkward, erratic flight of the petrels makes them easy prey for the gulls. The latter stand guard in the colonies and exact a heavy toll from the bewildered and de-

fenseless little birds when they come fluttering in from the sea at night.

To test the ability of a gull to swallow adult petrels, an experiment was conducted with a captive black-backed gull. In twenty minutes this bird succeeded in swallowing five birds in their entirety. Little wonder is there then that without adequate protection petrels may vanish from our oceans.

The razor-billed auk

Our interests were not all centered on Kent's Island. Six miles away was a unique colony of razor-billed auks, and another six miles would take us to Machias Seal Island, home of a thriving group of puffins. We planned an excursion on the "Bowdoin II," our floating laboratory, that would include both interests. Because the Murr Ledges took a grim toll of life and ships in the days of sailing vessels, a great lighthouse was placed on near-by Gannet Rock. From the friendly keeper of this isolated post, we received instructions for our visit to the ledges. Only the rocky mass upon which the auks nest remains above high tide, so we were particularly careful in navigating through such dangerous waters. However, the tide was flood; and if our boat should run aground, the rising level of the ocean would soon float it again.

The auks made no pretense of enjoying our visit. Most of the adults took to the air and scolded us roundly. When we succeeded in catching a bird on its nest, we often suffered considerable casualties. They had not been named razor-billed in vain. How they could bite! Full of fight, and wiry creatures to boot, they were a strenuous proposition to handle. They are so much like their departed cousins, the great auk, that clues to the life history of the extinct form are being secured by making studies of this surviving species.

The Atlantic puffin is the most exotic-looking bird of the north. Its keen, spectacled eyes are surpassed in uniqueness only by the dazzling colors and shape of its parrot-like bill. This second feature of its physiognomy has caused the bird to be nicknamed the "sea parrot." Like the auk, it appears in a "full dress suit"; the white feathers of its breast and the black ones of its back and tail present a mock semblance to a white vest, starched shirt,

and tail coat. Its red feet, another distinguishing mark, are matched only by those of another of the alcidæ (family name of the auks, puffins, etc.), the guillemot. At our approach hundreds of puffins took to the air like a great ascension of miniature blimps. Such a comparison is spontaneous; their round bills and solid cigar-shaped bodies practically make small-scale silhouettes of lighter-than-air craft.

We banded ten thousand gulls, besides many birds of other species, on Kent's Island. The recovery of many of these banded birds has already been made. We are finding that the birds of many species return year after year to their same nests. The dispersal of the young herring gulls from the island is also clearly shown by banding records. This group is spreading all over North America. Bands from one-year-old gulls are being returned from points farther north, from western states, and from such distant countries as Cuba.

The sport of bird banding

Banding young gulls soon became routine work. We operated in pairs. One man caught and held the bird while the bander snapped the numbered aluminum ring of the United States Biological Survey on its right foot. Once in our haste we slipped a band on the wrong foot (the left), and when the youngster was released, we noticed that it had a band on each foot! We started in full pursuit. It gained the water and was about to swim out of reach when a big breaker rolled it inshore, and we were able to recapture the very much frightened and over-banded bird.

It was often real sport to capture the adults for banding. Armed with powerful flash lights, two parties would work their way along opposite sides of the island. Made awkward and almost stunned by the bright lights, they were sometimes easy prey, but many a bird led us on an exciting chase over the slippery rocks. The influence of the rays of the lights seemed to have a certain hypnotic effect upon them. In the majority of instances, we could make the birds stand motionless and often walk toward us by shining the light directly into their eyes.

Jacking was used with good results on shore birds. Their migration is in progress during the middle of August, and Kent's Island is directly in one of the lines of flight. The re-

sult is that thousands of these birds use the island as a feeding and resting station. Great flocks would gather in the basin near our wharf on foggy and stormy nights. The tidal flats are a favorite place for feeding at low water, and the depredations of birds upon the crustacea and other low forms of life quite disgusted our invertebrate zoölogist who had hoped for "rich pickings" in that highly accessible spot. When the basin was filled with birds and visibility almost nil, we could often succeed by means of our lights in capturing several hundred of the migratory sandpipers.

The most welcome of the birds are the swallows. Four kinds—cliff, barn, tree, and bank—have established themselves on the island. They are our closest bird friends. Some nest under the eaves of the laboratory, a number bring up their young in the cellar, others occupy the boxes that we have provided, and one species digs holes in the bank along the shore. Aside from an appreciation of their æsthetic qualities, we were well aware of their service in checking the insect population. If the flies and mosquitoes had not been controlled by the swallows, we would have been forced to screen our buildings. One zealous insect chaser even entered my room on four consecutive nights to catch mosquitoes attracted there by the light.

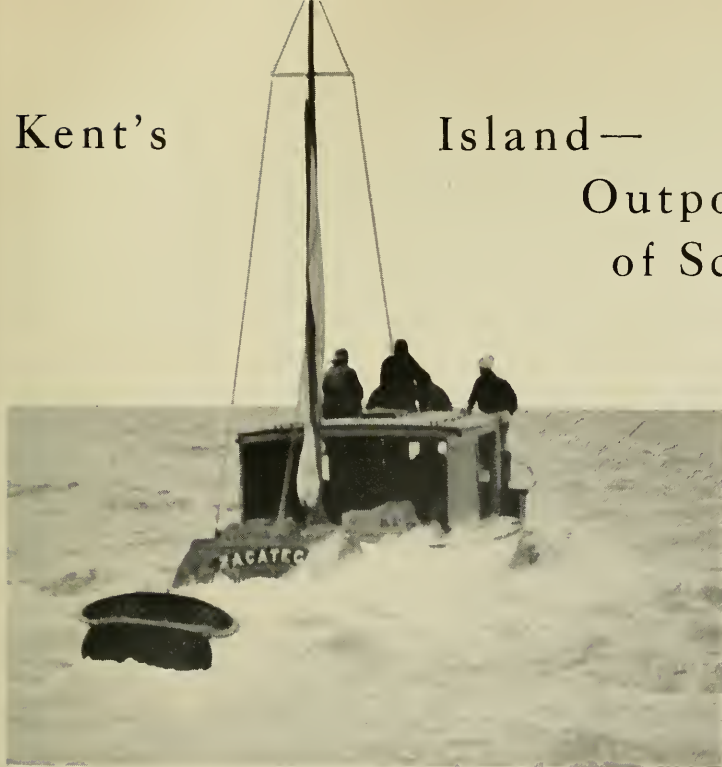
While much stress was laid upon the ornithological aspects of the expedition, we were not idle in other fields of science. Collections were being made of the island's flora and fauna, a base line was laid out by the surveyors, and the meteorologist was busy. For the main part, these preliminary surveys gave every indication that volumes of potential nature lore can well await the naturalist on this fascinating island. Perhaps, too, the studies of the Kent's Island bird colonies will be rivaled by discoveries on the strand and in the depths offshore.

September was soon upon us. The bird population was already changing. The exodus of our breeding birds was followed by great migration flights from the north. Ernest alone would stay on the island during the entire year. There were tears in that kindly man's eyes when he said good-bye. I would not see him again for more than eight months, for we, like the birds, were migrants and had to flee the winter.

Kent's

Island—

Outpost
of Science



The "Zacatecas" leads the little fleet across the Bay of Fundy to Kent's Island. During the night the light on the lead-ship's mast served as a guide for the second boat



Smooth waters are necessary for landing on sea islands, and the dory is the best craft for the purpose



Unloading equipment and supplies for a season's work at the Kent's Island wharf



The top of this tree is covered with a thick growth, solid enough to walk on. Herring gulls trample down the outermost branches of the trees stunting their growth and making them of abnormal shapes



(Left) Removing nestling swallows from their nests for banding



The Kent's Island Express. Scientists have more than one kind of work to perform! The heavy equipment was carted from the wharf to the laboratory in a decrepit two-wheel wagon



(Right) A bird blind made of burlap bagging and drift wood near the high-water mark



(Left) "Ernest," the young black herring gull, not only provided service in the way of scientific data but also supplied an obvious need of every isolated party, the need of a mascot. At the end of the summer Ernest was crated and taken back to Massachusetts. By then he was very large, and a good flyer



(Left) A black-backed gull swallowing an adult petrel. In twenty minutes this gull had swallowed five birds in their entirety



(Left) A rare albino gull standing guard over its offspring: one normal and one albino



(Below) A pair of herring gulls await the arrival of their next offspring. One chick just hatched looks on



(Above) Four freshly hatched eider ducklings make a good-sized handful. These chicks had come from the eggs only a few hours before the photograph was taken

(Right) Members of one of the largest colonies of eider ducks on the Atlantic coast, found on Kent's Island



(Right) A one-day old eider duckling resting on the seaweed after a swim in the cold waters of the Bay of Fundy



Self-portrait of a Leach's petrel. These birds, also called "Mother Carey's Chickens," leave their burrows only at night



A young "Mother Carey's Chicken" which looks like a little ball of down. The one shown at the left was three weeks old

*(Opposite page, right)
A study of a ruddy
billed auk, nearest
living cousin of
now extinct great*

Banding "Mother Carey's Chickens" on Green Island, in a typical petrel colony. Their homes are burrows in the heavy soil



An intricate flashlight camera equipment which automatically photographed the petrels as they left their burrows

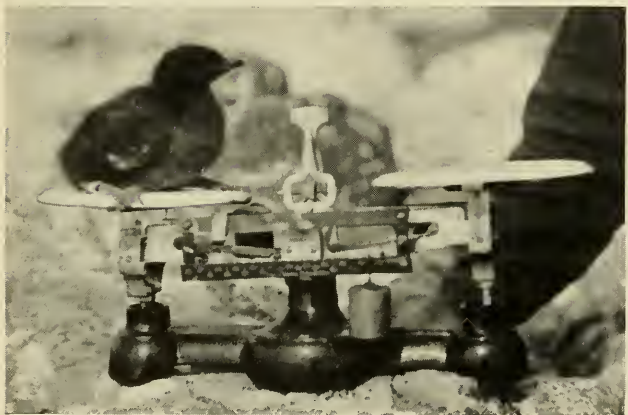




(Above) Black guillemots conceal their nest under great rock masses, so they must be located from the water



(Left) A black guillemot comes up with a rock eel, the result of a successful dive



A young guillemot weighs in. The growth of birds whose life histories were being studied was carefully noted

The Curious Life Habits of the Sea Horse

For centuries naturalists mistook the male sea horse for the female because of a strange reversal in the reproductive functions

By RENÉ THÉVENIN

IT IS easy to understand how a type of fishes so singular in appearance as the *Hippocampi* or sea horses should formerly have been thought of as a group far apart from all others.

The French scientist, Georges Cuvier, created for them (and for their cousins the *Syngnathi* or sea needles) the order of Lophobranchiata. As the name implies, the distinction depended upon the structure of the gills, which in the sea horse grow in the form of tufts instead of in comblike formation as in most other fishes.

Unusual characters

Today it is known that this characteristic of the respiratory system is also found in other fishes in various stages of development. Likewise, the armor of the sea horse which protects its body and which replaces the scales is not absolutely unique. But in spite of these later discoveries which minimized somewhat their strangeness, the *Hippocampi* still deserve special interest because of their unusual appearance and also on account of their life habits. I have the good fortune to illustrate this article with photographs taken from the extraordinary film of my compatriot, Jean Painlevé, which traces in a most expressive manner the principal events in the life of the sea horse.

Sea horses are primarily inhabitants of the warmer seas, though a few representatives may

be found in comparatively cold waters. In Europe, where we studied them especially, they occur as far north as in the Channel. But they begin to be rare in these latitudes, while they are very common in the Mediterranean Sea.

The most abundant varieties do not grow larger than about two inches, but the tropical forms sometimes attain much greater size. In the Australian Seas and also near Japan large specimens occur. The largest are possibly two feet in length.

Like the "knight" in chess

Their appearance also varies, but in general they justify fully the popular name "sea horse." The head of these fishes closely resembles that of a horse, or, even more exactly, the "knight" in the game of chess. Their skin shows no scales but instead a "skin-skeleton," similar to that of the insects. The plates which form this skin-skeleton are connected with each other in rings that give the body of the animal the shape of an irregular polyhedron. One can count fifty-odd such rings from the neck to the lower end of the body. The shields which ride on the back of the fish like the tiles of a roof produce a crest on the head, the neck, and the back. In certain varieties, especially those of the warm seas, these appendages are elongated, overgrown and branched in the most extraordinary fashion, and seemingly for camouflage resemble the marine plants among which the creatures live.

One of the peculiarities of this family is

that unlike all other fishes its members swim in a vertical position. And the tail is not used for propelling the animal at all, but only for gripping a more or less solid support around which it curves itself like a spiral. This support is usually a plant of some sort, but any other object might serve the same purpose. It is easy indeed to have a sea horse clinging to one's finger in an aquarium. To bring this about, it is only necessary to touch its caudal extremity gently. One notices in this instant how much gripping power the little tail of the fish has; it could be compared to that of a small child's hand. The sea horse is the only fish aside from the closely related *Nerophis* that has a prehensile tail. *Nerophis*, of which at least two species are known in Europe only, belongs to the same family as the sea horse.

A vertical posture

The tail is restricted to this use and does not serve as a fin. The anal fin is also reduced to the simplest form and apparently no longer has any function. The fins that are normally found in pairs on the bodies of fishes are represented only by those farthest forward, namely, the pectoral fins, which are placed just behind the gills. They are used to maintain the vertical position and the equilibrium of the body in the water. The only really active fin is the dorsal fin, which oscillates in a rapid, rhythmic manner, reminding one almost of a propeller.

The sea horse does not swim much. Hooked to a bunch of seaweed, it remains motionless in its vertical position; if it does not discard its support it has no exercise at all.

The structure of the head is extraordinary, too. It ends with an elongated snout which opens and closes with a rapid movement. One can distinctly hear the faint smacking sound it makes when it snaps at its prey.

All these characteristics may easily be observed in an aquarium, where sea horses can be kept alive without any difficulty. This at least applies to our native (French) varieties, especially *Hippocampus antiquorum* which is the variety discussed here.

This animal certainly accustoms itself easily to changes in temperature, as well as to changes in the salt content of the water—even to a change of diet. Its food consists, in captivity,

of little shrimps, worms, and even small pieces of meat, which the sea horse catches by a very quick movement of its head the instant they come near its mouth. It is in this moment that one can hear—when listening carefully—the sound produced by the opening of the mouth. The prey is swallowed quickly without being chewed.

In the act of catching its prey the animal is greatly aided by the mobility of its eyes. They are placed on the sides of the head, and are independent of each other. Their way of working reminds one of the eyes of the chameleon. The eyes of the sea horse appear to sense very slight changes of form and illumination.

Light apparently has also an important influence on the general coloration of the body. The color varies not only with the species, but also with the surroundings in which the specimens are found. The commonest color is a dark gray, almost black. But reddish, greenish, and silverish colors are also found; quite often the body shows very brilliant spots. Male specimens sometimes show the dorsal fin rimmed with yellow; the coloration of the females is less pronounced.

When these dark colors turn to a greenish-yellow or even to white, it is a sign of bad health, and the animal usually dies very soon afterward. At the same time the sea horse abandons its vertical position and begins to swim on its side. Sometimes bleedings occur, accompanied by losses of skin which may lead to the loss of parts of the tail. Most frequently all these signs of bad health do not show before it is too late to interfere.

Ascending and descending

When the sea horse descends, it curves its neck and rolls its tail in; when it wants to float upward, it straightens itself out almost completely. It can also creep on the bottom by little movements of body and tail.

The breathing is done, as has already been stated, by means of pufflike gills. In the moment when the water is inhaled the tongue bones or hyoid bones are erected and poke out the skin from the inside, producing the semblance of little horns.

The rigidity of the skin-skeleton makes it exceedingly easy to preserve the bodies of the

dead sea horses. The mummified little forms are picked up on the shores of the Mediterranean by the children—especially in Naples—and constitute the stock of a minor trade, or, more exactly, an excuse for begging.

Reproduction

But the most interesting thing to observe in sea horses is their manner of reproduction and their way of caring for the young.

In the adult state the female carries about two hundred eggs. When the time has come for mating, the male and female approach each other and begin to make movements which may be compared to a dance.

The male is equipped with a ventral pocket or pouch which extends from the twelfth to the eighteenth ring and has its place underneath the pelvic bone. To be exact, there are two pockets in the skin, right and left, which join in the middle in the adult, leaving only a small slotlike opening.

The female inserts her cloacal appendix into this slot and projects in that way her eggs into the male pouch; while passing the slot they become fecundated. This brings to a conclusion the duties of the mother, and thenceforth the father performs the rôle of a mother—a unique reversal of the usual habits.

When the pouch of the male sea horse is not occupied, it is lined with conjunctive tissue, which is only slightly wrinkled. But from the moment that the eggs are deposited a considerable change takes place. The tissue begins to swell and to grow, it becomes spongelike and the capillary blood vessels enlarge and multiply. In short, placentation is occurring. Interesting speculation surrounds the question as to how the male may have developed this complex function.

Soon after the eggs have entered the pouch each one produces a localized excitation; little holes form, the whole tissue takes on the appearance of a quadrangular network, and each compartment engulfs one egg. In addition, a wall begins to grow from the bottom of the pouch and approaches the seam of the outer skin of the pouch so that it is divided into two parts. Thus two additional surfaces are created which give the remainder of the eggs a chance to secure a place on the pseudo-placental tissue. Those that do not succeed in finding

a place where they can develop, degenerate.

The successful eggs start to develop at once, and as they grow they embrace more and more tissue.

The shell, or rather the skin of each egg splits open inside the pocket, but the embryo is not yet expelled. It rests in the pseudo-placental tissue and remains in this position usually until its yolk is used up almost entirely. During this time it has the curved position of many embryos and does not straighten itself out until it is finally projected into the water.

Sometimes it happens, however, that a few embryos are expelled which are still in possession of a fairly large yolk sac. It is to be noted that these are handicapped in the struggle for existence. The young ones best equipped to meet the dangers of life are those that have freed themselves completely from the natural reserves of the embryonic stage. These also swim in the vertical position at once, the position customary for the sea horses. They even show the adult tilt of the head at once.

Further proof that the connection between the young ones and the father is a very close one can be observed in the fact that the male suffers considerable difficulty in the act of expulsion. He can be seen writhing on the soil, rubbing his body, and struggling energetically. At the same time his eyes are wide open and move convulsively in the rhythm of breathing. Finally, with considerable force the male ejects its burden of young sea horses, the residue of the eggs, pieces of tissue, and many bubbles of gas.

The pouch does not empty all at once. There are several expulsions which may extend over a number of days in the form of consecutive spasms. Even when the pouch is finally empty, the contractions continue for a time, slowly becoming less violent. Finally the pouch is deflated, its slot, wide open during the expulsion, closes again. The tissue in the pouch returns to normal, the network of blood vessels becomes more ample.

Possible accidents

A few accidents may happen during this period. The pouch may close over a comparatively large amount of gases not ejected together with the embryos. These gases, of

course, disturb the buoyancy of the animal. In the aquarium it is easy to catch the specimen and to insert a narrow tube or cannula into the pouch and allow the gas to escape, pressing gently against the sides of the body to expel it.

After the young sea horses can no longer draw from their father or their reserves of yolk they have to seek their nourishment independently by the normal means. Their appearance at this time still varies even with specimens of the same variety, according to the conditions of their birth. Those that are "born" prematurely still carry the burden of their vitelline sac, swimming awkwardly in a horizontal position. In spite of the yolk sac which tends to drag them down to the bottom, they swim near the surface, probably because their still highly developed swim-bladder keeps them afloat.

Physical characters of the young

Their eyes are still very large and remind the observer of the eyes of the embryos still in the egg. On the other hand, the snout is very short and so to speak flattened out over the face. The face looks vaguely like that of a Pekinese dog. The body is still more or less transparent and one can see the tiny heart beating. But soon the first spots of pigmentation begin to appear here and there, in a strange pattern. Slowly the distribution of these spots becomes more regular, and they begin to look like stars. The blots unite and cover the whole surface of the body, which becomes opaque and takes on the coloration of the adult.

Though normally it should occur at the time of birth, sometimes the snout does not protrude until an advance date. But finally the head assumes the adult position at right angles to the body and the animal begins to swim in the vertical position. At the same time the little animal descends deeper into the water and begins to look for a water plant as a support. Quite often, the young ones, misled by limited experience, try to attach them-

selves to non-solid objects such as air bubbles that come from the plants or float on the surface of the water.

The sexual characters do not appear before several months have elapsed. It is not before that time that the forming of the male pouch and the female appendix can be observed. Generally speaking, the animal is not ripe for reproduction before the following year. In our European climate the couples begin to unite in spring, and the events we have described take place sometime in the summer, according to circumstances. The expulsion of the young ones takes place forty to fifty days after fecundation.

These are the curious life habits of the sea horse—life habits which have been known to naturalists for hardly a century. To be sure, the incubation pouch was long ago mentioned by classical authors, but quite naturally it was attributed by them to the female, and careful observation by scientists was necessary to reveal that the opposite condition existed.

The final achievement in elucidating the life habits of the sea horse should perhaps be accredited to Monsieur Jean Painlevé, for it was his skillful studies with the motion picture camera that made it possible for the man in the street to observe and understand them.

Early records

The first person to observe the intertwining of sea horses in the act of transferring the eggs was probably Dufosse, a Frenchman, in 1854. He published his description in 1874; and in the same year Fanzago, in the zoölogical station in Naples, observed the same process. In 1867 Lockwood, an American, saw the delivery of the young.

Huot, another Frenchman, published in 1902 a paper in which he showed sections through the egg pouch, and showed that the epithelium makes nests surrounding each egg and that the network of blood vessels supplies nourishment to the eggs by osmosis. Cohn extended and confirmed Huot's observation.

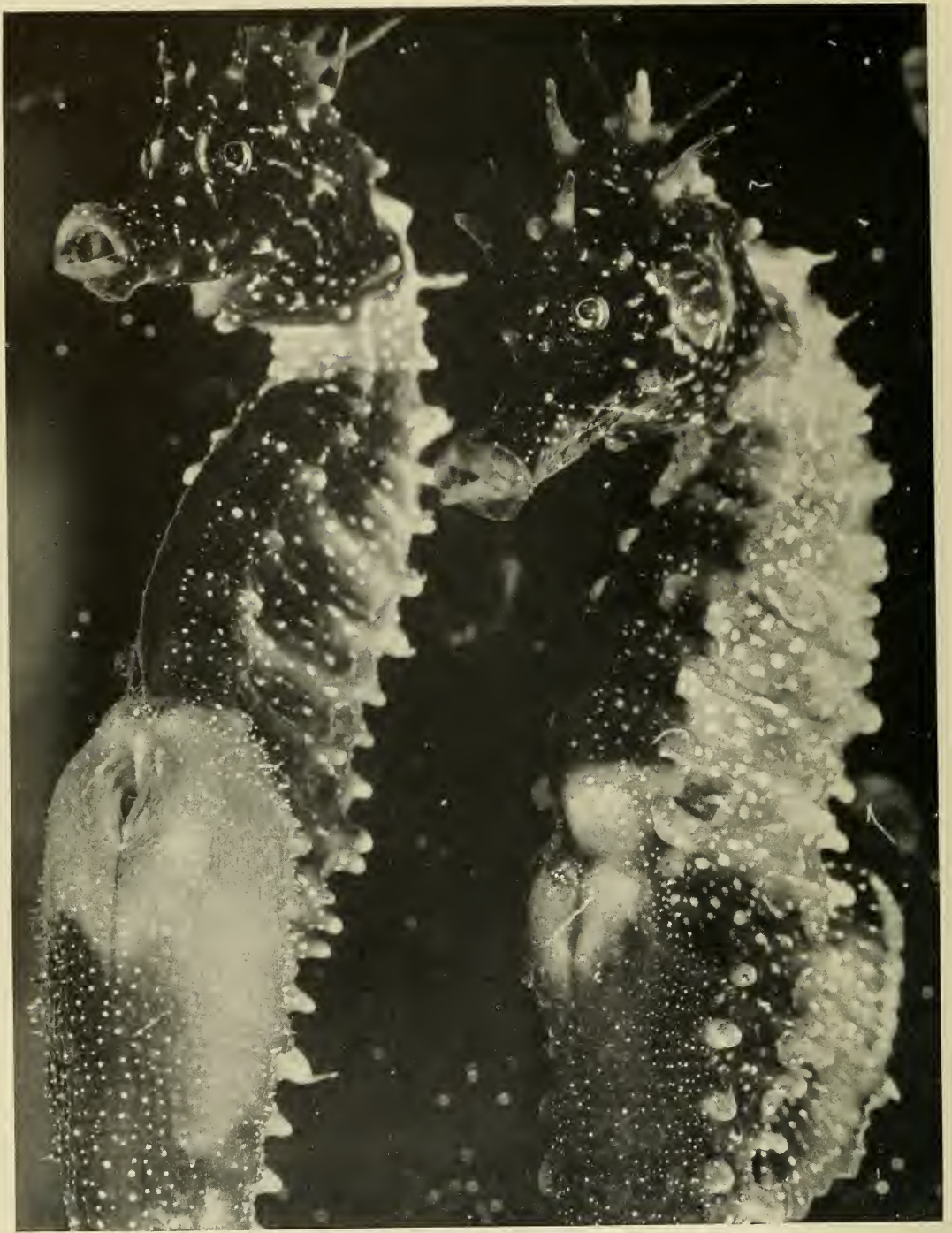


The Curious Life Habits of the Sea Horse

ALL THE ILLUSTRATIONS IN THIS SERIES ARE FROM THE FILM BY JEAN PAINLEVÉ

The sea horse does not swim about much, but spends considerable time remaining motionless, attached to some marine plant by his prehensile

tail. He maintains a vertical position by means of the pectoral fins, one of which can be seen just behind the gills in the photograph above



MALE SEA HORSES

In this photograph of two male sea horses the observer can plainly see the incubation pouch into which the female deposits her eggs by means of her cloacal appendix

The picture below shows very clearly the peculiar shape of the head, the spiral of the tail, the covering of the body, the dorsal fin (the only active fin), and the cloacal appendix with which the female puts the eggs into the male pouch





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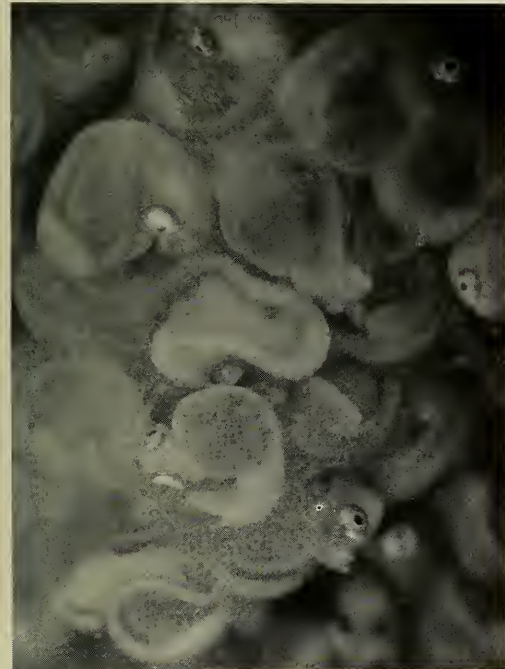
In the European climate the couples begin to unite in the spring. The female carries about 200 eggs. These she deposits into the male pouch by means of her cloacal appendix. The

time for the transfer of the eggs varies from twenty-four to forty-eight hours. Thenceforth the father takes on the duties of the mother and it is his task to bring forth the young



(Above) The incubation pouch of the male in this picture is distended with its burden of eggs. From forty to fifty days are required for the eggs to develop to maturity and the young to be born

(Below) A greatly magnified view of the embryos embedded in the tissue of the incubation pouch of the male



(Below) Detail of the incubation pouch, charged with eggs which will mature during the period of the "male pregnancy"

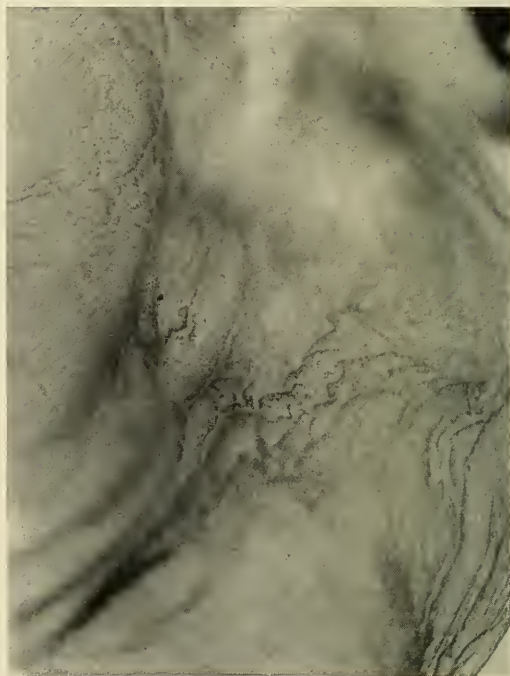




(Above) The male sea horse, at the time of the expulsion or birth of the young, suffers great difficulty in accomplishing this. The pouch is inflated to its limit; finally, with considerable force, the male ejects its burden of young sea horses

(Below, left) Showing the pouch open, giving a view of the embryos embedded in the tissues

(Below, right) After the expulsion of the young, the inside tissue of the pouch returns to its normal condition





(Above) At this period in the development of the embryo it is still in the pouch of the male. Sometimes, however, it is born prematurely at this time and must overcome many handicaps in the struggle for existence, for it still carries the burden of its vitelline sac

(Below) A young sea horse just after its birth. The yolk is absorbed and the tail already curved, but it still maintains a horizontal position. Note the short flattened snout; also the large eyes reminiscent of those of the embryo still in the egg



When the young sea horse grows up, the spots of pigmentation enlarge, become more regular, and begin to look like stars, as may be seen in the photograph at the right. In the adult stage they finally cover the whole body



(Above) One week after birth the snout is already prolonged, the color thicker and more evenly distributed, and the head begins to form an angle with the body. The animal still swims horizontally, however



(Left) The young sea horse has now arrived at that point in its development when it can swim in the vertical position

A Visit With Grey Owl

In the forests of Saskatchewan, abode of moose, bear, beaver, and all sorts of other wild creatures, where Grey Owl, the conservationist, lives among the animals he befriends

By T. D. A. COCKERELL

*University of Colorado,
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SASKATCHEWAN, so far as I was concerned, was little more than a large blank space on the map. I knew no one living there, nor anyone who had come from there. Our people in Colorado, when they travel, go East or West, sometimes South, but rarely North. When I laid out my route to the local passenger agent, he protested, "Why," said he, "no one ever goes that way." But go we did, my wife and I, and we discovered what was to us a new world.

The southern half of Saskatchewan, the part seen by those who cross the continent in Canada, is a land of rolling prairies, open country where they grow vast amounts of wheat. There are some large lakes, but the general aspect is monotonous. Biologically, this region belongs to the Transition Zone, like the foothill country of Colorado. On the other hand, northern Saskatchewan is a country of innumerable lakes, large and small, and where not under water is covered by forest. It is the abode of moose and bear, beavers and all sorts of wild creatures. In the closing paragraph of his new book, *Sajo and Her Beaver People*, Grey Owl thus describes it:

And perhaps, too, you may hear, if you sit very quietly and still, the rustle of falling leaves, hear the magic call of Talking Waters, and the soft low sound of voices, the voices of the Forest People, both large and small, who dwell in that great, lone land that is so far away, that is so wild, and yet so very beautiful—the Land of the North-West Wind.

It is difficult to exaggerate the beauty and romance of this northern country. It recalls the stories of Fenimore Cooper, of lake and forest,

and travel by canoe. One imagines that the conditions and the life he described were of the past, of a hundred years ago, but here they exist in the present, hardly modified by the hand of man.

It is possible to take a light canoe, which can be carried over the mostly short portages, and go on and on, through the Canadian Zone, into the Hudsonian, and eventually to the Arctic. In the winter, it is extremely cold, and the lakes are covered with thick ice; but in the summer it is warm, the country is gay with flowers, and people swim in Lake Waskesiu. Actually, the latitude is only that of the north of England, but conditions are more boreal, the northern lights are brilliant at night, and the fauna is largely what we call circumpolar, that is, found all round the world in the far north. Thus, of thirteen species of spiders collected at Waskesiu, no less than seven are also found in Europe.

A journey with a purpose

We went to Saskatchewan to see Grey Owl and Anahareo. About two years ago my wife obtained one of the moving picture films, put out by the Canadian Parks Administration, showing Grey Owl and his beavers. This was shown to many thousands of people, in Colorado, California, and Wyoming, and was very popular. Later, the Canadian Parks Department sent us several other films dealing with the same general subject, and in the meanwhile, Grey Owl's books were published, and greatly stimulated our interest in his personality.

Grey Owl had a Scotch father and an Indian mother. He was adopted by the Ojib-

way Indians, to whom he owes his name Grey Owl, given because of his habit of traveling about at night. As a trapper, guide and packer, he was unknown to the public; and we might never have heard of him but for the fact that he and his wife adopted two little beavers which had lost their parents. In the autobiographical work *Pilgrims of the Wild*, Grey Owl tells the whole story. The personality of the young beavers, named McGinnis and McGinty, took hold of his imagination, and he came to feel that the beavers should be protected and not destroyed. The beaver is the Canadian National animal, and it is only too easy to detect its presence in any stream, so that it seemed only a matter of a few years until there would be no beavers in the whole country. Grey Owl and Anahareo became what we should call conservationists, and unwittingly allied to that large company of people, all over the world, who are striving, with remarkable success, to save the native animals and plants.

The power of the press

Even so, what they had to say on the subject, a voice crying in the wilderness, might have had no appreciable effect, had not Grey Owl taken to writing. It is a nice problem for the professors of English literature to explain how he did it. No genius can really explain the fire within him, but it is very interesting to read Grey Owl's account—how he began by writing scraps of stories, things he had experienced or known of, during the long winter evenings, when there was so much leisure time. He did it to satisfy himself, with no thought of a public. With Anahareo, he collected interesting words, and studied their meaning. He read everything which might aid him. Eventually, having accumulated quite a pile of these writings, it occurred to him that he would make a connected story, with illustrations. This he sent to an English magazine.

"I copied the effusion all out laboriously, parcelled it up with about fifty photographs intended to be used as illustrations, and made a special trip to town with it, a matter of forty miles. I was not particularly anxious to sell it, but wanted a whole lot of people to read this stuff, and if they paid me, so much the better."

He remarks that such a thing as a rejection

slip was quite beyond his knowledge, and so when he thought the necessary time had elapsed, he again went to the town, expecting to get his check—and there it was.

Other writings followed, and the attention of the Canadian Park Service was called to the matter. A representative went to see whether the stories about the beavers were fact or fiction, and was more than satisfied. This led to the production of the moving pictures, which were shown far and wide. From East to West they became widely known, and they were a regular part of the entertainment on the Canadian Pacific liners going to the Orient. But curiously enough, they were not known in Saskatoon, the capital of Saskatchewan, and we had the pleasure of introducing them to audiences there. At Prince Albert this was not possible, because no projector was available, and Grey Owl himself had not seen more than one of them.

The Parks Department, through Mr. J. C. Campbell, became so much interested that they appointed Grey Owl as resident naturalist, first in Riding Mountain Park in Manitoba, later transferring him to Prince Albert Park in Saskatchewan. Having shown Grey Owl on the screen innumerable times, we thought it would be very interesting and worth while to see him in his environment, and so have a more vital sense of his personality and his work. Our journey was made in September, which we are told is the most favorable time, though it is after the end of the regular tourist season. The locality is almost nine hundred miles due north of Boulder, but it is not possible to take a direct route on the train. We had to go through Wyoming and Montana to Lethbridge and Calgary in Alberta, and thence on the Canadian National Railway to Saskatoon.

Educational progress

The capital of Saskatchewan, Saskatoon, is a large and attractive town, with a river flowing through its midst, and an excellent University. There is now a large school system, with over 350 teachers, but so recent are all these developments, that we were told that at the beginning of the century they had only a single teacher. Much scientific work is done at the University, and there is an important forestry department, which supplies innumer-

able small trees to be planted as wind breaks in the open country to the south.

From Saskatoon we took the train northward to Prince Albert, where we met Major J. O. Wood, the superintendent of the Park. From this point onward, we were indebted to him for our transportation and all the facilities, without which it would have been very difficult to proceed. There is now a good automobile road to Waskesiu, a village on Waskesiu Lake, the center of all the activities in the Park.

In Grey Owl's homeland

At this point we were transferred to a canoe, with a motor attached to the stern, and thus traveled the whole length of the lake, some fifteen miles. There, after a short portage, we crossed Kingsmere Lake, a matter of about six miles. At the north end of Kingsmere is a warden's lodge, and another portage leads to the small Ajawaan Lake, where Grey Owl has his cabin. On the way we met Grey Owl and Anahareo, who had come out to meet us.

Those who have seen the beaver films will have a good idea of the place. The little log cabin, mirrored in the lake, is known to many thousands. The lake itself, with numerous water-lilies, and surrounded by dense forest, mainly coniferous trees and aspens, is very beautiful. It is quite unspoiled, and far enough away from Waskesiu to be beyond the range of the ordinary summer tourists.

We spent the night in Anahareo's cabin, up on the slope of the lake. We saw the famous beavers, Jelly Roll and Rawhide, and saw them do some of the things we had shown so often in the pictures. They came from the Province of Quebec, and Grey Owl has had them for about seven years; he thinks that the life of a beaver is probably not less than a quarter of a century. Their young, born each year, normally wander away to seek mates and found new colonies; but recently one came back with a mate, and is building a lodge close to Grey Owl's cabin, being helped in the work by the old beavers.

We had a delightful evening talking and telling stories, and discussing the prospects of Grey Owl's lecturing tour in England, for which he was getting ready. He sailed on the "Empress of Britain" from Quebec on October

12th. At night, Grey Owl spends some time patrolling the forest near the cabin, and I was allowed to accompany him. But he said that the animals would be alarmed to hear a strange voice, and he frequently called "All right," in a characteristic way; not that they would understand the words, but they would instantly recognize the familiar sound, and know that their protector was there. A large moose had been in the immediate vicinity for some time, and we saw him in the wood, a vaguely outlined form in the dark, with an eye brilliantly deflecting the light of Grey Owl's flash light. We did not venture to go very near, for it was the season when moose are apt to be dangerous.

The next day we saw part of the new picture, to be taken to England, being filmed, and then started on the homeward journey. I now quote from a letter I wrote to Grey Owl from Waskesiu, describing our adventures after leaving him.

"We ventured forth on the wobbly waters of Kingsmere, and all went well for a time, but the waves rose higher and showed white caps, and the spray came into the boat, and presently the water ran down my wife's back and wetted our coats, and was very cold and uncomfortable. So we put ashore at a place where there was a deserted fisherman's house, and built a fire, and got dried out, and the canoe went round a perilous point, while we took the trail across the forest, a beautiful path among the trees, with red leaves and toadstools of all colors on the ground. We came out eventually and again took the canoe, and this time arrived without difficulty at the portage.

A water-logged canoe

"Reaching the Waskesiu Lake side—there was the canoe of the day before, but it had been exposed to all the rain, and was as wet as canoes can be, and the motor was somehow water-logged. The boys worked and worked, and it really seemed that we should never get away, and all the time it was getting darker and colder. But at last the motor recovered its strength, and off we went. I think it was 7:15.

"It was soon night, but although it was cloudy, the moon kept us sufficiently lighted to see the way. We hurried along through the narrow part of Waskesiu Lake, and the water

was calm, and everything just as it should be. But as soon as we came to the beginning of the broad part of the lake, the motor ceased to function, having (as appeared later) got flooded with water. After numerous efforts it was decided that there was nothing left to do but to go ashore, so we landed on a little sandy beach, in a small cove.

The "Hotel Cockerell"

"We think of asking the park authorities to name this place the Hotel Cockerell, for such it was for us. There is a good sandy beach, but just back of this only trees and dense brush. The only place we could have a fire was on the beach, although the wind was now blowing in-shore and was cold enough. But we had blankets, and curled up, making ourselves as comfortable as circumstances permitted. This all happened at 9 p. m. It was quiet, except for the wind, and no creatures came around. At one time I suddenly thought some insect was biting my nose, but it was only a spark from the fire.

" . . . By 4:30 some evidence of the coming morning was apparent, and a duck scuttled over the water, and presently some loons flew overhead. The pinky dawn came slowly, and it was now possible to doctor the sick motor, and we got away at about six o'clock. On the sandy shore I found a good lot of fresh water shells . . . We made the journey across the wide part of the lake in something over an hour (the motor losing heart every now and then) and got to the Pleasant Inn at Waskesiu just as they were opening up, and a good Chinaman gave us an excellent breakfast."

We had only been a little while in Grey

Owl's cabin, when he produced his new book, copies having been received from the publisher two days before. It is *Sajo and Her Beaver People*, a most charming story for young and old, about two Indian children and their pet beavers. On the title-page Grey Owl wrote "In remembrance of a pleasant and long-looked-for visit, with kindest regards to Mrs. Cockerell, from the Grey Owls." The style and character of the book are quite unique, but if comparisons must be made, we think first of Hans Christian Andersen.

On our way homeward we stopped again at Prince Albert, and there saw Dawn, the little daughter of Grey Owl and Anahareo, now three years old. She is a very lively and dramatic little person, reminding us especially of her mother.

Autumn beauty

Since we got home, a letter from Grey Owl, dated September 23, describes "this, the loveliest time of the year, though the Park may be officially closed. This place is very, very beautiful now, and all the leaves are turned, and the forest is a golden hall of dreams and beautiful thoughts. The beavers are working steadily, and you just must be here to see it. It seems so selfish to enjoy this all alone, the two of us."

As to the purely scientific results of the journey, it is too early to say much. But as always happens, new vistas were opened up, and all sorts of interesting problems presented themselves for solution.

We are indebted to Mr. J. C. Campbell, of the Canadian National Parks, for most of the illustrations used on the following pages.



Canadian National Parks Photograph

The sandy shore of Waskesui Lake in Saskatchewan. The untouched beauty of

this land recalls the settings of Fenimore Cooper's stories

A Visit With Grey Owl

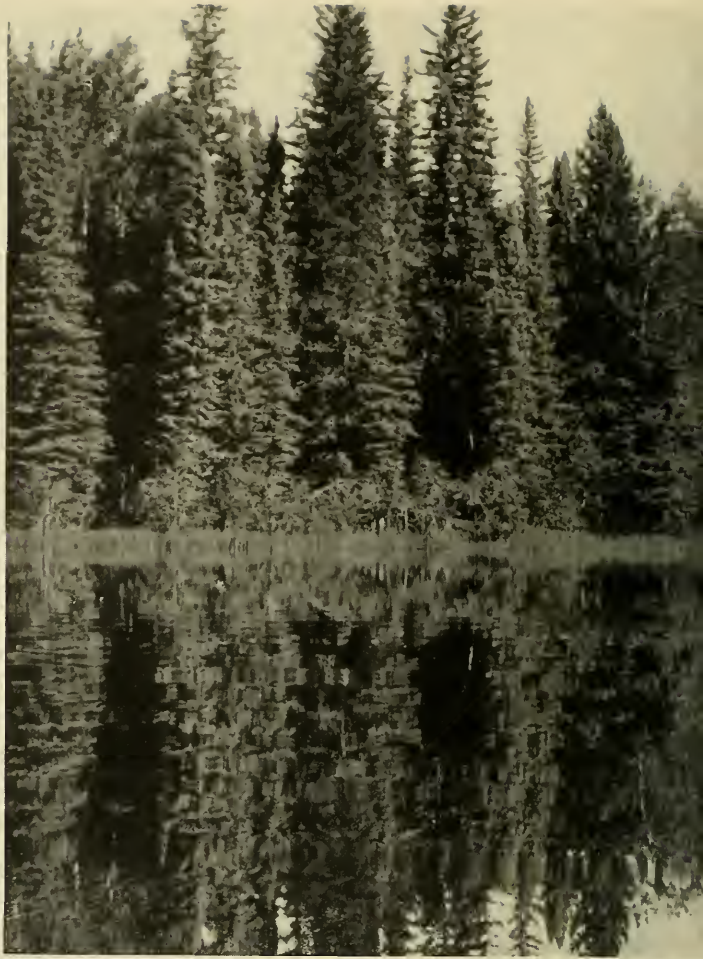
Photograph by W. J. Oliver

Grey Owl and Anahareo with Mr. and Mrs. Cockerell at the warden's lodge on Kingsmere Lake



*(Right) "Beaver Lodge,"
Grey Owl's cabin, on the
shore of Ajawaan Lake. The
little log cabin lies in the
midst of a beautiful forest
which harbors interesting
wild life in its denseness. A
little to the left of the cabin
the Cockerells spied a moose*

*Canadian National Parks
Photograph*



*(Below) Grey Owl feeding
a beaver. The survival of
these animals in Canadian
National Parks is largely due
to the energetic conservation
work of Grey Owl*

*Canadian National Parks
Photograph*





(Below) A food raft made of aspens by the beavers, which Grey Owl considers one of the largest and best he has ever seen. It is easy to detect the presence of beaver

*Canadian National Parks
Photograph*





(Above) Grey Owl and a Canada jay. These birds are very tame and are well known to campers in the woods. Those in Prince Albert Park are the typical Canada jay, different from the Rocky

Mountain race. Canadian National Parks Photograph.

(Below) Mr. Cockerell is drawing pictures to amuse Dawn, the three-year-old daughter of Grey Owl and Onahareo

Photograph by Mrs. H. S. Winters



A Dragon Fly Emerges

PHOTOGRAPHS BY CROY, FROM BLACK STAR

The dragon fly or darning needle as we commonly know it is the insect which perhaps most reminds us of an airplane. Poised delicately on a water plant, its four large wings remain outstretched, while in flight they carry it rapidly above the surface of the water or over fields in search of small insects upon which it feeds. But before the dragon fly becomes a flying insect, it lives under water in a quite different form

1. The upper figure in this photograph is the dragon fly larva among weeds in the water immediately after shedding its skin, which is seen below





3. (Below) Presently the upper portion of the body is free; but part of the wing pads, from which the gauzy full-grown wings will develop, and most of the body are still encased in the skin

2. (Above) When the inner development of the dragon fly is finished, the larva crawls out of the water, and the wonderful transformation takes place. The back bursts open and the dragon fly begins its emergence by thrusting out the back of its thorax



4. (Below) The insect continues to slip farther out of the skin. Even the legs must be drawn from individual sheaths like fingers from a glove. It now bends backward until the claws on the legs can grasp the plant



5. (Above) The dragon fly has completely emerged. The body is still soft and flexible. The wing pads are thick and opaque and must be expanded by having blood and air pumped through the many veins





6. (Above) The wings are now fully expanded but their milky color attests to their softness. As yet the adult dragon fly is quite helpless; the body is equally soft



7. (Below) The dragon fly has now reached the perfect stage, but it is not yet ready to fly. Though the wings are shiny and transparent, they are yet too soft for locomotion



8. READY FOR THE FIRST FLIGHT

The dragon fly has extended its wings and in a moment will take to the air for the first time. Never again will it rest with wings folded over the back. It will pass the remainder of its existence skimming over water, marshes, and hillsides, preying upon other flying insects.

It will lay its eggs in the water where they will soon hatch into tiny nymphs that will look exactly like the one that crawled from the water at the beginning of this series of photographs. The transformation generally requires only about an hour or less from the time when the creature emerges until it flies

A Mineralogist Abroad

How the traveler willing to leave the beaten track can visit many fascinating mines and quarries, and build up his own collection of semiprecious stones and minerals

By FREDERICK H. POUGH

*Assistant Curator,
Minerals and Gems, American Museum*

ONE goes to Europe to see art museums, to study architecture, to hear music, or just to get away from it all; but, unless one is peculiar that way, one seldom goes to "do" Europe mineralogically. However, for those who fall in the latter group, there is a great attraction in a trip through Central Europe, especially Germany. It is there that mineralogy got its start as an independent science, and there that many of the world famous mineral localities are, or were.

The explanation of the rarity of mineralogical visits lies in the last word, for today many of the old mines of Schneeberg and Johanngeorgenstadt, famous in their own right for their productivity and made better known by their literary and historical associations, are hardly to be found. Of many, even the dump has disappeared; hauled away to be used in roads or so overgrown that it looks like little more than a natural mound.

Some mines are still in operation, however, and new ventures have been started at old localities. In addition, fine collections may be inspected, unparalleled specimens seen, and some of the older mineralogists may be met and talked with. There is so surprisingly much to be seen and found on such a trip that it well repays the effort.

Transportation difficulties

Traveling through Germany in a leisurely fashion and collecting minerals at more or less

remote localities involves certain transportation difficulties. The happiest solution to the problem seemed to be the bicycle, a universally used vehicle in Germany. The practicality of the bicycle was proved at the first locality visited, the strontianite occurrence at Drensteinfurt near Münster in Westphalia, for the owners of the mine simply mounted upon their bicycles and all rode companionably out to the mines.

Old hunting grounds

These were formerly very active, but few are now in operation. One of the most famous, the Grube Mathilda, is marked only by a dump today, the Anna Mine, next in line along the same vein, closed down this summer to give way to the Eleonor Mine, still farther along the vein. The vein continues for a long distance across the country, cutting across the nearly horizontal sedimentary formations and widening out at intervals into lens-like pockets, on which the different mines are situated. It was discovered and traced by borings, no outcrops showing on the flat topography of the region.

Each owner has named the mine for his wife; and as the mines outlasted the wives and the owners, no complications over names have so far ensued. Good crystals of strontianite are still to be found, small and colorless or larger and white, attached to matrices of calcite or fibrous strontianite. The present demand for strontium is slight and much of the production is probably used in the manufacture of fire-

works for the castle illuminations at Heidelberg, Würzburg, and along the Rhine. It was formerly used in greater quantities in the manufacture of sugar, but other processes have largely superseded the strontium hydroxide separation method.

The route south of Münster, through the Ruhr valley, leads to Cologne, with its magnificent cathedral. The cathedral has mineralogical as well as æsthetic appeal, for Krantz, the famous mineral dealer in Bonn, admits that his source of the well-known Drachenfels sandine porphyry is not that castle-crowned peak,

but the Cologne cathedral. Its periodic partial renovations release somewhat weathered blocks which are more easily broken to reveal the crystals in the finer matrix. The original source, near Bonn, is a popular climb for visitors to that city. Near the summit, along the main path, vertical cliffs mark an old quarry face, at the foot of which loose blocks are abundant and good specimens easily collected, though not without the attentions of a gathering of curious people and donkeys. Crystals showing several habits and different types of twinning may be found. As the tabular crys-



MINERALOGICAL HIGH SPOTS

The region visited by Doctor Pough, showing the most famous mineral localities of Germany

and Austria. A serpentine trip of 2200 miles made on a bicycle

tals have a tendency toward orientation in parallel planes, it is necessary to find the proper plane and break the block to develop maximum surfaces in this plane.

Bonn itself has a fine mineralogical institute and its former head, Prof. R. Brauns, though retired, is still active and is probably the best known of living German mineralogists. The collections contain many specimens of minerals from the Eifel, a volcanic region lying to the west of the famous scenic stretch of the Rhine.

Beautiful conical peaks and crater lakes with frequent lava flows are scattered over the landscape, showing by their perfection of form that they have not long been extinct. Quarries are numerous, for the lava is made to serve many purposes. Chief among them is the manufacture of road blocks, so popular as a paving material in Germany. Skillful workers chip curbs and millstones out of the material, without the aid of any machines. The columnar basalt prevailing in several quarries is very simply put to use without even the necessity of shaping the blocks. They are white-washed and erected along the roads to serve as guards and markers. Piles of these columns, looking for all the world like cordwood, may be seen along the Rhine, near Remagen.

A famous mineral region

The region is famous mineralogically, partly for the crystals of such minerals as zircon, apatite, and hauynite found during the quarrying operations, and still more for the rarer minerals occurring in the sanidine blocks that were thrown out of the volcanic vents during eruptions. Collecting over this terrain is fascinating, with always the chance of discovering a good specimen. Fresh blocks are uncovered by every storm and every plowing so the field is perpetually rejuvenated, and actively working quarries are always productive collecting sites. Fall, after the potato harvest, is the best time for search, offering the largest number of freshly exposed blocks with peaceful working conditions. At other times the farmers are less enthusiastic about people strolling through their fields.

A little south of the Eifel lies Idar, the home of the German gem industry, where all phases of the trade may be seen and wonderful stores of raw material examined. Still farther

south is Heidelberg, the seat of the oldest German university, on the edge of the Odenwald, where the Neckar enters the Rhine graben. Heidelberg is famous in the history of geology and mineralogy, for Rosenbusch and Goldschmidt, two of the masters of the science, worked here and many of the best known American geologists studied here under their guidance. The famous Seligman collection of minerals, one of the finest private collections in Europe, is now in Heidelberg, the property of Gehr. Bosch, of the German Dye Trust. The Victor Goldschmidt Institut für Kristallforschung, carrying on the work of its former head, and the Rosenbusch petrographic collection are also in Heidelberg. *Homo heidelbergensis*, another old resident, is still to be seen, investigations into his ancestry having revealed no reason for his banishment from the place of honor in the university.

Fluorite mines

Though formerly the site of much mining, southwestern Germany produces little of interest today, and one must go eastward nearly to the Czechoslovakian border before mineralogical interest is again aroused. The limonitic iron ore mines near Amberg occasionally yield interesting phosphate minerals. Far overshadowing these in interest, however, are the famous fluorite mines of the Wölsenberg.

Wölsendorf, the nearest village, will not be found on any but the most detailed of maps, for it contains but a few houses, and no road, just a winding path, leads to it. The approach along a road from Schwandorf leads across a bridge, where a sign marked Wölsendorf indicates a trail, but the path soon divides into several forks each leading to a different cluster of houses off against the hills. One must be psychic to select the right group from this lot, but eventually, by making enough inquiries, it can be found. The several mines, of which two are in operation, lie behind the town at the edge of the hill. With luck interesting specimens can be collected, showing crystals of fluorite or nice banding reminiscent of the famous English "blue-john." The fluorite is used for the manufacture of acid and in the aluminum and steel industries.

The most interesting minerals of the deposit (and they are only to be found at the Johan-

nisschacht) are the associated uranium minerals occurring in masses of the dark fluorite, which emit a strong odor upon fracture. This type of fluorite is known by the appropriate name of "*Stinkspath*"; the smell is said to be that of free fluorine and resembles an exploded firecracker more nearly than anything else in common experience.

The rare uranium minerals are found in cavities in this material, and the beautiful yellow needles of uranotile are well known to collectors. Somewhat rarer are the square platy crystals of uranocircite, of a yellow-green color varying according to the light source. An intense fluorescence is responsible for the green tones and is very noticeable in ordinary sunlight. Many of the Belgian Congo uranium minerals have been found in small quantities at this deposit; and pitchblende, the original uranium mineral, may occasionally be found. Quartz druses, earlier than the secondary uranium minerals and brilliant red in color, with yellow barite crystals are common.

Unique phosphate pegmatite dikes

Not far north are the unique phosphate pegmatite dikes of Pleystein and Hagendorf. At Pleystein is the Kreuzberg, an isolated abrupt peak in the middle of the town, about two hundred feet high and not more than a quarter of a mile across. The nearly vertical walls are composed of white quartz, and at their top is a monastery, giving the hill its name. The quartz is a pegmatite outcrop and for a time was actively quarried for road material. During this activity the rare minerals kreuzbergite, phosphosiderite, strengite, kraurite, and so on, were found, but as the work endangered the buildings above, operations were halted and the entire hill is under *Naturschutz*. A fine little collection of the minerals of the vicinity, made up by a resident of Pleystein, may be seen in a small museum maintained by the town.

Hagendorf is near by and is the most famous of the pegmatite regions. Here there are two mines, producing feldspar, but only one was in operation during the summer, and that, mineralogically is the less interesting. Apatite and other phosphates are sometimes found in this dike, but the knots of mica in which the cavities containing the beautiful crystals of

phosphophyllite, vivianite, wentzelite, fairfieldite and other minerals are found, are restricted to the border zones of the other pegmatite. After the manager is convinced that the visitor is not a Czech who wishes to spy, there is no trouble about inspecting the plant or collecting on the dump.

Not far north, on the borders of the Erzgebirge, the greatest mining center in Germany, is another fluorite deposit of a unique character and of interest for the fluorite itself. This is at Schönbrunn, by Oelsnitz and not far from Plauen. The deposit consists of two nearly vertical, banded veins showing successive layers of fluorite in crusts of octahedral crystals, alternating with bands of feldspar and quartz. At the center is a later fluorite in larger masses in cubic crystals. Late hydrothermal action has altered and decomposed the feldspar, so that it is not difficult to secure good specimens of the octahedral crystals by splitting the specimen at the contact of the fluorite with a later layer of feldspar. Sometimes deep purple octahedrons are found perched upon the apices of larger green octahedrons; curved octahedrons, nearly spherical in form, and dodecahedrons are known. Crystals of this earliest generation never occur in vugs, the few vugs that are found appear to have been later in their formation and to have been largely filled by a late generation of secondary fluorite in small cubic crystals. Associated with this late phase are sulphide minerals and beautiful iridescent crystals of goethite.

Topaz crystals

From here it is not far to Schneckenstein, one of the most famous of the old localities. Schneckenstein means "snail-stone" and refers to the original shape of a mass of rock projecting above the ridge upon which it stands as an erosional remnant. Schneckenstein was described and pictured in one of the oldest mineralogical works and looks today much as it did then. For a number of years the rock was actively quarried for the topaz found in it. Numerous stones cut from this topaz may be seen among the Saxon crown jewels in the Grüne Gewölbe, in Dresden.

The remnants of the old workings and a large dump may still be seen with topaz crys-

tals everywhere abundant. Signs proclaim it under *Naturschutz* and prohibit all collecting, as they prohibit everything else in Germany, but for once their message is not heeded, and nearly always someone is sitting on the dump and pounding away at the fragments, seeking topaz for collections or for cutting purposes. The present abundance of topaz, despite several centuries of such collecting, proves that it was not rare here, although good cuttable crystals are not common. Finding good specimens, as is often the case, is merely a matter of hard work and a little luck. Topaz is by no means restricted to this rock mass, it is to be found in a narrow zone several miles long which has been subjected to a topazing alteration, and the result seems to have depended upon the nature. A breccia, with many vugs filled partly or completely by crystals of quartz, topaz, columbite, wavellite, and other minerals has been formed at Schneckenstein. A little to the north of the Schneckenstein is an outcrop of a porphyry, in which the feldspar has been altered to topaz and the ground mass to a sugary mass of quartz.

Old specimens at Schneeberg

Schneeberg, lying in the heart of the Erzgebirge, was once the source of the most beautifully crystallized specimens of some of the secondary cobalt minerals and other rare minerals. Today there is but little mining there, mostly of bismuth for pharmaceutical preparations, but one may visit the offices of the company, and after a little persuasion, view the old specimens. Incomparable crystals of erythrite, roselite, sphaerocobaltite, troegerite, walpurgite, zeunerite, and so on in numerous examples may be seen. The best specimens were found between 1870 and 1900; since then little worthwhile has appeared. The employees still wear the old garb indicative of their position as white collar mine workers; a short black jacket with much fringe and some gold decorations, with buttons marked by the crossed hammers, the emblem of mining throughout Germany.

Johanngeorgenstadt, a few miles away, with its mines now under the same direction, is another famous old mining town, with but one mine, the Wildman, still in operation. On the plain a little above and behind the town, is the

"*Pferdegöpel*" a mine more than two hundred years old, which was running until twenty-five years ago. The power was supplied by a team of horses which walked around a circular track within a conical building, turning a drum which raised or lowered the skips in an inclined shaft 67 *Lachten* deep, a *Lacht* being about six feet. The buildings are said to be the only ones of the type preserved in Germany today. Johanngeorgenstadt is now the center of glove manufacture and most foreign visitors today are the glove buyers. A tablet in the hotel commemorates Goethe's visit to the mines, with a quotation from a letter written there describing his awe and wonder at the subterranean world.

Silver "thalers"

St. Joachimsthal, or Jáchymov as it is now called, is just over the border in Czechoslovakia and is best known as a bath resort purporting to cure nearly anything with its potent radium waters. Radium is actually mined in the town in the form of pitchblende or uraninite, and this is the source of all the radium sold by the Czechoslovakian government. The earliest mining operations were for silver, and during the fifteenth and sixteenth centuries more than 1,200 men were employed, working the rich proustite, pyrrargyrite, and native silver deposits. Silver was so abundant that a mint was established in 1518, and coins known by an abbreviation of the name simply as "Thalers" were made. Because of the purity of the silver they were in great demand, and the name widely known. After going through several transformations it has emerged to give us our name for our unit of coin, dollar, the word having been derived from the old name for these coins.

As the mines deepened, the silver began to diminish and they were operated more for their bismuth, cobalt, and nickel ores. Uraninite was known but thrown away until 1852, when it was discovered that good pigments could be made from it. Ever since, this has been primarily a uranium mine. The secondary uranium minerals found in recent years in the mine are the result of reactions between the pitchblende and the products of oxidation of marcasite with which it is sometimes in contact. As the oxidation can only take place

after exposure to the air through the mining operations, uraninite is the only uranium mineral occurring altogether naturally in the mine.

Above Jáchymov, extending to the border of Germany, is a high, bare, rolling mountain region which is a popular winter resort, and ski-school after ski-school dot the landscape. It is a barren, bleak land, giving an impression of being much higher than it is, and must be wonderful skiing country.

From there the famous tin and tungsten mines of Ehrenfriedersdorf are not far, but the purple apatite which abounds in many collections comes, not from the mines, but from a comparatively small granite quarry on a hill known as the Greifenstein, above the town. On the summit are a series of granite needles, forming prominent pinnacles which serve as a background for a *Festspiel*. The granite quarry is in the woods, not far from the summit, and the stone is quarried for roads and building purposes.

Luck and patience

A narrow vein, not over four inches wide in most places, cuts through the granite in one corner of the quarry, and from this single vein all the apatite specimens have come. It appears to be richest in apatite where the vein is thinnest and the quartz at a minimum, with crystals of both minerals attached to granitic matrix. As the vein widens and the quartz increases, the apatite disappears, fluorite or torbernite in rare crystals occurring in its stead. Without luck, nothing will be found, as the workers collect the good specimens to sell as soon as they are revealed, but by digging around in the dirt which has been washed down at the side of the quarry where the vein disappears into the granite, it is possible to find quite nice specimens.

Across the road in the woods adjoining this quarry, is a small prospect pit, in which was uncovered a quartz vein with embedded colorless to pale blue crystals, about half an inch long, of brilliant, well-terminated topaz. The most difficult part is locating the pit; once found, specimens are easily collected.

Mecca, for the mineralogist, is Freiberg in Saxony, for it was here that Abraham Gottlob Werner, credited with being the founder of the science of mineralogy, taught, as a pro-

fessor in the world-famed mining academy. The *Bergakademie* has a fine new building now, but the mines of Freiberg are a thing of the past, and except for the historical interest of the town and collections on display, there is little to be seen. The collections are well worth a visit, however, for the specimens of crystallized Freiberg ore minerals are unequalled elsewhere. Freiberg still lives in its past and one sees many relics of the heyday of its mines. The crossed hammer insignia are everywhere, figurines of miners in their traditional uniforms, with their leather knee pads and leather aprons worn behind instead of before, are to be seen in many shop windows. A search may even reveal miners' *Batten*, axe-like implements formerly used as weapons or tools, old miners' tallow lamps, or even an ancient copy of *Agricola*.

To the east of Freiberg lies Dresden, one of the most fascinating cities in Germany and the capital of Saxony. In one of the former palaces, the Zwinger, is a small collection of minerals. The Grüne Gewölbe contains the crown jewels, including the famous Dresden green diamond, and a collection of worked objects; precious stones, carved crystal, amber and ivory. An interesting pair of figurines in bronze portrays two negro boys bearing rich emerald specimens from the mines of Columbia, but to which, alas, the best crystals have been attached by man and not by nature.

Through Czechoslovakia

South of Dresden the route lies through the crest of the Erzgebirge, past the former tin mines of Zinnwald, threads between the volcanic peaks of northern Czechoslovakia, source of beautiful zeolite specimens in the collection of the American Museum, and out on to a plain which extends all the way to Prague. In the immediate vicinity of Prague there is little of mineralogical interest, but the museum has a fine collection, well displayed in stepped cases. The Czechoslovakian university has a well-equipped mineralogical institute with Prof. Slavik at its head; there is a German university as well but it seems to be less prosperous.

A big jump from here takes us into the Tyrol; across glacial outwash plains, up terraced valleys, into the very heart of the moun-

tains. The region known as the Salzkammergut is scenically superb and receives its name from the many salt deposits worked in the area. These salt beds are not horizontal, as are those of northern Germany, but are highly folded and contorted by the forces responsible for the mountain structures.

Unsurpassed scenery

The most interesting portion of the Tyrol, however, is the mountains known as the Hohe Tauern, lying to the south and west of Salzburg. The range is composed of two peaks, the Gross Glockner, up which an automobile road has just been built, and the Gross Venediger. They are large mountains, covered by glaciers and rising over 3,500 meters. Four valleys, running side by side on the northern slope of the Gross Venediger, have produced most of the minerals for which the Tyrol is famous. They are: the Hollersbachtal, the Habachtal, the Untersulzbachtal, and the Obersulzbachtal. Most collections contain specimens recognizable to most collectors on sight as epidote crystals from the Knappenwand of the Untersulzbachtal, a locality which has long since ceased to yield specimens, but which will undoubtedly remain as the most beautiful of all epidote occurrences. The Habachtal is nearly as famous for its emerald mine. It is a wild and rugged region, visited only by climbers. A road of a sort extends halfway up the valley to several climbers' inns; beyond, the floor soon rises above timber line and becomes very rocky. At the end the Habach glacier perches above a cirque and its melt-water flows in a white cascade over the lip, down to the floor a thousand feet below. As a collecting ground for minerals it is scenically unsurpassed, with the white summit of the Gross Venediger looming in the distance.

The region has been carefully studied and its geology is well known. A progressive metamorphism toward the granite core has been noted and the minerals to be expected from each point along the ridges on either side can be predicted. The old emerald mine lies near the uppermost of the inns but about three thousand feet above it, just below the crest of the ridge. The workings may still be seen and bits of the mica schist in which the crystals occur can be collected. As gems the emer-

alds were never of very high quality but this sort of an occurrence of emeralds in metamorphic rocks is unique.

Less well known are the specimens of emerald in a serpentine or talc schist, apparently derived from an alteration of the original mica schist with the emerald surviving, relatively unaffected. There are three dumps, two of which are now pretty thoroughly picked over, while the third, usually covered by a snow bank, is seldom accessible. The mine now belongs to an English company, but probably never will be reopened.

The other specimens for which the Habachtal is famous are those of adularia, quartz, and sphene, which may be found along the entire inner third of the valley. Naturally, after generations of collectors, good specimens are not easy to find, but the occurrence may be seen and specimens showing the associations collected without leaving the main trail up the valley. The country rock is a mica schist, through which quartz veins cut at all angles, widening out or narrowing down with great irregularity. Here and there vugs occur, and in these vugs adularia, calcite and quartz crystals are common, with occasional sphene in brilliant golden yellow transparent crystals.

The higher slopes still abound with good specimens; and the less energetic collector may, with some hope of success, search over the talus on the floor below, for it is being continually renewed by boulders showering down from the cliffs above. But for the "Mohammeds" who insist upon going to the mountains, it would be possible to wait for the mountains to come to Mohammed. However, one does not begrudge the effort, for the possibility of collecting superb specimens, coupled with the magnificent scenery, make it truly a collector's paradise.

The rewards waiting for the traveler who makes such a journey and visits these places are manifold. The many mines that are still in operation, the collections to be seen, the inspiring men to meet, all serve to make such a trip memorable and one worth any inconvenience and difficulty it may involve. The mineralogist sees not only all that the tourist sees, but finds things of intense interest where the ordinary traveler sees nothing, and perceives a deeper significance where the tourist sees only the superficially interesting aspects.



(Above) The castle-crowned peak of Drachenfels. In the circle is

a specimen of sanidine porphyry from the Drachenfels

A Mineralogist Abroad

(Below) Volcanic peaks in the Eifel. Bell lies in the valley between two flows of lava, with typical low conical peaks in the background





(Above) The Palisades of the Hudson in miniature,—a basalt quarry on the Rhine. (Circle) Future road guards piled for shipment

(Below) The Pferdegöpel at Johanngeorgenstadt. The last survivor of horse-powered mine shafts, over 200 years old



UTILIZING NATURE'S PRODUCTS

(Below) Hand-picking the ore in Germany's most interesting but little known fluorite mine, at Schönbrunn near Plauen in Vogtland. In

the circle are some octahedral crystals of fluorite in a matrix of quartz and feldspar from this mine





Miners' lamp of hand-wrought iron used in the sixteenth century in the Erzgebirge. The bright flame emanates from the original wick burning the ancient tallow with which it is soaked. In use the lamp was hung from a timber, or mounted upon a stick fitted into the socket at the back

(Below) The entrance to a drift of the famous Stahlberg mine in Müsen. The crossed hammers, symbol of mining, are the emblem of the Bergakademie in Freiberg





(Upper) The upper Habachtal. The talus slopes and shoulders to the immediate right and left are productive collecting grounds of

the minerals for which the valley is famous. (Lower) Epidote from the Untersulzbachtal, the neighboring valley to the east



(Above) Anabas on land. This amazing fish can travel long distances overland when in quest of new aquatic environment. Drawing by D. M. Blakely



(Left) Anabas in water. It looks like an ordinary fish in this environment, but the fact is, it cannot live without air

A Walking Fish

It drowns if it cannot reach the air, climbs steep banks, walks long distances on dry land, and perhaps even climbs trees

By HUGH M. SMITH
*Formerly Fisheries Adviser to the
Kingdom of Siam*

IN 1791 a Dane named Daldorff, while in Tranquebar, at that time a Danish possession in India, came upon a fish which, during a heavy rainfall, was climbing a Palmyra palm and had reached a point five feet above the ground. There it was apparently enjoying itself in a little stream running in a fissure in the palm's trunk from a broad frond which collected the rain water as in a funnel. Near-by was a swamp from which the fish had probably come.

Daldorff published his observations in the Transactions of the Linnaean Society of London in 1797 and described the fish as a new species under the name of *Perca scandens*, or climbing perch. He was the first European to give an account of the live fish, but the species had already received the name of *testudineus* (in reference to its hard covering like a turtle shell) at the hands of the German zoölogist Bloch in 1795, so the significant name applied by Daldorff had to yield to the law of priority.

Christened anew

The name climbing perch by which the fish has generally come to be known among English speaking people and in English works of reference is somewhat inappropriate. The fish is not a perch and is not even remotely related to the true perches, common fresh-water fishes of America, Europe, and northern Asia. The generic name *Perca* first borne by the fish had no nomenclatorial standing, and in 1817 the fish was brought by Cuvier under the new

generic name *Anabas*, or climber, and became the type of the oriental family Anabantidae, which includes such well known species as the diminutive paradise fish, the Siamese fighting fish, and the giant goramy. All of the members of this family have, in addition to gills, an accessory breathing apparatus, and most of them blow bubbles to form a floating nest in which the eggs remain during incubation.

Alternate common names by which this fish has been called are climbing fish and walking fish, but these are borne also by several gobies, catfishes, serpent-head fishes, etc. On the whole, it may be best to adopt the perfectly distinctive generic name as the common designation of the fish in European languages and call it *Anabas*.

A tough coat

Anabas seldom exceeds eight inches in length and averages about six inches when fully adult. Its blunt head is very hard and the gill covers are bordered with backwardly projecting spines. The body is enclosed in a thick, tough coat covered with hard overlapping scales which are edged with spinules. The dorsal and anal fins contain sharp spiny rays. The thick skin retards the loss of moisture from the tissues when the fish is out of the water, and the spinous armament discourages or altogether prevents the attacks of water and land snakes, water lizards, birds, and other fishes. The small, conical teeth are in bands in each jaw, and are adapted for crushing insects, shrimps, and snails which constitute a large part of the food.

There are gills such as ordinary fishes possess, but the gills in the long process of evolution have become less important and are now quite inadequate to sustain life. This is

easily shown by putting a fish in an aquarium with a wire-mesh screen just below the surface. With inability to take in atmospheric air, the fish begins to suffer and will soon die. The reduced gills represent only a small proportion of the total respiratory surface, and the major part of respiration is carried on by means of a special structure occupying a cavity over the gills and consisting of a series of thin, concentrically arranged bony plates covered by a vascular mucous membrane which enables the fish to absorb atmospheric oxygen.

Some writers have apparently failed to appreciate the exact rôle of the accessory branchial organ in *Anabas*. Thus, Dr. Francis Day, who spent many years in India and Burma and published a monumental work on the fishes of those countries, stated that the

hollow superbranchial organ . . . enables the climbing perch to retain water for a considerable time, so that it can moisten its gills and live whilst out of its native element.

As has already been noted, this organ is dissociated from the gills and enables the fish to breathe atmospheric air when the gills can not be used. The gills function only when the fish is submerged; the superbranchial organ functions only when the fish is out of the water. In this species we have an example of a water animal which is in course of evolution into a land animal, or, perhaps more correctly, a normally water-breathing creature which has already ceased to depend entirely on its gills and ultimately may respire only atmospheric air.



THE AIR-BREATHING ORGAN OF *ANABAS*
It is this superbranchial structure, occupying a cavity over the gills, which enables the fish to absorb atmospheric oxygen. (From "*The Study of Fishes*" by Günther)

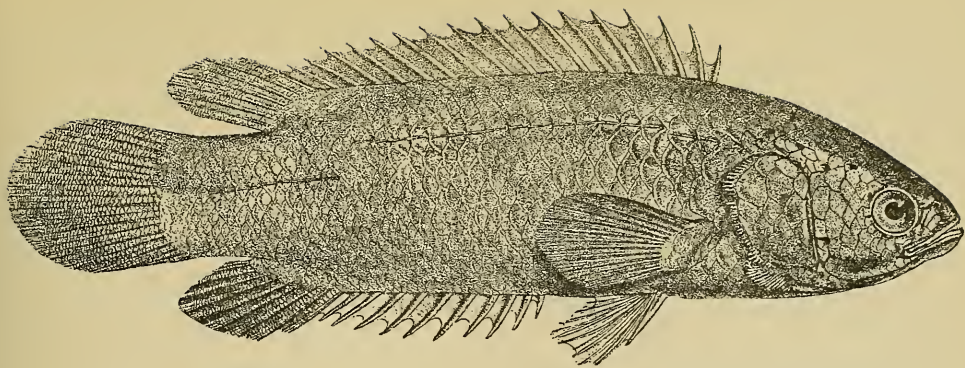
In the Dravidian language of Ceylon and India the name for *Anabas* means a tree climber, but the tree-climbing powers of the fish have been viewed with doubt or altogether denied by some of the leading ichthyologists of India. Thus, Doctor Day, in his work *The Fishes of Malabar* (1864), refrained from expressing a positive opinion, and said:

The climbing properties attributed to this fish in other portions of India and Ceylon are fully believed in by the inhabitants of Malabar. Certainly it is with difficulty that they can be retained in a vivarium as unless it is covered or its summit upwards of a foot from the water they invariably escape. They are able to progress along the ground in two ways, either by lying on their sides, flapping their tails, and moving their pectoral fins, or else chiefly by the aid of the latter fins, first one being advanced and then the other. They can erect their fins and likewise their scales at pleasure, even down to those at the base of the caudal fin. This power of erection, especially as it also exists in the gill covers, would be of great assistance did they employ the latter in climbing.

Dr. Francis Hamilton, in *An Account of the Fishes Found in the River Ganges and Its Branches* (1822), regarded the habit ascribed to this fish by Daldorff as non-existent and held that Daldorff's powers of observation were defective. Thus:

To what enjoyment this dangerous faculty of climbing trees could lead a wretched fish, I am totally at a loss to imagine, and I therefore believe that Daldorff was mistaken; but to what circumstance, neglected to be noticed in his narrative, the error should be attributed, I cannot take upon myself to say.

There is no reason why *Anabas* should climb trees as a regular habit, and in my rather extensive acquaintance with the fish in India, Burma, Ceylon, Siam, French Indo-China, Malaya, the Philippines, and some of the Indo-Australian islands I have never known one to climb a tree or to be found in a tree except at its base. But from what I know of the out-of-water movements of this fish I would have no difficulty or hesitation in accepting Daldorff's statement. A Palmyra palm, with its rough bark and its fronds beginning near the ground, would be no more formidable for an *Anabas* to ascend than would be the vertical side of a wicker basket. For a fish that for weeks or months may have been suffering from a deficiency of water, a stream of rain water flowing down an inclined palm trunk would have a strong appeal.



A FISH THAT DROWNS WITHOUT AIR

A drawing of *Anabas scandens*, taken from "The Fishes of India" by Dr. Francis Day.

The average length attained by *Anabas* is six inches

The climbing powers of *Anabas* are exercised chiefly in leaving its home in a pond, swamp, or canal and seeking other waters that may afford better living or feeding conditions. In making this change of quarters the fish may have to travel on dry land, and it is this habit which is characteristic and well known to oriental people. In Siam, I not infrequently came upon an *Anabas*, usually at night, crossing a dusty road or traversing a lawn or field. It was easy to discover the water which a fish was leaving but it was not always possible to determine the particular water to which it was heading. In some cases the body of water to which the fish was obviously bound did not seem to the human observer to be more attractive than the water which had been left. The banks of drying canals and ponds up which the fish has to climb may be high and steep, and skill and patience may be required to negotiate them; but on arriving at a new body of water the fish may exercise much less care in descending, and I occasionally saw one, apparently deliberately, roll or fall down a steep bank and go into the water with a splash.

As would be expected in a fish which regularly leaves the water and travels overland, *Anabas* displays no conspicuous color which might attract attention. The adult fish is of a uniform dark brown while the young is light brown, with a few blackish transverse stripes.

Walking powers

The walking powers of *Anabas* seem to be exercised only when in quest of a new aquatic

environment, and there appear to be no observations indicating that the fish regularly feeds when out of the water, although it may conceivably seize insects or worms that happen to be in its terrestrial path.

The walking movements lack the grace and ease of those of a lizard and of some of the gobies, such as the mudskipper (*Periophthalmus*). The gait is jerky but comparatively fast, and the efforts are usually persistent, so that a fish may travel a considerable distance in a short time. I have a note on the actually observed out-of-water movements of an *Anabas* in Peninsular Siam. This fish had been living in a small pool in a detached circular garden thickly planted with flowers and shrubs, but was removed when the pool was to be cleaned. It was taken by a servant for release in a stream on the edge of the compound. The servant, however, was called away and put down the basket containing the fish just before reaching the stream. The fish immediately climbed out and, instead of entering the near-by stream, headed back in the direction of the pool. Its subsequent movements were partly conjectured but were under observation during the latter half of the journey. The fish first passed through grass and then over a metalled driveway between houses; and on arriving at the garden it continued on the driveway to the far side and then made a short turn, plunged through the flower beds, and reentered the pool. The distance traveled was more than three hundred feet and the time occupied was about thirty minutes. This particular fish, in addition to progressing readily on dry land and

breathing atmospheric air, had well-developed aerial vision (which is rare in fishes) and seemed to exhibit a homing instinct.

Anabas is a valuable food fish in India, Burma, Siam, Malaya, China, and the islands lying off the southeast coast of Asia. Its importance to man arises from the inherent edible quality of its flesh, from the adaptability of the fish to almost any kind of water, and from its hardiness which permits easy handling in commerce. In Siam it is one of the staple foods over the whole country and is in great repute for its wholesomeness and for its invigorating quality in convalescence. The Siamese name is *pla mor*, or doctor fish. It is taken to market in tubs with little or no water and in wicker baskets, and is usually exposed for sale out of water; it apparently suffers little or no inconvenience from such treatment, its only requirement during a long day in the market being infrequent sprinkling with fresh water to keep its air-breathing apparatus moist.

Baiting for market

Various kinds of basket traps and nets are employed in taking Anabas for market; and the fish is much sought and easily caught by

youthful anglers using almost any kind of bait on a short line attached to a slender bamboo pole. In many places the children thus keep their families supplied with fresh fish.

A dangerous practice

Young Siamese fishermen sometimes insert the head of a newly caught Anabas between their teeth so as to leave both hands free to rebait and recast the line, while in India fishermen often kill their catch by putting the fish in their mouths and biting the backbone just behind the head. On rare occasions this practice has led to dire consequences, for the fish has given a jerk, wriggled into the back of the mouth, and become lodged in the pharynx, from which extraction is almost impossible owing to the strong backward-projecting spines on the sides of the head. When in Siam I learned of several deaths from suffocation when Anabas became tightly impacted over the windpipe of fishermen; and Dr. E. W. Gudger, of the American Museum of Natural History, has published accounts of these and many other cases in which oriental children and adults have been killed by having live fish wedged in the pharynx.



THE DISTRIBUTION OF ANABAS

The species described in the foregoing article occurs in estuaries and fresh waters of India, Ceylon, Burma, and the Malay Peninsula and Archipelago; and eleven other species occur

in Africa. So far as is known the African species never go tree-climbing or land-walking. (From "Cambridge Natural History," page 645)

The Wonders of Mount Rainier

New facilities aid the hiker and nature lover on the slopes of one of the most beautiful mountains in the American Northwest

By C. FRANK BROCKMAN

IN Mount Rainier National Park the greatest charm and most engaging interests, in spite of the beauties that are spread before the eyes of the motorist, are found along "back country" trails. Picture, if you can, a mountain whose broad base covers an area larger than that occupied by metropolitan New York City; whose ragged, icy crest stands more than eleven times higher than our greatest city's tallest building, and you have some idea of the huge dimensions of one of America's greatest volcanoes. The lavas which flowed from the earth destined to compose the base of this giant mountain laid a broad foundation—inundating approximately one hundred square miles of the original mountainous country.

A trail in wonderland

Encircling this peak is the Wonderland Trail, appropriately named, and one must spend from eight to ten days with pack sack or pack horse if one wishes to encircle Mount Rainier. In order to stand upon "The Mountain's" highest point, 14,408 feet above sea level, the climber must run the gamut of adventure on glacial ice and crumbling rock cleavers for the better part of two days.

So much for Rainier's size. A hasty observation of this national park from an airplane or an examination of an accurate relief model of the area will indicate the problems of the hiker, as well as the varied interests that lie along his path.

For 115 miles the Wonderland Trail wends

a tortuous way through dense forests, across broad glacial gorges, traverses flower-strewn alpine meadows, and alternately ascends and descends lofty, windswept ridges.

The mountain squats just to the west of center within the park's boundaries, its twenty-eight tongues of glacial ice radiating from its upper elevations and penetrating deep into the heavily timbered zones far below.

Ups and downs

Thus a trip encircling Rainier is largely a series of ups and downs. A cross section of the route traveled would look like a graph of stock market trends, for the glacial canyons, radiating from the mountain like spokes of a wheel, alternate with numerous ridges which separate them. Often a day's travel carries the hiker across several such canyons and their adjoining ridges, the difference in elevation between valley and ridge-top occasionally being in excess of 5000 feet.

But as one alternately climbs and descends, he has this to console him and ease his efforts—figuratively he is shod with the fabled "seven league boots." Keep in mind that a change of 1000 feet in altitude brings about climatic changes corresponding to a 300-mile change in latitude, and one can visualize the powers of this imaginative footgear. As one ascends, he passes through several altitudinal zones—Transition perhaps, then Canadian, Hudsonian and Arctic Alpine. The character of plant and animal life in these zones is very similar to the latitudinal zones of like names to the north, because of climatic conditions therein that are

very much alike. Thus, with every step upward, one figuratively is striding with giant steps into the north, and, descending, one retraces these mythical Gargantuan paces southward.

Until a few years ago it was necessary, in order completely to encircle the mountain via the Wonderland Trail, either to carry provisions on one's back for the entire journey or hire a number of pack animals. Both methods were accompanied by serious objections. To carry all necessary food and paraphernalia on one's back for a two weeks' journey over this rugged country is a fatiguing pastime. The latter method had an equally obvious objection because of its expense.

Now, because of a partly completed road system, one may easily reach several "key" points within this national park. At each one, with the exception of Carbon River where only a public camp ground is found, there are available hotels, housekeeping cabins, public camp grounds, and allied features. By hiking out along the trails that converge at each of these spots, one may cover all accessible country within a particular section. One then merely drives to another point and repeats the process.

Another method that is worthy of interest is first to visit each of these "key" points, leave a cache of supplies designed for a few days' travel at each, and then replenish the pack sack from these as Mount Rainier is encircled.

Conveniences for the hiker

Along the trails one finds, at distances approximating a day's travel, rustic shelters and fire pits for the convenience of the hiker. Here one may make himself comfortable and be largely free from the vagaries of the weather. Hikers have the C.C.C. to thank for these shelters, for it was the efforts of the boys in this organization that made them possible.

Glacial activity in the past has fashioned the topography of this region and set the stage for such scenic gems as Comet Falls. Here, in a narrow, glacial-carved glen, one sees a slender stream plunge over a 250-foot precipice, its waters cascading downward in numerous comet-like masses which account for the name. Its spray bathes the rock and earth in the vicinity with a filmy mist that enriches the floral life of this spot. It is a pleasant place in which to

stop and rest on the way to Van Trump Park, where numbers of mountain goats may be seen in their native habitat.

But man was not the first to discover the cooling advantages of this place. During the warm days of late July and early August when that pestiferous insect, the deer fly, is particularly obnoxious to many four-footed animals, I have shared the spray of Comet Falls with numerous deer which find in the cooling mist a ready relief from the pugnacious activity of these flies.

The higher slopes

The goats, upon the higher slopes, have their own particular way of avoiding the heat of midday. Often, while crossing the ice of Van Trump Glacier, I have seen shallow hollows on its surface, melted by the warmth of the bodies of these animals as they reclined upon nature's refrigerator. Mostly one sees the goats from a distance, stepping gingerly about over some precipitous cleaver, but occasionally one has the good fortune to get better acquainted with them.

I recall one instance when, after a hard climb into Van Trump Park in a soggy fog, we were on the point of leaving, disgusted with the state of the weather. As we debated the advisability of retracing our steps, the wind changed, and quite suddenly (for one never can understand the weather here) the fog dispersed. With its dissolution we discovered that we had wandered into part of a large band of goats, but the animals already were moving rapidly away. Without the slightest sign of confusion but, nevertheless, with a well-defined purpose of retreating to higher and more inaccessible ground, the goats ambled toward a near-by rocky cliff. More than sixty individuals were counted, and thus an otherwise disappointing day was transformed into one of great satisfaction.

One must admit, however, that the bane of the hiker on any extended trip about this old mountain is the weather. Mount Rainier has temperamental moods akin to those of the most fabled prima donna, so, while the summer months are generally pleasant, it is wise to be prepared for storms. A light waterproof garment, such as a silk weather-proofed parka, is essential, for rain, fog, and, on the higher por-

tions of these trails, snow are often encountered Too, these periods of bad weather are not the usual temperamental mountain storms. They may last for days and cause considerable discomfort to those not prepared.

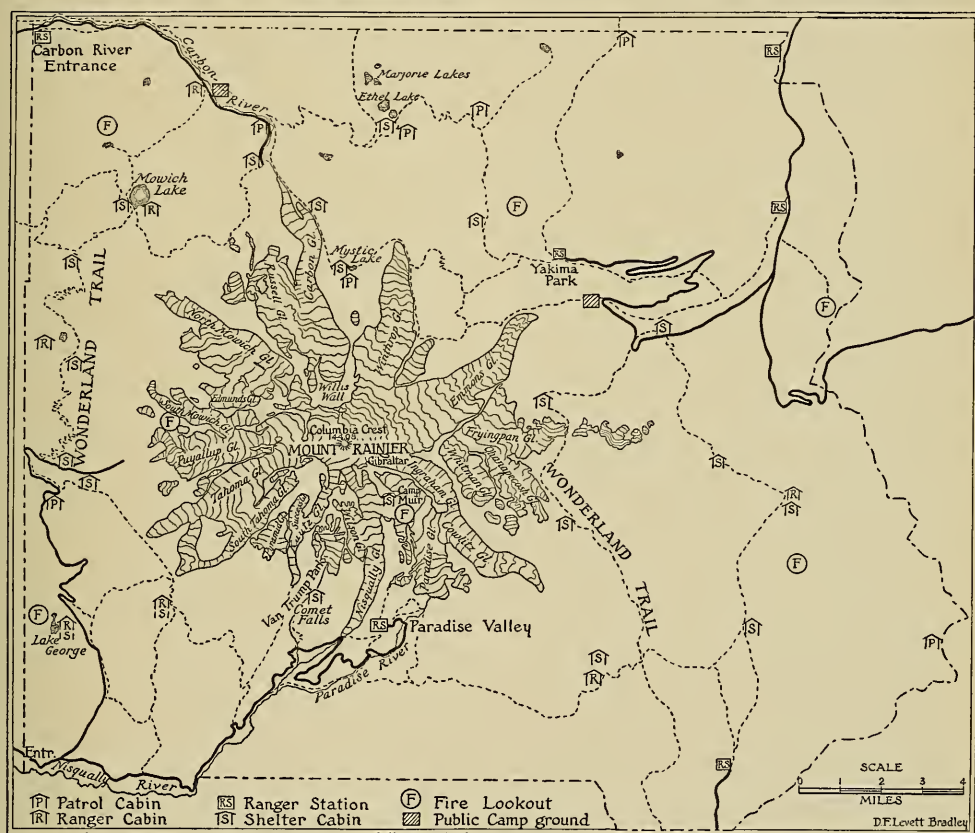
As the hiker encircles Mount Rainier, he is forced to swing wide about the ends of the long tongues of glacial ice. There are twenty-eight of these, approximating a surface total of fifty square miles. He crosses streams that rush forth full born, from beneath the discolored ice, for the major park streams which have their origin in the gradually receding glaciers are not of the type that decrease greatly in volume near their origin. And the power of these swift streams is tremendous; one has but to listen as boulders of all sizes pound and crunch against one another, to realize that a misstep in crossing such a torrent would be fatal.

Intermixed with rock débris cut from the

mountain by the moving ice in years past, the termini of these glaciers present a sorry appearance. From a distance they look like great piles of coal, but, upon close approach, one sees that they are really ice. Their dirty appearance, while disappointing in one way, tells a dramatic story of the power of moving ice.

As the glacier nudges down the mountain side, it is constantly cutting deeper into Rainier's flanks and undermining the steep canyon walls. Rock falls upon the ice surface, forming knife-edged lateral moraines near the sides of the glacier, and this débris is slowly carried downstream where, at the snout, it covers almost the entire surface of the glacier.

Great boulders quite often roll pell-mell from the face of the ice at the snout, and numerous rills from the melting surface ice add to the volume of water that thunders from beneath the lip of the glacier.



MOUNT RAINIER, WASHINGTON

The long tongues of glacial ice radiating from Mount Rainier are gradually undermining its steep canyon walls. They approximate a sur-

face total of fifty square miles. The boundaries of Mount Rainier National Park are shown above by the dot-and-dash lines

Those of us who have an opportunity to see these glaciers at regular intervals note a constant change in their appearance. And annual recession data give evidence of the fact that, in spite of a downward flow that sometimes reaches a maximum of twenty inches a day, these "rivers of ice" are slowly becoming shorter at an average yearly rate of seventy feet. The accumulation of snow at the upper elevations is not sufficient to offset the melting at the snouts.

Climate of course influences the rate of recession. During the year period 1933-34 these glaciers melted back in some instances more than twice the average amount. The explanation lies in the long period of drought which affected practically every section of the country to some degree. Although the effect of this dry spell was not otherwise readily apparent along the habitually moist and humid northwest coast, it showed in the record recessions of Mount Rainier glaciers.

Historical records fortunately yield clues to the position of Nisqually Glacier as far back as 1857. It was in that year that Lieut. A. V. Kautz, with four companions, made his historic and heroic though unsuccessful attempt to ascend Mount Rainier. This was the first attempted ascent on record and in Kautz's journal an excellent word picture of the terminus of Nisqually is given, which enables us to identify its position in that year. Today a modern highway crosses the Nisqually River over 200 yards above that point. Other records indicate that about 1885 the glacial ice rested approximately upon the site of the highway bridge. In that year the Longmires, who had established a hotel about five miles below this point, used to make occasional trips to the snout of the Nisqually and chip pieces of glacial ice from the glacier to be used in the refrigeration of perishable foods at their pioneer backwoods hotel. Today the terminus of the Nisqually chokes the narrow canyon almost a half mile above that spot.¹

The Nisqually has the honor of being the first glacier in our country to become accessible by road and, in 1908, while the first motorists may have experienced considerable discomfort characteristic of motoring in those formative days of the automobile, they nevertheless had the pleasure of driving to within practically a stone's throw of the wall of ice. Today visitors to this spot must content themselves with a more removed view of the glacier's terminus unless they walk up the trail that is provided for that purpose. Those who return to the park periodically never fail to notice considerable variation in the appearance of the Nisqually's snout with each visit.

Glaciers, living and dead

Besides receding up its valley, the glacier is of course also moving downward. Experiments conducted on one or two occasions have shown that the downward flow of the glacial ice reaches, on hot summer days, a maximum of twenty-four inches. Roughly speaking the average maximum downward flow is 175 feet per year. As the average annual recession for the Nisqually is, for recent years, 72 feet, a total of about 225 feet of the glacier melts away each year. When one considers that the snout, roughly rectangular, forms a wall of ice about 75 feet high and 200 feet wide, one can readily see that considerable ice melts away. Herein lies a partial explanation of the volume of the river that rushes off, full born, toward the sea from this point.

Glaciers of this type are known in local parlance as "living" glaciers. In short they have a perceptible downward flow due to gravity and other causes and are still carrying on their work of gouging out their deep, awe-inspiring canyons. During their greatest activity on hot summer days, the streams that come from them are murky with countless tiny particles of ground-up rock known as "glacial flour."

A second type, known locally as a "dead" glacier, does not move downward. At one time perhaps such a glacier was of much greater size, but it was forced to recede just as the Nisqually, the Emmons, the Carbon, and the South Tahoma are doing, to a shelf or basin high upon the flanks of Mount Rainier. There, owing to the topography, it lies stag-

¹ The tabulation of the recession of the Nisqually, which is generally considered as the third largest glacier in the United States, is as follows:

1857-1885.....	760 feet	1925-1926.....	86 feet
1885-1892.....	140 feet	1926-1927.....	43 feet
1892-1918.....	1310 feet	1927-1928.....	89 feet
1918-1919.....	59 feet	1928-1929.....	52 feet
1919-1920.....	46 feet	1929-1930.....	118 feet
1920-1921.....	106 feet	1930-1931.....	49 feet
1921-1922.....	67 feet	1931-1932.....	50 feet
1922-1923.....	44 feet	1932-1933.....	44 feet
1923-1924.....	83 feet	1933-1934.....	155 feet
1924-1925.....	73 feet	1934-1935.....	54 feet

nant and shows little if any downward flow. Most famous of these dead glaciers in Mount Rainier National Park is the Paradise, and for many years great ice caves were its outstanding feature. For a time, as we are able to ascertain from old photographs, it receded rapidly but now it seems to have slowed somewhat in its mad retreat.

Rainier's glacial system

What is the reason for the existence of this great glacial system on this mountain? It is not simply the altitude of Mount Rainier for there are other mountains which are slightly higher above the level of the sea. Both Mount Whitney in California and Mount Elbert in Colorado may boast of greater elevation but neither possesses glacial systems. The reason is snow. Upon the broad flanks of this huge volcano, due to the great amount of moisture that is swept inland from the Pacific in the prevailing winds, occurs one of the heaviest snowfalls on record in our country. At Paradise Valley (5557 feet), which is widely known for its wild flowers during the summer season, it is not unusual for twenty-five feet of snow to be found upon the ground in mid-winter, while unquestionably a great deal more snow falls at the higher levels where most of the glaciers are born. This snow, in packing down, is transformed into glacial ice and keeps alive these remnants of the "ice age." Each winter it partly repairs the damage of the warm summer sun but the glaciers are fighting a losing battle. Eventually, perhaps, at some time in the distant future these great glaciers, some of which are more than four or five miles long today, may be mere traces of their former magnificence.

Higher on the mountain flanks the ice is crystal clear. The morainal material that renders it so ugly near the snouts gradually becomes less pronounced in volume as one traces the course of these glaciers to the summit. And with these changes in conditions comes also the necessity for a new technique and special equipment if one is to penetrate into this rigorous land of perpetual snow and ice. The National Park Service exercises strict supervision over all parties who venture into such dangerous places.

When one contemplates "hitting the high

spots" on Mount Rainier, he should not be without the parka, already mentioned—which in the high elevations will serve as a windbreak as well as protection against snow, a pair of crampons, an ice axe or alpenstock, caulked boots, dark glasses to protect the eyes from the sun's glare upon ice and snow, and the usual warm clothing necessary for such ventures. In addition, each party must have a satisfactory rope with which to rope over or around bad places in the route to Rainier's crest.

The first ascent, made by Stevens and Van Trump in 1870, was accomplished by what is known as the Gibraltar route because of a large, blocky obstacle, along the face of which one must climb, that stands on the way just above the 11,500 foot level. It is over this route that most of the ascents are made today, though Mount Rainier has been climbed successfully by means of several other routes on numerous occasions. The route from Yakima Park over the Emmons Glaciers is probably the most generally used of these secondary ways of ascent.

From Paradise Valley at 5500 feet one sees the blocky Gibraltar jutting from the flank of Rainier, and on the way up the climber has this landmark in front of him until early morning of the second day of the ascent. The start of this climb is made just after noon, and wise is he who chooses his dinner with an eye to the physical efforts of the climb. Woe be to the man who gnaws merrily at a juicy steak at this parting repast, for such gustatory delights have a habit of turning one's stomach inside out at the higher elevations.

At ten thousand feet

At about six o'clock, the flower meadows having long since been left behind, two stone cabins at the 10,000-foot elevation offer a welcome haven for a few hours. A bit of light lunch is enjoyed; warm tea is sipped, while the eye feasts upon a glorious panorama of tumbled, jagged peaks that stretch away to the south in endless rows. Upon the horizon loom sister volcanic peaks of Rainier—Mount Adams, Mount St. Helens and Mount Hood. Near at hand is "The Mountain" itself, with its writhing mass of cold, bluish ice offering anything but a ready welcome.

One seems surrounded by a labyrinth of cold ice and forbidding rock cleavers, great, yawning crevasses, and overhanging bergschrunds. With such a fantastic picture in mind, one turns in and tries to get a bit of rest and possibly sleep. The last lap of the climb and by far the most dangerous and thrilling part is begun at about 1:00 A.M. Climbers must return to Camp Muir—the resting place at the 10,000-foot elevation—by noon, for the warm sun's rays which strike the southwest face of Gibraltar with great energy after that time, dislodge rock and ice that pelt the narrow ledge along which one must climb.

The base of Gibraltar is attained at about daybreak and there, at a spot known appropriately as Camp Misery, those who are unable to continue farther are left in a sheltered place until the return of their party. After one leaves the camp, the numerous leering crevasses that one views far below from the precarious footing of the Gibraltar ledge do not help the peace of mind of any timorous individual.

On to Rainier's summit

But the climb is just about under way. At the upper level of Gibraltar one again takes to the glacier. Here the ice is badly broken up. In fact, the entire Gibraltar route is becoming more dangerous each year as the ice becomes more forbidding and the narrow ledge trail slowly sloughs away. From the upper part of Gibraltar to the summit the climber is forced to pick a meandering trail through a maze of broken-up ice. Occasionally snow bridges are crossed. Often it is necessary to climb via a

tortuous route around some particularly dangerous crevasse where no other method of crossing seems available. Above, the summit—or rather the crater rim just under the summit—seems to mock at one from a gradually receding distance. One's knees seem to be of rubber after a couple of dozen steps, and breath comes in short, labored gasps. And then, quite surprisingly, the rocks of the crater rim are achieved.

A force that defies familiarity

It is a glorious sensation, this final achievement of the crest of Rainier. After a short rest one may care to hike around the rim of the small crater to Columbia Crest, the highest point and 14,408 feet above the level of the sea. There are only two other spots in the United States higher than this—the summits of Mount Whitney and Mount Elbert. But Rainier rises from a comparatively low base level, and in climbing from Paradise Valley one ascends a total vertical distance of almost 9000 feet. No wonder one feels as though he has “been some place” upon the return.

And, so, to know Mount Rainier National Park *intimately*, one must have had the experience of hiking its many miles of trails and climbing about on its awe-inspiring crags and glaciers. Its moods are those of a harlequin, a “Dr. Jekyll and Mr. Hyde” in ice and stone. Each day, each hour brings new and delightful changes that will thrill the hiker and fascinate the student of natural history. We, who live in its shadow, see in its changeable nature a dominant force that defies familiarity.

MIRROR LAKE

(Opposite page) Up is down when you view Mount Rainier in Mirror Lake, in Indian Henry's Hunting Ground. With pack sack or pack horse one can encircle the mountain in eight or ten days

The Wonders of Mount Rainier





Emmons Glacier shown above is the largest "river of ice" in the United States. Twenty-seven other glacial tongues radiate from this mountain. Photograph by Asahel Curtis

Snow bridges such as this one span deep crevasses, and the climber sometimes is able to cross by them; but extreme caution must be exercised lest the bridge be too weak





A typical crevasse in the surface of one of Mount Rainier's glaciers. The ice of these glaciers is in places many hundreds of feet thick. Photograph by Asahel Curtis

“RIVERS OF ICE”

Mount Rainier's glaciers are shrinking. In spite of a downward flow that sometimes reaches twenty inches a day, they are gradually becoming shorter at an average rate of seventy-five feet a year. There is not enough snowfall on the upper levels to offset melting. Perhaps in some far-distant age the mountain will be bare of ice



*Excellent highways lead the
within the park where the major
a portion of the highway near
east corner of Mount Rainier*



*Comet Falls. Glacial activity carved
the glen in which this slender stream
plunges over a 250-foot precipice.
Here mountain goats may be seen,
amidst rich floral life. Photograph
by C. F. Brockman*



motorist to several "key points"
 trails converge. Above is shown
 Yakima Park in the north-
 western National Park



Dangerous crevasses sometimes obstruct the climber on Rainier's glaciers. Special technique and equipment are necessary if one is to assault this rigorous land of perpetual ice and snow



(Above) One of the dangers of mountaineering—a giant bergschrund or crevasse in the snow slope at the head of a glacier. Ladders are sometimes used in crossing such obstacles

(Upper right, opposite page) Mowich Lake. Shelter cabins are found along the trails about a day apart. For 115 miles the Wonderland Trail winds through

dense forests and traverses glacial gorges, flower-strewn alpine meadows, and wind-swept ridges. Photograph by C. F. Brockman

(Right, opposite page) A summit party resting at Camp Misery. Here one looks down upon the Cowlitz Glacier stretching away into the lowlands beyond



The New York State Theodore Roosevelt Memorial

A utilitarian and artistic symbol of the life and ideals of a great Statesman, Naturalist, Conservationist, Explorer, Humanitarian, and Patriot

WHEN on January 19 the New York State Theodore Roosevelt Memorial adjoining the Museum was dedicated for public use, a dual purpose was achieved. A splendid architectural monument was consecrated to the memory of Theodore Roosevelt, the statesman, explorer, and nature-lover, and additional educational facilities and opportunities were added to the American Museum of Natural History.

"We know how he loved the great outdoors," said President Franklin D. Roosevelt at the dedication. "He loved the life of the boundless plains which he had known as a rancher in the West. He found strength in the wilderness. He knew the birds and the animals and the trees and the plants and the flowers. . . . His volumes on American history, on current problems, and on his own experiences as a hunter and explorer, captured, as we know, and retained the interest of the American people."

Building portrays broad attributes

It was Henry Fairfield Osborn who after Theodore Roosevelt's death seventeen years ago advocated the erection of such a memorial and devoted his continued efforts toward it.

"Many people and many groups have, in their own way, memorialized Roosevelt's life in thought, word, and deed," Mr. A. Perry Osborn, son of the late President of the American Museum pointed out. But "it was given to one man—a boyhood and life-long friend—to conceive an enduring and inspiring

Memorial." It was planned that the building "should be simple in architecture yet splendid and heroic in dimension . . . that it should possess warmth yet useful purpose, making its appeal to all men. Thus, the building should have the very characteristics of the man it memorialized."

Competition for design

In 1925 the Board of Trustees invited the leading architects of New York State to submit plans in competition. The design which won the award was that of John Russell Pope.

Another competition, in which twenty-five leading artists anonymously took part, was held for the selection of the murals. The design submitted by William Andrew Mackay was selected.

Describing the purport of these gorgeous panels, Governor Herbert H. Lehman said: "On the walls of this great hall . . . there are painted scenes depicting the accomplishments of a great president: acts of physical courage—undertakings which resound to the glory and profit our nation."

Some intimate glimpses of Theodore Roosevelt were given at the ceremony by his son Theodore, Jr.: "At home I have a battered volume of Wood's *Natural History* in which his name is scrawled in a boyish hand. It was his first nature book. While reading it, his artistic sense evidently overcame him, for the picture of the elephant is extra illustrated with a platoon of little figures of this single-line school, which are chopping at the elephant's

back and legs with what look like knives and axes. In other convenient places he has drawn strange animals that I am sure, in later life, he would have characterized as nature fakes.

"His love of nature began when he was very young. By this time he was only ten or twelve and he was really actively interested. His father, another Theodore Roosevelt, helped and encouraged him in every way. There is a family story telling how his eldest sister objected when she found he was keeping dead mice in the ice box. He is supposed to have remarked solemnly on hearing this that she was obstructing the course of science. . . .

"We in the family believe that my father would be very proud of this Memorial we are dedicating today. It deals with natural history, of which he was so fond, and will benefit the people of the country to whose service he dedicated his life."

Secretary George N. Pindar, of the Board of Trustees of the Memorial, describes the building as follows:

"The façade is executed in a pinkish granite from Massachusetts. On the parapet wall surrounding the terrace are carved inscriptions indicative of the fullness of Roosevelt's life as follows: Ranchman, Scholar, Explorer, Scientist, Conservationist, Naturalist, Statesman, Author, Historian, Humanitarian, Soldier, and Patriot. Upon the pedestals supporting the exterior columns and the pedestals flanking both ends of the terrace, which is 350 feet in length, Edward Field Sanford, Jr., the sculptor, has carved in bas-relief the figures of animals native to America and Africa.

"In the center of the terrace, immediately in front of the great entrance arch, upon a polished granite pedestal, will be an equestrian statue of Roosevelt with two accompanying figures on foot, one an American Indian and the other a native African, representing his gun bearers and suggestive of Roosevelt's interest in the original peoples of these widely separated countries. This group will rise to a height of thirty feet above the sidewalk. It is the work of James E. Fraser, the well-known sculptor, who designed and executed the four statues that surmount the great columns on the main façade.

"The niches at either side of the entrance are planned to hold sculptured figures of two typical specimens of American big game, the

bison and the bear. It is intended that the bear shall typify courage, tenacity, and power; the bison, romance, fortitude, and endurance, dominant characteristics of Roosevelt. . . .

"Passing through this entrance, one steps into the Memorial Hall itself, a conception of grandeur and dignity in harmony with the spirit of Roosevelt's lofty ideals and fearless character. This hall, exclusive of recesses, is 67 feet wide by 120 feet in length. The floor is richly patterned in marble mosaic, the walls to a height of 9 feet, being of St. Florient cream marble surmounted by mellowed limestone extending to an elaborate Corinthian cornice and culminated by an octagonal coffered barrel vault, reaching to a height of 100 feet above the floor. . . .

Utility with beauty

"From the practical and educational standpoint the building is splendidly equipped with class rooms, exhibition rooms, a lecture hall, a hall for the display of the resources of New York State, and a room devoted to Rooseveltiana. At the right of the entrance vestibule are located the administration offices or Trustees' Room, while at the left is a group of superbly finished panelled butternutwood interiors, forming a suite of rooms to be known as the Statesmen's Rooms. A cafeteria and lounge are located in the basement."

In the dedication ceremony A. Perry Osborn called attention to the harmonious combination of utilitarian and artistic ideals: "The first two floors serve as an entrance to the Museum, useful and adequate. The upper portions of the building contain study rooms, work rooms, and a lecture hall to serve educational purposes. . . . Here people who come will find peace and quiet, and in the nobility of these surroundings will think of the man for whom this Memorial stands both as a tribute and as a symbol of his greatness. Here people will find help for their own lives and inspiration to serve humanity and country. Meetings of our citizens will be held in the Memorial for objects in which Roosevelt was interested, and so broad were his interests that these meetings will take in the range of human activity.

"What an appropriate, useful, beautiful, and inspiring Memorial this is, an honor to all its creators as well as to the man it honors!"



Photo by Charles Phelps Cushing

THE ENTRANCE HALL

The grandeur and dignity of this hall are in harmony with the spirit of Roosevelt's lofty ideals and fearless character. Recesses on three sides contain murals like the one in this photo-

graph. The Roman Corinthian columns, 48 feet high, are executed in red antique marble. The vault reaches to a height of 100 feet above the floor

The New York State Theodore Roosevelt Memorial



(Above) The façade is executed in a pinkish granite. The entrance arch, 60 feet in height, is flanked by columns supporting heroic figures of Lewis, Clark, Audubon, and Boone

PHOTOS BY WURTS BROS.

(Right) The pedestals supporting the columns are decorated in bas-relief with figures of animals native to America and Africa





Photos on these pages by F. J. Hart

THE SOUTH

(Above) Theodore Roosevelt, at lower left, is shown with delegations from Russia and Japan gathered to negotiate for peace in the Russo-Japanese War—1904. Death, Famine and Plague are represented at the top

(Left) Events in old Russian history are represented here through several historic personages of the period before 1000 A.D. At the bottom are shown the ancestors of the Roosevelt family, their names above them



WALL MURAL

(Above) This panel is the Japanese counterpart of the one opposite, showing that both nations face the same loss and ruin which follow war. At bottom Justice and Mercy are shown separating the belligerent armies

(Right) Japanese spiritual beliefs are here represented in the figures of various gods and goddesses and in the first historic Japanese emperor, descendant of the Sun Goddess. At the bottom are the maternal ancestors of Theodore Roosevelt





(Above) Theodore Roosevelt stands over a Nubian lion and lioness. Several birds which completed the collections at the American Museum and in Washington are included



(Above) In a tangle of gnarled trees, hemmed in by rocks, an African elephant is captured by a group of native hunters with shields and spears

(Below) The panel below illustrates an episode of Biblical history pertinent to Africa—The dispersal of the sons of Noah after the Flood. Photos on this page by F. J. Hart



A Federation of Wildlife Interests

A congress of individuals interested in conservation meets in Washington at the call of President Roosevelt

THE North American Wildlife Conference met in Washington, D. C., February 3 to 7. This gathering was called by President Roosevelt who stated "My purpose is to bring together individuals, organizations, and agencies interested in the restoration and conservation of wildlife resources. My hope is that through this conference new coöperation between public and private interests, and between Canada, Mexico, and this country, will be developed; that from it will come constructive proposals for concrete action; that through these proposals existing State and Federal governmental agencies and conservation groups can work coöperatively for the common good."

It was estimated that 2000 or more delegates attended the many sessions which centered about the Hotel Mayflower as headquarters. It was probably the greatest assemblage of representatives from all of the various wildlife agencies ever brought together for the common good, namely, conservation of wildlife.

The primary purpose of the Conference was the formation of a *General Federation of Wildlife Interests*. At an early meeting, an outline for the proposed General Federation was first presented to the delegates. In brief, this plan provides for the welding of all wildlife interests into a super-organization with headquarters at Washington. Each State will have one representative in this Federation, and provision is also made for representation from nation-wide organizations and societies. For the purpose of administration a board of trustees is to be set up, the board consisting of members selected from thirteen regions into which the United States is divided, and an additional six members at large. The State representatives must be selected by a general caucus of all interested parties in a State and in the manner provided by the constitution and by-laws of the Federation set up in that particular State.

The potential usefulness to conservation of such a plan is based upon the organization of local interests. When there is need for concerted action on the part of those who believe in any phase of wildlife conservation, the best avenue for reaching a legislature is by way of the local constituency. The Federation headquarters at Washington will operate as a transmitting agency to pass along facts to the very bottom of the Federation organization, namely, the counties. Acting upon advice from Washington, the organized local interests may very effectively communicate with Con-

gressmen and place their views upon record in a manner most likely to receive attention. If matters of conservation policy are made topics of immediate interest throughout the Nation, it should not be long before Congressmen can be made to feel that wildlife must be taken into consideration. As a matter of practical application of democratic principles, it would seem that this idea offers a better opportunity for constructive wildlife planning than does the present desultory sniping away at legislators by a host of unorganized conservationists.

After considerable informal discussion, the proposed constitution for the General Wildlife Federation was formally presented for a vote on the afternoon of Wednesday, February 5. By a unanimous vote a constitution was approved to operate for the first year. Because of the difficulties inherent in a large-scale operation of this sort, it was realized that many of the first steps should be tentative and that some time would undoubtedly elapse before a smoothly running machine could be set up. The ultimate success of the Federation will depend upon the degree of coöperation received from the many and various interests which may be logically included under the conservation banner. Any aggressive move for domination of the Federation by a particular group will certainly create distrust and suspicion and will militate against the success of the undertaking, and it will be necessary to adopt a policy of give and take without undue emphasis upon the latter. The project was launched to a most auspicious start upon the election of Mr. J. N. ("Ding") Darling as the president of the Federation. The spontaneous endorsement received by Mr. Darling whenever he appeared before any gathering at the Wildlife Conference indicated beyond any shadow of a doubt that if any individual could swing all of the varied conservation interests into line, this man was "Ding" Darling.

The focus of attention shifts now from Washington to the local activities of the "wildlifers," and the success or failure of the Federation depends upon the degree of harmony achieved in the merging of common aims and submerging of selfish interests. It is to be hoped that all will pull together for the Federation and that the American public will become not only wildlife conscious but sympathetic to the needs of wildlife conservation.

—H. E. ANTHONY.

Science in the Field and in the Laboratory

Exploration, Astronomy, Education, Exhibits, Research, New Members, Lectures

Edited by A. KATHERINE BERGER

The Fleischmann-Clark Indo-China Expedition

The Fleischmann-Clark Indo-China Expedition of the American Museum of Natural History sails on the "President Coolidge" from San Francisco on Friday, February 21, to engage in an extended collecting trip, starting for the jungle from Saigon.

The members of the expedition are Major Max C. Fleischmann, of Santa Barbara, well-known sportsman, big-game hunter and fisherman, and Dr. James L. Clark, director of the department of arts, preparation and installation at the American Museum. Both men have a wide experience in the field.

Major Fleischmann has hunted throughout America, in Central Asia, and in Africa. Doctor Clark, in addition to his lesser hunts in Wyoming and Canada, went as co-leader of the Morden-Clark Expedition to Russian Turkestan after the *Ovis poli*, and to the Thian Shan Mountains for ibex; again, as co-leader of the O'Donnell-Clark Expedition to Africa after giant eland on the Upper Nile; and also as co-leader of the Carlisle-Clark Expedition after lions in Tanganyika.

The object of the Fleischmann-Clark Expedition is to obtain as many varied specimens as possible from the interior of Indo-China for purposes of scientific study. Wildlife there, as elsewhere, is on the wane and it is of the utmost importance that the mammal collections of the Museum should be supplied with all forms of fauna obtainable, before they become extinct. The expedition expects to hunt the tiger and the wild buffalo and to collect a multitude of the smaller mammals of the region. Photographs by motion and still cameras will be taken for the Museum's educational work.

Snyder Colorado Expedition

At the generous invitation of Mr. Harry Snyder, Mr. George G. Goodwin, assistant curator of mammalogy, spent six weeks collecting on the western slopes of the Rocky Mountains in Colorado. He returned to the American Museum on January 6, bringing back 3 elk, 4 mule deer, and 150 small mammals, including coyote and lynx.

Collecting was done at elevations between 6,000 and 10,000 feet, and at temperatures averaging 14° below zero.

Hitherto the Colorado material in the Museum has been rather inadequate, and it is gratifying to receive the present series for its collections.

It is of interest to note here that this is the third expedition that Mr. Snyder contributed to the Museum during 1935.

The Archbold New Guinea Expedition

The 1936 New Guinea Expedition, one of the series of expeditions organized and led by Mr. Richard Archbold of the American Museum of Natural History for the biological exploration of New Guinea, left New York the early part of this year to collect natural history specimens in South New Guinea, on the upper reaches of the Fly River, and the mountains beyond.

Besides being fully equipped with collecting materials, the present expedition is taking with it portable radios and a new Fairchild amphibian airplane which Mr. Archbold has called the "Kono," a native name for a rare duck which lives on the mountain lakes of the interior of New Guinea where the expedition hopes to explore.

Mr. Archbold, himself a mammalogist, returned from New Guinea in May, 1934, after leading a very successful expedition into Southeast New Guinea, collecting mammals, birds, and plants. The scientific members of the present party will include, in addition, Dr. A. L. Rand, assistant leader and ornithologist and Mr. L. J. Brass, botanist, both of whom were also with the 1933 expedition, and Mr. G. H. H. Tate, mammalogist. The airplane party will consist of Mr. Archbold, who is also pilot, Mr. Russell R. Rogers, co-pilot and mechanic, and Mr. Ewing C. Julstedt, radio operator. Another white man will be picked up in New Guinea to look after the land transport of the inland party.

The expedition plans to concentrate on collecting mammals and birds for the American Museum of Natural History, and plants for the New York Botanical Society. It is also planning to make collections of cold-blooded vertebrates and insects.

Living palm seeds are to be collected for the Coconut Grove Palmetum, Florida, where it is hoped it will be possible to grow indigenous New Guinea species of palms. Besides the collection of land fauna, Mr. Archbold is planning to collect porpoises and sea turtles in the Torres Straits. There is a cockpit in the very bow of the plane. Here the collector with a harpoon gun will be stationed. After locating the porpoise or turtle from the air, the plane will land on the water and taxi up within range of the beast. As well as collecting specimens, an effort is to be made to study the habits and habitats of the birds and mammals and to make a complete study of the displays of some of the birds of paradise.

The party plans to reach New Guinea in March. A base camp will be established on Daru Island near the mouth of the Fly River. This will be the airplane headquarters where stores will be received by boat and from which the inland flights will start.

From Daru a number of reconnaissance flights will be made first over the head waters of the Fly River to discover the most promising and accessible areas for field work. Then the inland party, consisting of Doctor Rand, Mr. Brass and Mr. Tate, with about thirty native carriers, will be flown about 550 miles up the Fly River. The river here is several hundred yards wide so that the plane can land here, and an advance base is to be constructed in case of emergencies. The ground party will then proceed inland on foot, attempting to reach the highest altitudes, keeping in touch with the base camp and the airplane by means of a portable radio and being supplied with food stuffs by the airplane while on the march.

The inland trip

The inland party will make the first collecting camp the farthest inland and as high as possible, probably about 150 miles inland beyond the advance base at the river landing and at 10,000 feet altitude on the Dap range. The carriers will bring in only the barest necessities for traveling. The rest of the equipment will be flown in by plane. Two or three times monthly the Baby Clipper will fly inland with supplies from Daru. These supplies are to be landed by parachutes which are to be loaded with one hundred pounds of food or collecting materials. From experiments conducted in Florida during November and December of this year, Mr. Archbold found that about 130 feet from the ground is the proper distance to release the parachute. An automatic rip-cord attached to the plane opens the chutes and the load floats gently down to land in the camp clearing of the inland party.

An expedition depending upon the old type of transport by native carriers would have to get along with the barest necessities, but with this modern airplane transport a full allowance of necessities as well as a few luxuries can be landed. A scheme for picking up packages by plane has yet to be perfected, so there still remains the problem of carrying out the collected specimens to the

river landing, where the plane will receive them.

A receiving and sending short wave radio set is to be carried by the inland party to keep in touch with a similar radio set which is to be carried in the plane and another at the base camp. Thus each night it will be possible for the exploring party to carry on a conversation with the base camp. The necessary supplies can be requested and the progress of the work reported.

An unexplored area

The interior of New Guinea is one of the few unexplored areas in the world, areas that are still blank on the maps. The Fly River was discovered by Captain Blackwood of H. M. S. "Fly" in 1843. It was ascended for the first time by the pioneer naturalist D'Albertis in 1873. D'Albertis, to whom we owe the only natural history collections from this area, ascended to about 500 miles. Sir William MacGregor gave an excellent account of the river up to about 600 miles in 1890 but he was unable to reach the mountains. A few expeditions and patrols have since gone up the Fly River, but they brought back no natural history collections and none more than reached the foothills where they reported impassable limestone hills. Until 1927 no white man had ever penetrated the mountains about the head waters of the Fly River, the mightiest river of the southern slopes of New Guinea. Its exact source was unknown.

In 1927-29 the Northwest Patrol was organized by the Papuan government to find the source of the Fly and to cross to the Sepik River. Mr. Karius and Mr. Champion of the Papuan government service, intrusted with this difficult mission, found a way over the limestone hills and were completely successful in their second attempt; they were the first men to cross New Guinea in this area.

The various accounts of these hurried patrols, which earned for Karius the medal of the Royal Geographical Society, are the only descriptions available of the area in which Mr. Archbold's party plans to collect as it follows inland the trail blazed by Karius and Champion.

To the east the nearest collections from the mountains come from the Wharton Range about 450 miles away. To the west no collecting has been done nearer than the Snow Mountains a distance of about 200 miles which are still imperfectly known.

The expedition is going into a practically unknown area. It plans to stay there nine months or more where local assistance from the natives is uncertain and land travel and communication slow and precarious. But with the adoption of the most modern means of air travel and radio to the needs of a well organized and well equipped natural history expedition, it promises to be extremely successful. Besides blazing a trail into new country, the expedition is also adopting a new technique in exploration which will shorten the weeks and months of travel as experienced by the older explorers to hours and days in this new type of exploration of the future.

Astronomy and the Hayden Planetarium

During the month of March the subject of the Planetarium lecture will be "THE SEASONS."

On March 18, 10:45 to 11:00 P.M., there will be given the monthly broadcast of the Hayden Planetarium over Station WABC. This broadcast is entitled "THE DRAMA OF THE SKIES" and is presented by Clyde Fisher, Hans Adamson, and Bob Trout.

Planetarium Special Lectures

The two lectures scheduled for March, in the Second Series of Six Planetarium Special Lectures, are:

March 11—THE MIDNIGHT SUN: THE SKY AT THE NORTH POLE.

March 25—SPRING CONSTELLATIONS OF OUR HOME SKY.

These lectures will be given by Dr. Clyde Fisher, curator of astronomy and The Hayden Planetarium at 6 P. M.

Subscription to the series of six lectures is \$2.50. Admission to any individual lecture may be had only by subscribing to the entire course. The two March lectures are the second and third of the series.

Subscription tickets may be purchased at the Planetarium Ticket Office, or by mail—check made payable to E. Roland Harriman, Treasurer.

Amateur Astronomers Association

At the meeting of the Association on Wednesday, March 4, Mr. Joseph L. Richey, of the American Telephone and Telegraph Company, will speak on "ASTRONOMICAL FACTORS IN RADIO." This lecture will be illustrated with sound motion pictures and lantern slides.

At the meeting of March 18, Mr. Charles H. Coles, Research Bureau of Brooklyn Edison Company, will speak on "PHOTOGRAPHIC EXPERIENCES IN ASTRONOMY," with motion pictures and lantern slides.

These meetings are open to the public and are held at 8:15 P.M. in the Main Auditorium of the American Museum of Natural History.

Astronomical Exhibit

The Astronomical Exhibit, under the auspices of the Amateur Astronomers Association, was open to the public for sixteen days in late January and the beginning of February. During that time almost 15,000 persons visited the exhibit and displayed considerable enthusiasm.

The Foucault Pendulum, which was swinging continually across the floor of the hall, was the center of interest. By its apparent turning across the floor it gave visual proof that the earth is rotating on its axis. A daily demonstration was given of how the craters on the moon may possibly have been formed by the impact of large

meteorites long ago. During this demonstration the lecturer dropped, or threw, marbles and ball-bearings into a soft, flat mass of modeling clay mixed with water. It was found that under the right conditions craters were produced very similar to those now seen on the moon, even including the central peak Meteor Crater in Arizona is believed to have been formed in the same manner.

Another daily demonstration given by members of the Amateur Telescope-Making Class illustrated the method used in grinding telescope mirrors. The process and materials employed are similar to those used to grind the largest telescope mirrors in the world, including the new 200-inch glass which will be installed on Mt. Palomar in California. Also, in many cases were shown mirrors which were made by amateurs, and on the floor of the exhibit were displayed the tubes and mountings in which these mirrors are used. The largest telescope on display was made by Mr. J. McAdams of Hastings, New York, a 12 $\frac{1}{2}$ -inch reflector with a mounting weighing more than 200 pounds and an aluminum tubing.

Many charts, star maps, models of stellar distribution, star boxes, home made sextants, as well as similar products of commercial producers were also displayed. Also many astronomical books, old astronomical instruments, and a replica of Galileo's telescopes were shown.

The growing interest of the public in astronomy was conclusively demonstrated, not only by the interest shown by those attending the exhibit, but also by the large number of individual exhibitors who made it possible.

The Junior Astronomy Club

The ancient astronomers used to reckon the beginning of the year from the March equinox and the Junior Astronomers do likewise this year when their elections fall on the meeting of the twenty-eighth of that month. The present officers have carried the club through its most successful year with the publication of the *Handbook of the Heavens* by McGraw-Hill, and the successful revision and sale of the *Star Explorer*. The speaker for the March 14 meeting is to be selected by competition and will add another speaker to the already large number of Juniors who have qualified to lecture to the club, and to other groups who call upon the club's Lecture Bureau for speakers on astronomical subjects.

American Museum Lectures

CHILDREN'S LECTURES.—During March the free lectures for children of the public schools will be given on Fridays, at 10:30 A. M., as follows:

March 6—THE DUTCH AND THE INDIANS IN EARLY NEW YORK. A. E. Johnson.

March 13—MEXICO. G. L. Pratt.

March 20—THE STORY OF COMMUNICATION. J. R. Saunders.

March 27—ANIMALS, PEOPLES, AND PRODUCTS OF AFRICA. W. R. Smith.

SATURDAY AFTERNOON PROGRAMS.—These motion pictures will be shown at 2:00 P. M.

March 7—ANIMAL BABIES.

March 14—THE WORLD OF PAPER.

March 21—JOURNEYS IN EUROPE.

March 28—OUT WEST.

At 4:00 P. M., on March 21 will be given the first of four informal talks on the Cultural Appreciation of Gems, by Mr. Herbert P. Whitlock. It is entitled GEMS—ANCIENT AND MODERN. The second talk, on March 28, will be on THE ART OF THE LAPIDARY.

CHILDREN OF MEMBERS.—The March lectures for children of members are held Saturday mornings at 10:30 o'clock.

March 14—AFRICAN ADVENTURES WITH WILD ANIMALS. Capt. C. W. R. Knight.

March 28—WILD FLOWERS OF SPRING. Clyde Fisher.

MEMBERS LECTURES.—These lectures are held at 8:15 P. M.

March 12—ANIMALS AND PEOPLES OF NORTHERN BURMA. H. C. Raven.

March 26—IN THE SOUTH SEAS ON THE "ZACA." James P. Chapin.

Visual Education

Mrs. Grace Fisher Ramsey, associate curator of education at the American Museum, will address the Greater New York Safety Conference on March 5 at the Hotel Astor on "Visual Aids for Safety Teaching," giving sources of material that will aid the teacher in safety instruction, the standards by which the value of visual aids may be determined, and why the positive approach should be emphasized.

On March 13 Mrs. Ramsey will speak before the Geography Section of the New York Society for the Study of Experimental Education. Her subject will be "The Teaching of Geographic Relationships with Objective Aids." Her talk will be illustrated with many types of visual material from the American Museum, including miniature habitat groups, lantern slides, photographs, motion picture films, etc.

Lectures by Explorers

The American Museum is inaugurating a series of lectures for the general public, with a view to giving visitors an opportunity to hear from its explorers themselves a personal account of the Museum's important expeditions. The lectures are free and will be given in the auditorium of the Museum on Tuesday evenings at 8:15 o'clock, according to the following schedule:

March 3—BIRD ISLANDS OF PERU: Dr. Robert Cushman Murphy, Curator of Oceanic Birds.

March 17—HUNTING FOSSILS IN CANADA: Dr. Barnum Brown, Curator of Fossil Reptiles.

March 31—DAY AND NIGHT ON DOMINICAN TRAILS: Dr. G. Kingsley Noble, Curator of Herpetology and Experimental Biology.

April 14—GORILLAS AT HOME: Mr. Harry Raven, Associate Curator of Comparative and Human Anatomy.

April 28—DIVING IN CORAL GARDENS: Dr. Roy W. Miner, Curator of Living Invertebrates.

It is considered that this acquaintance with the field work upon which the habitat groups are based will add greatly to the interest of visitors to the exhibition halls.

The Bahaman Coral Reef Group at the American Museum

The Bahaman Coral Reef Group in the Hall of Ocean Life was completed during the latter part of 1935. Since that time the western end of the hall immediately surrounding it has been renovated and protective brass rails installed in front of the group, so that all parts of this two-story exhibit are now completely accessible to visitors for close inspection.

This exhibit, which was designed by Curator Miner, has been in progress for the past twelve years. To obtain material for it, Doctor Miner led five undersea expeditions to the Bahamas. The work has been executed under his direction by Chris Olsen of the modeling staff of the department of living invertebrates, assisted by Bruce C. Brunner and, at various times, by Dr. George H. Childs, Worthington H. Southwick and Herman Mueller, also of the departmental modeling staff. The upper background was painted by Francis Jaques and represents that part of the lagoon at Andros Island in the Bahamas where the studies of the coral barrier reef were made.

Forty tons of coral specimens, hundreds of gorgonia and other creatures of the coral reef, including sponges, crustacea, and fishes, were secured for this exhibit. About eight and one-half tons of steel were utilized in its construction, as well as extensive surfaces of plate glass. The two great sheets of glass protecting the front of the group are among the largest that have been installed in this city.

Many persons have participated in making this group possible. Among those who have taken part in the expeditions or who have coöperated with Doctor Miner in the field, besides Chris Olsen, Dr. George Childs, Herman Mueller, and Francis Jaques of the Museum staff, were J. E. Williamson, who contributed the use of his remarkable submarine tube in 1924 and accompanied the expedition of that year; John H. Phipps, in connection with the expedition of 1926; Hugh L. Matheson, in 1930; and Mr. and Mrs. Roswell Miller, Jr., in 1933. Mrs. Miner and Roy W. Miner, Jr., also accompanied and assisted in various expeditions. Among the supporters of the expeditions, including those who contributed boats, equipment, and other facilities, were the Angelo Heilprin Fund, Ford Forsythe, E. S. Toothe, Junius Spencer Morgan, Clarence L. Hay, Mrs. William Belknap, John S. Phipps, Daniel Bacon, Roswell Miller, Jr., and Edwin C. Moseley.

The Bahaman Government coöperated in the enterprise most effectively, and placed every facility at the Museum's disposal. In this connection, special thanks are due to the Governors of

the Bahamas who have been in office during the course of the work, namely, Sir Harry Cordeaux, Sir Charles Orr, and Sir Bede Clifford, as well as to the late Sir George Gamblin, formerly president of the Governor's Council, and Mr. Elgin Forsythe, Commissioner of Andros.

A group of this monumental character could be brought to completion only with the efficiently organized coöperation of Museum personnel with cordially interested collaborators and the support of generous benefactors.

Gorillas

"In Quest of Gorillas," Prof. William K. Gregory's record of the Columbia University-American Museum expedition across Africa is appearing serially in the *Scientific Monthly*. The first chapter was published in November, 1935, and succeeding parts will run throughout the year. The party included Mr. H. C. Raven, leader of the expedition, Prof. J. H. McGregor, Dr. E. T. Engle, and Professor Gregory.

Visiting European Museums

Dr. Robert T. Hatt, director of the Cranbrook Institute of Science at Bloomfield Hills, Michigan, and Mrs. Hatt (Marcelle Roigneau) sailed from New York January 31 on a short trip to England, Germany, and France. They will visit all the larger museums of Germany in the interest of Cranbrook Institute, returning to this country about the middle of March.

Exhibits in Memorial Hall

A committee of the education department staff of the American Museum has been appointed to take charge of the placing of timely and temporary exhibitions in Memorial Hall. The purpose of these exhibits is to bring to the attention of the Members and the public the latest additions to the collections, new exhibits for the halls, and other features pertaining to the Museum's work. For examination during January a model of the South Polar Cap was displayed, showing the route of Lincoln Ellsworth's flight across Antarctica, while near it were displayed some of the specimens collected on previous expeditions by Mr. Ellsworth and presented to the Museum.

Another exhibit was the reproduction of a monolith in the form of the human figure from Easter Island, collected by Dr. Harry L. Shapiro as a member of the Templeton Crocker Expedition to the South Seas.

In February an exhibit was made of implements collected from tribes in the center of New Guinea and presented to the Museum by Mr. M. J. Leahy. Another February exhibit was two mounted specimens of the giant panda, collected and presented by Dean Sage, Jr.

The March program will include the display of the model of the Coral Reef Group showing what the real Coral Reef Group in the Hall of Ocean Life is like.

These temporary exhibits are displayed for about two weeks each.

On November 26 at a meeting of the Fellows of the American Geographical Society, the Charles P. Daly Medal was presented to Dr. Roy Chapman Andrews, director of the American Museum of Natural History. The medal was presented by Mr. Roland Redmond, president of the American Geographical Society. The citation is as follows:

Doctor Andrews has said of himself, "I was born to be an explorer. There never was any decision to make. I couldn't do anything else and be happy." In satisfying his own instinct Doctor Andrews has contributed vastly to human knowledge. By his expeditions to Central Asia he has demonstrated that the day of the lone explorer, who merely gathered impressions by passing through an unknown country, is over. An expedition carefully planned and intelligently equipped to study in the field all the various aspects of the unknown, to gather collections of importance and to transport them to the laboratory, the workshop and the exhibition halls of civilization, is now the order of the day. Due largely to his work a new standard of exploration has been established.

His name is indissolubly linked with a vast region. Men in all walks of life associate his name with Mongolia much as they associate the name of the late Colonel Lawrence with Arabia. Thanks largely to Doctor Andrews' work the wild plains and wind-swept uplands of that vast country are no longer among the least known parts of the earth's surface.

To Doctor Andrews—Andrews of Mongolia—it is my privilege to present, on behalf of the American Geographical Society, the Charles P. Daly Medal, awarded from time to time by the Society for valuable or distinguished geographical services or labors.

Among the other recipients of the Daly Medal are Robert E. Peary, Roald Amundsen, Vilhjalmur Stefansson, Sir Francis Younghusband, Knud Rasmussen, and Captain Robert A. Bartlett.

Yellow Fever

Raymond M. Gilmore, who collected specimens for the department of mammals of the American Museum at the Harriman Ranch in Idaho this past summer, has been given a special assignment by the International Health Division of the Rockefeller Foundation to study and collect monkeys and other wildlife of South America in connection with the work of the Foundation on yellow fever. The American Museum has large collections of South American mammals and, more specifically, important series of New World monkeys, so that it enjoys a community of interest with the Foundation in the results of Mr. Gilmore's work in the field. When sufficient material and data have been assembled, Mr. Gilmore will be offered the facilities of the mammal department in making his identifications, comparing with the material in the department, and in following out any of the biological clues pertinent to the yellow fever problem. It is hoped that such mammal material collected

by Mr. Gilmore as will not be needed on permanent deposit as reference collections with the Foundation will eventually find its way into the collection of the Museum.

The plans for the work of Mr. Gilmore are of

special interest to the Museum because of the possibility of a close coöperation between the student of life histories and of biological data and the doctors leading an attack upon a menace to human life, namely, yellow fever.—H. E. ANTHONY.

RECENTLY ELECTED MEMBERS

A REPORT from the membership department lists the following persons who have been elected members of the American Museum:

Associate Founder

Mr. Templeton Crocker

Patrons

Mrs. H. P. Davison

Messrs. Max C. Fleischmann, Frederick M. Warburg.

Fellows

Messrs. William Bingham, 2d., William C. Wood.

Life Member

Mr. William S. Paley

Sustaining Member

Mrs. John J. White, Sr.

Annual Members

Mesdames Charles Brickell, Eva S. Browning, Moses H. Cone, Willard I. Emerson, Oliver D. Filley, W. A. Graham, Walter Huber, Lizzie F. Jones, Milton W. King, Christopher La Farge, Richard L. Livermore, Anne-Marie MacDonald, D. A. Moulton, J. Prince, Rita Sengstaken, Charles W. Stapleton.

Misses Elizabeth F. Broden, Ellen M. Bywater, Grace G. Engleman, Anna Hollwegs, Edith G. Marshall, Bertha A. Moat, Gertrude Moodey, Audrey F. Moritz, Rachel Hopper Powell, Maria F. Schuette, Helen Tompkins, Susan W. Underwood.

Doctors Philip G. Cole, Daniel Crosby, Ralph E. De Lury, George Draper, James Alexander Lyon, Frank R. Ober, James Ralph Scott.

Professor Earle B. Phelps

Messrs. Edward A. Bell, John Benson, Harry Blickstein, F. C. Bolles, Jr., N. H. Busey, Jr., H. C. Carpenter, Thomas I. Dowling, Martin F. Ernst, Fred W. Fuhrmann, James B. Gould, Andrew P. Hachtmann, George Watts Hill, W. Knowlton Hoag, George W. Hubbell, Eugene W. Kettering, William H. Kilpatrick, J. Frederick Larson, James McEvoy, Edward Q. McVitty, Henry W. Muller, George Pert, Auguste Richard, Otto Rucker, Whitney H. Shepardson, Barry C. Smith, Alonzo Williams.

Associate Members

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Raymond Coppinger, H. D. Cornelius, E. H. Denicke, Lewis B. Franklin, Henry G. Fritsche, Charles W. Hinckley, Milton J. Hoffer, Marie Kingsbury, Frank S. Lloyd, A. M. Loeb, John Lushear, R. McCarthy, H. B. McFarland, Mary Nelson, G. E. Rarig, M. N. Schnur, Clarence Southerland, Rush Sturges, Edith Tallmadge, Luella M. Wiers, Frederick H. Wiggin.

Mother Birchman

Misses Grace W. Andrews, Mamie G. Armsby, Marion Avery, Winifred Bartlett, Jane Colburn Belcher, Lulu N. Booth, Fern Bradford, Edith S. Brodney, Jemima O. Brown, Caroline Bullock, Gertrude Cahill, Elsie M. Calder, Mary H. Davis, Marjorie Dickieson, Constance Everett, Lilla A. Frohock, Gratia Goller, Diane Gould, Elsa C. Haupt, Lorena Hindes, Naomi Howells, Janet P. Jamieson, Elsie Kaisinger, R. Kapp, Pearl Keller, Helen Kerr, Sue A. M. Konn, Stella N. Krieger, Marjorie M. Lamm, Bertha M. Leathers, Elizabeth Morley, Neilsine Neilsen, Etheldreda L. Norris, Dorothy Pease, Marjorie Pease, Mame Priest, Caroline S. Rawlins, Olive O. Robinson, Elise E. Ruffini, Florence Sebastian, Florence B. Shawkey, Agnes Snyder, Jennie Stott, Adelene Sylvester, Clara Mae Taylor, Elizabeth W. White, Sarah O. Whitlock, Lenore Wilson, Maud May Wood.

Reverends A. R. Brown, Gerhard Bunge, Bradford Young.

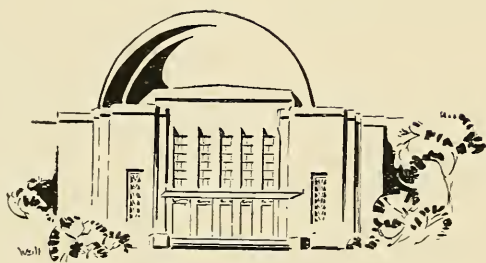
Lieutenant Morton D. Adams

Doctors Thaddeus Hoyt Ames, Harry E. Bacon, Eleanor S. Bancroft, William Bates, William A. Bennett, Edward W. Briggs, B. J. Brown, W. W. Bunnell, Sylvester, Cherniak, Eugene M. Clifford, Frank E. Collins, Henry N. Costello, John A. Doering, Wm. Epstein, Lucy G. Forrer, B. A. Fuld, Ruth Gilbert, Charles H. Green, Charles H. Greene, James E. F. Henry, Robert J. Hill, Donald H. Hooker, Ralph L. Jacobs, Irving W. Losee, Donald F. Munro, Frank D. Myers, George W. Papen, Wm. H. Perry, A. D. Pierce, Max Pollock, F. C. Rodgers, W. Vernon Ryder, P. V. Senegas, Hermann B. F. Seyfarth, George L. Shattuck, Leslie A. Spelman, George F. Stoney, Atle B. Suhrland, C. L. Thenebe, Louisa Paine Tingley, Charles H. Tozier, Everett C. Turner, Henry E. Utter, F. A. Walsh, Wm. A. Weinreb, Dwight E. Weir, R. W. Whitcomb, Norman C. Yarian.

Professors Charles J. Pieper, Carl N. Shuster.

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Reviews of New Books

Aquaria, Astronomy, Birds, Insects, Ferns, Mankind

1001 QUESTIONS ANSWERED ABOUT YOUR AQUARIUM. By Ida M. Mellen and Robert J. Lanier. Dodd, Meade & Co., New York.

THE recent growth in popular interest in aquarium fishes has been responsible for the appearance of an array of new books. Although the subject matter in these various aquarium books is much the same, the methods of presentation, the illustrations, and the number of species considered vary from book to book. The most recent addition to this group of aquarium books has been produced by Miss Ida Mellen, formerly of the New York Aquarium, and Mr. Robert Lanier, of the Steinhart Aquarium, of San Francisco. Doubtlessly, these two workers in the course of their professional duties, have had many occasions to answer questions in regard to aquaria under their supervision. The book they have just published, however, is far more than a set of answers to the most frequent questions raised by visitors to a public aquarium. It is actually a complete handbook, with chapters on fresh-water aquaria; tropical toy fishes; gold fishes; salt-water aquaria; outdoor aquaria, and terraria. It also includes hints on the care of diseases of fishes; methods of regulating the pH; ways to catch and ship fish, as well as various other items of interest to the keeper of fishes, frogs, turtles, and snakes.

In order to hold to a uniform plan of raising questions and then answering them, the authors have found it necessary to split up many simple subjects into small sections. Questions 395 to 400 run, for example—What is the disposition of *Rivulus*? What food is necessary for *Rivulus*? What water temperature is necessary? What size does *Rivulus* attain? How are the sexes distinguished? What are the characteristics of *Rivulus*? Such minute divisions of a simple subject make the reading difficult. The chapters dealing with terraria and native fishes are very brief. But the bibliography includes 236 titles which may tempt the student of aquaria to dig deeper. The book is enhanced by many illustrations, several of them in color.

In brief, the book in spite of its cumbersome method of presentation will remain a useful addition to the recent series of books which the student of aquaria should have near at hand.—G. K. N.

BIRDS AND THE SEA. By Frances Pitt. Longmans, Green & Co. London-New York-Toronto. \$2.50.

IN this series of essays, Miss Pitt has given us some animated sketches of several "wild goose chases," not only after wild geese of various sorts, but also in search of gannets and shearwaters, guillemots, puffins, phalaropes, loons, and numerous other species of birds (even including seals and meadow mice) which inhabit the coasts and islets of the British Isles. The author is a keen observer and a pleasing writer, and her descriptions of the habits and activities of the different species she has encountered on her excursions, not to overlook her own activities, make interesting reading.

Sometimes her statements are too sweeping when she is quoting from outside sources. Thus, one might query the note that the great northern diver stays on salt water, even in the breeding season, which is not unqualifiedly true of this species throughout its range; or that "it has been proved that birds subjected to artificial illumination will come into breeding condition (with consequent desire to migrate) in mid-winter,"—a statement that also needs some modification to escape all burden of error. Nevertheless, such errors are not frequent, and do not discredit the accuracy of the author's personal observations on the wild life she has studied in the field. Whether on the sandbanks of The Wash, the Cumberland coast, the Welsh Islands of Ramsey, Grassholm, Skomer, and Skokholm, the Farne Islands, or the Orkneys, or on the wild Norwegian lake where one scene is laid, she found always something of interest to record and something about which to speculate. This is no technical dissertation nor is it concerned with debatable problems, but it gives a running account of enjoyable days and nights afield and the lover of nature will find pleasure in the reading. Numerous excellent illustrations from photographs, presumably by the author, illustrate the book.—J. T. Z.

FERNS OF THE VICINITY OF NEW YORK. By John Kunkel Small, 285 pp., The Science Press, 1935.

FERN lovers will welcome this manual of their favorite plants,—ferns and fern allies,—of the New York region, written by one of America's highest authorities in systematic botany. For many

years the author had charge of the herbariums of the New York Botanical Garden, but this important position gives no indication of his indefatigable work for more than a third of a century as a field naturalist.

This little volume, it seems to the reviewer, leaves nothing to be desired in the way of a handbook for use in learning to know this group of plants. First, it is complete, covering all of Connecticut and New Jersey, eastern Pennsylvania, and southeastern New York. The parts of New England and New York not covered add but a few rare species to the eighty-five treated here, and those of Pennsylvania none. Second, it is popular, that is, usable by the amateur; and yet it goes beyond the usual information of elementary guides.

The full-page illustrations, one for each species, are the feature that make it useful for beginners in fern study and for those who do not like technical keys. The illustrations showing the fruit-dots (the sori and indusia), and the venation were very carefully drawn under magnification. We believe it is safe to say that the line drawings in Doctor Small's book are the best figures of our local ferns ever published. In fact, they are so clearly drawn that the fern specimen may be identified by simple visual comparison with the drawings.

This attractive manual should find wide use among Boy Scouts, Girl Scouts, Camp-fire Girls, Woodcrafters, and other beginners in fern study.

—CLYDE FISHER.

OUR ENEMY THE TERMITE. By *Thomas Elliott Snyder*. Comstock Publishing Co., Inc., Ithaca, N. Y. 196 pp.; 56 figures. Price, \$3.00.

POSSIBLY no other insects have furnished the basis for so great and so widespread human frauds as have our native termites. Doctor Snyder, who for years has been the federal government's authority on these interesting creatures, describes the situation very mildly in saying,

"Recently in the vicinity of New York City, and earlier in other localities, the normal spring appearance of winged forms of termites in or about buildings was used by unscrupulous agents to sell useless materials or perform expensive and ineffective treatments to buildings. Salesmen have been exaggerating the danger from termites in an effort to sell treatments, many of which have little or no merit, but which they picture as absolutely necessary to prevent the collapse within a short time of buildings invaded or under alleged danger of being invaded by termites. Home owners should be aware of overdrawn and alarming reports of injury to buildings by termites. In particular they should be wary when exaggerated statements of this kind form a part of the 'sales talk' for a termite treatment."

In this book Doctor Snyder has brought together a great amount of general information about termites. He tells of their distribution in time and space, of their "social" life superficially so like that of ants, of their "guests" and their

parasites, and of still other things that make termites intensely interesting to biologists. While these are not told with the literary charm of a Maeterlinck, the facts are there. Furthermore, this book is important to Americans because it exposes the termite "racket," shows the uselessness of various nostrums, and points out how care in construction of our buildings prevents trouble from termites, at least in northwestern United States at present. If you have become termite-conscious, buy a copy of this book. The "enemy," when properly understood, is not always dangerous, but ignorance may be expensive.—F. E. LUTZ.

INSECT ENEMIES OF SHADE TREES. By *Glenn W. Herrick*. Published by *The Comstock Publishing Co., Ithaca, N. Y.* \$5.00.

THERE has long been a demand for the kind of book that Professor Herrick has given us—a chronicle of the insects attacking shade trees and detailed instructions for their control. The value of a work of this kind depends upon several factors, chief of which is the ability of the reader to discover the name of the pest attacking his trees. Once this has been found, the next step is the determination of proper control measures and their application. If we presume that the reader is acquainted with the names of the trees ornamenting his property, we can promise that there will be little difficulty in recognizing the pest and applying the necessary control measures. Professor Herrick has so arranged his text that a chapter is given for each of the important shade trees of the United States, the insects attacking each are discussed and control measures outlined. The principal insect pests are described in sufficient detail so that they may be readily recognized, particularly if recourse is had to the many wonderful illustrations. It is these latter that particularly incite our admiration for this book. We have seen very few texts on subjects dealing with economic entomology so thoroughly illustrated, and none in which the entire ensemble has been of such a high standard.

We have often wondered about the value of a shade tree. Of course, it is not possible to give a definite value because so many things enter into the picture. But, disregarding any sentimental valuation, we find that a ten-inch elm on an ordinary residential lot having a value of \$20 a front foot would be worth \$200, while the same tree on the same frontage at \$5 a front foot would be worth only \$50. In shade value and popularity the American elm is placed at the top of the list for the eastern United States, while, the author points out, the poplar might conceivably be placed in the position of honor on our prairies. Certain trees are best suited to certain conditions. The chapter on materials and apparatus used in insect control is thorough and one on the treatment of weakened trees covers this important phase of tree health. The main chapters are arranged alphabetically according to common names of the trees so that they may be quickly picked out without recourse to the index. Of all the shade trees

the gingko stands by itself, being almost free of insect enemies and never, apparently, subject to noticeable injury.

To a well-rounded treatise on the main pests of the larger shade trees there is added a chapter on enemies of smaller trees and shrubs, enemies of evergreens other than pines and miscellaneous pests attacking not only trees but rustic wood-work. The only vertebrates causing injury to trees are squirrels. "Usually there is not much to be done. Often the squirrels are protected by law and in any case one does not wish to shoot them. Sometimes a supply of food can be furnished when the animals are actually suffering for want of it." This is one method of control for these usually welcome animals. A more ingenious one is given.

We wish to personally compliment Professor Herrick upon his fine contribution to the scientific knowledge of the enemies of our most valuable trees and upon the clear, concise manner in which he has dealt with a difficult subject. *Insect Enemies of Shade Trees* should find a place on the shelves of every one deriving pleasure from the grace and beauty that the trees add to our American homes.—C. H. CURRAN.

MANCHURIA, CRADLE OF CONFLICT. By *Owen Lattimore*. Revised edition. Macmillan Co., N. Y., 1935. 343 pp. \$3.00.

TO a large proportion of western observers Manchuria, or in its newer guise Manchuokuo, has become symbolic of new forces reshaping the destinies of the East. To the average layman Manchuria merely represents a vague province once loosely allied to, but now severed from China, and recently established under the protection of Japan.

The first of these views is neither accurate nor historically just. The second is superficial. In *Manchuria, Cradle of Conflict*, Mr. Lattimore has rendered a valuable service by his careful orientation of Manchuria. He has analyzed the geographic, the historical, and the ethno-cultural forces that have been operating for centuries. And from these neglected elements he has extracted a new and convincing concept of Manchurian history. The problems associated with Manchuria are not new. On the contrary, they are ancient. The recent events that have transpired in Manchuria are merely new expressions of age-old conflicts. The modern actors in the drama play traditional rôles.

The anthropological point of view in this book illustrates the great contribution that such studies can make to the proper understanding of modern conditions.—H. L. S.

THE HILL BHUIYAS OF ORISSA. By *Sarat Chandra Roy, M.A.* "Man in India" Office, Ranchi, India. 1935. 8 rupees.

THE Hill Bhuiyas of Orissa are a primitive, rather negroid people living in the hills of Central India. Mr. Roy presents in this account an ethnological description of them, together with some comparative notes on neighboring groups.

An appendix contains measurements of stature and of the head and face of one hundred adult male subjects.—H. L. S.

NEW BOOKS ON ASTRONOMY.

DURING this mid-winter season a number of very excellent new works on astronomy have appeared, covering several phases of the science, popular and scientific. It is proposed that several be reviewed later in these columns. They are on exhibition in the cases of new publications on astronomy, in the Planetarium. Among them are:

Consider the Heavens, by Forest Ray Moulton; an outstanding book—brilliant and fascinating—by a world-famous astronomer and one of the co-authors of the planetesimal hypothesis of the origin of the solar system.

Worlds Without End, by H. Spencer Jones, Astronomer Royal, of the Greenwich Observatory, England, and author of one of the leading texts on astronomy. The above two are popular:

Following are two books in the form of texts: *Highlights of Astronomy*, by Walter Bartky, associate professor of astronomy, University of Chicago; a new book, very modernistic in design, and used as a college text; *Astronomy*, the third edition of the standard textbook by Prof. John C. Duncan, Wellesley College; it contains additions and new material.

Other notable publications are several specialized books: *Eclipses of the Sun*, fourth edition, by Prof. S. A. Mitchell, well-known authority on this subject, who is keeping this valuable reference book up to date; *The Solar System and Its Origin*, by Prof. Henry Norris Russell of Princeton University, a technical discussion of the dynamic, physical, and chemical properties of our planetary system, and its theories of origin; *The Binary Stars*, a very technical treatise by Dr. Robt. G. Aitkin, Lick Observatory, and a leading authority on double stars; *Stars and Telescopes*, by Dr. James Stokley of the Fels Planetarium. In this work much of the history of astronomers and their instruments is taken up, forming delightful reading.

Two foreign books reserve mention: *Il Sole*, in Italian by Giorgi Abetti of the observatory at Arcetri, Italy. Professor Abetti is a world authority on this subject, the sun; *Lunettes et Télescopes*, in French, by André Danjon, director of the Observatory of Strasbourg, and André Couder, astronomer of the Observatory of Paris. This last work of xvi + 715 pages is a very technical and useful guide for practical astronomers who are particularly interested in telescopes [refractors and reflectors]. It is well illustrated, covers the optics of the telescope, invention and history of the different types, mountings, auxiliary apparatus, the construction, testing and use of the instruments, and has detailed lists of the great telescopes in use. The book does not overlap on the grounds of the two recent American books on the subject, Doctor Stokley's book mentioned above, and the excellent volume *Men, Mirrors and Stars* by G. Edward Pendray, with its absorbing story of great telescope men.—HUGH S. RICE.

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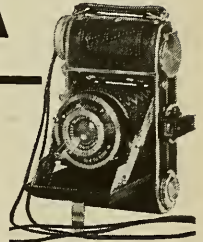
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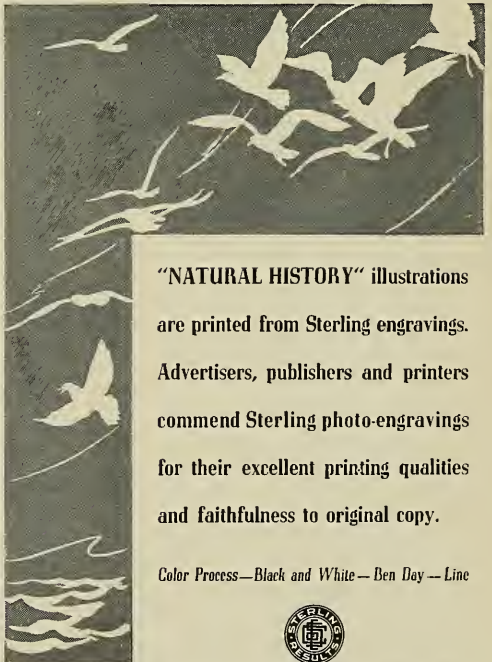
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The Journal of the American Museum of Natural History

VOLUME XXXVII

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PUBLICATION OFFICE: American Museum of Natural History, Seventy-seventh Street and Central Park West, New York, N. Y.

EDITORIAL: Edward M. Weyer, Jr., Editor; A. Katherine Berger, Associate Editor; Frederick L. Hahn.

Manuscripts should be sent to the Editor, The American Museum of Natural History, New York, N. Y.

SUBSCRIPTIONS. NATURAL HISTORY is sent to all members of the American Museum as one of the privileges of membership. Membership Supervisor, Charles J. O'Connor.

ADVERTISING: Sherman P. Voorhees, The American Museum of Natural History.

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A PRIMITIVE HOME IN RAPA

A Polynesian house, well built of native materials from palms, bamboos, and screw-pine leaves, is a joy to the eye.

All too many, nowadays, are made of sawn lumber, often imported. A grass hut of this simple type is a rarity

Through Southern Polynesia

Exploring some rarely visited islands of the South Seas, including Pitcairn and Easter—The second stage of the Templeton Crocker Expedition

By JAMES P. CHAPIN

*Associate Curator, Continental Old World Birds,
American Museum*

TEN days the "Zaca" had lain alongside the busy wharf at Papeete, the "hub" of French Oceania. Schooners arrived from the Tuamotus with cargoes of copra. Smaller fishing boats brought their abundant catch to market. A transpacific steamer discharged a cargo of lumber.

The "Zaca" was being prepared for the long voyage of five thousand miles to Valparaiso. It was now November, and we could expect the best weather of the year in that breezy belt of ocean, near the tropic of Capricorn, marking the southern fringe of Polynesia. Frequent easterly winds were certain to delay our progress, if nothing more, as we cruised through the Austral Islands and on to Rapa, Pitcairn, and Easter Island.

Earth's watery half

Take a globe and examine the half that includes the Pacific Ocean. You will be impressed by the small proportion of land visible on that side. Western North America and Australia are on its opposite fringes, and Tahiti is a tiny speck in the middle of a vast area dotted with many groups of islands, often separated by hundreds of miles of fickle ocean. If the first navigator in the Mediterranean had a heart of triple bronze, what shall we say of the brave Polynesians in canoes who discovered and colonized the majority of these Pacific islands? Starting from somewhere in Asia without compass or chart, they reached New

Zealand and Easter Island. In his comfortable "Zaca," the last word in schooner yachts, Mr. Crocker was now taking us in the wake of some of the ancient Polynesian explorers.

Off for Rimitara

At daybreak on November 23 we sailed southward from Papeete for Rimitara in the Austral Islands, a group sometimes also called the Tubuai Islands. For hours we watched the misty heights of Tahiti, where Orohena Peak, rising 7321 feet and seldom ascended by man, gave us an occasional glimpse until noon. The Austral Islands are mainly composed of volcanic rock, with coral reefs about them, sometimes hilly or even mountainous, yet not large. We were to visit three of the five islands, mainly for the study of their human inhabitants.

The voyage to Rimitara took only fifty hours. There are no gulls on these waters. A few shearwaters (*Puffinus*) or gadfly petrels (*Pterodroma*), red-tailed tropic birds (*Phaethon rubricaudus*), and boobies (*Sula*) are the birds usually seen. The boobies, like our northern gannet, have stream-lined bodies, almost cigar-shaped, propelled by energetic pointed wings, and dive expertly. The tropic birds have two long, red tail-quills, so slender as to be all but invisible against the sky. They seem inquisitive, often flying up from astern to look over the ship and squawk. The shearwaters and petrels keep more aloof, but their scaling flight is perfectly distinctive.

Close to land other sea birds appear. Approaching Rimitara, we were met as usual by

blackish-brown noddies (*Anous stolidus*), and graceful, pure white terns (*Gygis alba*), two of the commonest species in all the islands of this region.

Rimitara is a small, low island, formed partly by volcanism, partly by the upraising of coral rock. Landing is more difficult than it looks. From one apparently smooth beach two men came out in a canoe to warn us off. We should land at a spot where there seemed to be no beach at all. There we jumped out on the reef and walked up through great *Casuarina* trees, suggestive of pines, to a road leading to one of the three principal villages.

Austral Sabbath

It was Sunday, and nearly everyone was in church, a white stone building dated 1857. Christianity has taken firm root here, a large church dominates every village of any size, and the minister is usually a native. My day was spent largely in the woods, where there were but two resident land birds, a grayish warbler (*Conopoderas vaughani rimitaræ*) and a beautiful little red-breasted lory (*Vini kuhli*).

Out on the shore a few gray reef herons waded and fished. I know that if my work as a zoölogist had been there, I should have been so busy as to regret leaving. It was Mr. Crocker who always devoted a fruitful part of his time to collecting algæ, invertebrates, and fish from the tide pools.

A run of one night took us to Rurutu, the next island to the west, much larger and higher. One of its eminences, Mt. Manureva, rises to nearly 1300 feet. There are coconut groves and some woods with trees of relatively few kinds, and its hills are often grown over with ferns and grasses.

Some 1500 natives dwell here, as well as five whites and a few Chinese storekeepers. Avera Bay, our first anchorage, is partly filled by a broad, fringing reef. Through it runs a deep pass, so that the islanders are able to bring in the schooner they own, and moor it in a small basin. The village was not at all primitive. Here, as in Tahiti, mynahs (*Acridotheres tristis*) had been introduced, and there were no native land birds. Some of the cliffs attracted white-tailed tropic birds (*Phæthron lepturus*), whose long streamers are so broad they can be seen from afar.

The next morning we rounded the island and visited Moerai, where dwelt the French police officer, his wife, and three Americans. Father Olivier, Breton missionary on Tubuai for the past fourteen years, was also here for a visit. With him and the Seabrooks, a studious couple, my time passed all too rapidly.

The village school under the charge of a Tahitian schoolma'am and a male *moniteur*, held 120 youngsters. All rose at once and said "*Bonjour, Monsieur*" as I looked in. They learn in French but seem to forget all too much of that language after they leave school.

During our two evenings off Moerai we were favored with the most memorable fishing scene I have ever known. After nightfall, a half dozen large rowboats would put out through the reef to row back and forth, catching flying fish. The sport was illuminated by a huge torch of dried coconut leaves held aloft in the bow of each boat. Its flare, designed to attract the fish, showed us the oarsmen, the helmsman, and two or three men holding nets at the alert. One of them leaned out over the bow, his movements showing how frequently the fish rose to fly toward the blaze. Each torch burned about five minutes, then a new one was lighted. Our own submerged light attracted only a half dozen of the same fish, most of which escaped. This time the Polynesian method won.

Thanksgiving dinner

Passing just within sight of Tubuai Island, we continued toward Raivavae. On Thanksgiving Day the sea was so rough that Mr. Crocker's splendid dinner was eaten with some misgivings. Only a "dare" prompted a second helping of turkey. Another equally hard day followed and the next morning Raivavae showed the tops of its mountains, looking like separate islets. Finally they all joined up, and at four in the afternoon we dropped anchor outside a barrier reef that encircles the whole island. It is barely five miles long, yet rises in a narrow ridge with several peaks to 1434 feet.

About the vertical cliffs along this ridge both kinds of tropic birds were flying. There were more red-tails than white-tails. A half dozen small gray noddies (*Procelsterna albivitta*) seemed also to nest there. The talus at the base of the cliffs was wooded, but the

grassy higher levels on Raivavae support a few hundred goats of varied colors.

We soon acquired a native guide; and with Toshio Asaeda, our photographer, and two sailors, I spent a day following the crest of the high ridge. There was a narrow trail, worn rather by goats than by men, with many ups and downs. We heard a wild rooster crow, and later a hen clucking excitedly. There were guava bushes and orange trees up here, candle-nut trees and gnarled *Metrosideros* trees with bunches of small red flowers.

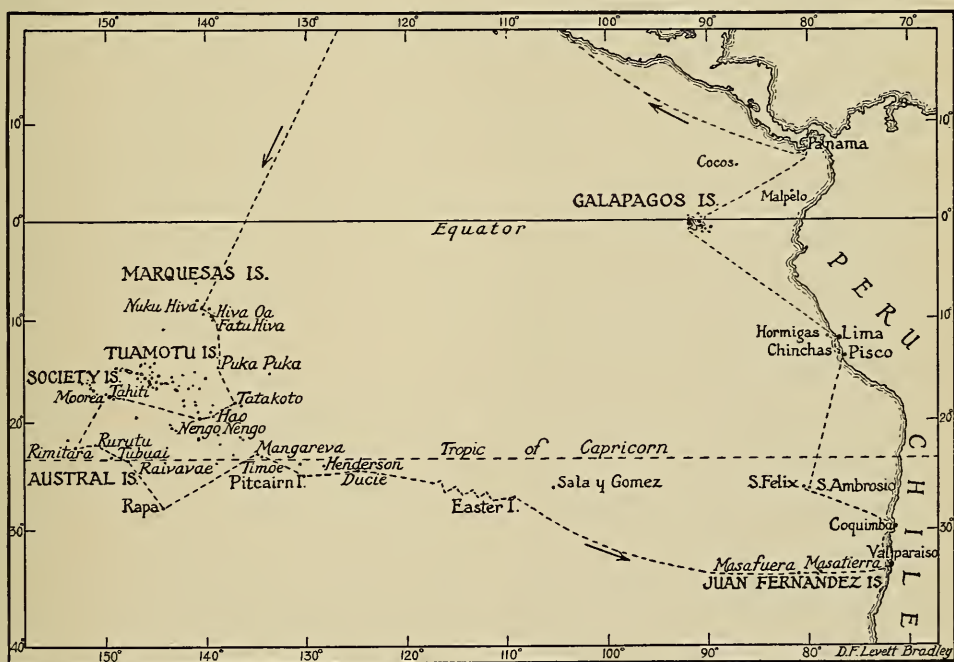
A little after noon we stood on the summit of Mt. Hiro, highest of them all, with a thrilling view over the whole island, its encircling reef, and several palm-covered widenings of the reef. Some shallow parts of the lagoon were white, with coral sand beneath. Other stretches were vividly green or blue-green, and the water over large patches of live coral dull dark blue.

There were no mynahs on this island, nor any indigenous land birds. Along the road-sides were an unusual number of the small lizards, brown with brassy stripes, to be seen on nearly every island.

Sailing from Raivavae, we had a good view of the wreck of a large schooner, high on the reef. This was the "Maréchal Foch," originally Zane Grey's "Fisherman," but later sold for commercial use. On her first visit to Raivavae she met her doom.

Rapa is sometimes included among the Australs, though lying much farther south, in latitude 27° S., about 320 miles from Raivavae. We were now going to a relatively cool island well off all ordinary courses. On the way, as usual, we watched for sea birds, a pursuit in which my friend Jaques is expert. Field-glass bird-study in the Pacific is no simple matter. The shearwaters and gadfly petrels in particular are a never ending puzzle. These two groups are easily confused, their flight is similar and they seldom come close. Many are alike in their gray, brown, and white coloration, while a blackish bird may belong to either genus, or may be only a dark color-phase. They wander far from their home islands, and many a doubtful identification is inevitable.

The morning of the third day showed us the northwest corner of Rapa, an island only



THE LONG ROUTE OF THE YACHT "ZACA"

The Templeton Crocker Expedition sailed nearly 14,000 miles in the Pacific Ocean. The portion discussed in the present article lies be-

tween Rimitara in the Austral Islands and Easter Island; a region very seldom visited by naturalists

five miles long and four wide, deeply cut by bays, and eroded to a jumble of sharp peaks. The outer coast has many promontories ending in vertical cliffs. The slopes elsewhere seemed green and grassy, with a few trees but no palms. The first birds seen were a flock of fifty gray noddies hovering over the water, surprisingly like small petrels. A few white terns, common noddies, and red-tailed tropic birds soon appeared.

Going around to the easterly side, we waited off Ahurei Bay until an elderly native pilot was paddled out in his boat. This bay goes far into the middle of the island, but its inner half is very shallow, with patches of growing coral. No reef encircles the island. On the shores of the bay grow a few coconut palms, but they do not prosper.

We found most of the people considerably browner than the average Polynesian, as a result—it is said—of the liberation of eighteen New Hebrides slaves nearly a century ago. Pure-blooded Rapans have become rare. Their houses were all more primitive, and regrettably dirtier than in the islands to the north.

Not enough men

The young men of Rapa are said to be so attracted by sailor-life that the stay-at-homes are always outnumbered by the women. In the little village of Ahurei there were forty marriageable women still unattached. So at least I was told by the two Frenchmen we found living there. Other settlers were an Australian, a Canadian, and two Japanese.

Horses, cows, and goats thrive on the island, European vegetables grow well, and the most abundant food plant was taro, cultivated in flooded fields with dikes. Many bananas are raised, and coffee for export to Tahiti. Much of the country visible from the bay was grassy but we were assured that there was fine rain forest on some of the higher mountains.

My first desire was to get up in the hills, and it was well rewarded. Looking down beyond the first ridge, I gazed into a well-watered valley with thick, verdant woods in its right half. From the taro fields near Hiri Bay women were carrying heavy bundles up the winding trail back to the village.

Farther along this ridge, still higher, there was one of the old native forts, of which we

had already noticed eight or nine, always on hilltops. A visit was paid to this one, a high terrace or platform, roughly triangular and about a hundred yards long, surmounted by a round tower some thirty feet high. Largely of earth, it had retaining walls of stones where needed. They must have been a quarrelsome people who built so many strongholds on so small an island.

From the ridge we could look down upon the gaudily colored fruit pigeons (*Ptilinopus huttoni*) flying from tree to tree, and hear them cooing. But climbing up or down this steep wooded slope, breaking a way through the ferny undergrowth, was hard work. The pigeons easily kept out of our way. The other birds that came flying over were the usual terns and tropic birds, with an occasional petrel (*Pterodroma neglecta*). There were no warblers on Rapa, and the large brown cuckoo (*Urodynamis taitensis*) that visits most of these islands between March and September had left for its breeding grounds in New Zealand.

While the cuckoos are away in the south, other migrants come from still farther away in the north. The wandering tattler, bristle-thighed curlew, and golden plover all nest in the region of Alaska. What navigators they must be to locate their winter resorts with such accuracy and regularity!

In marshy spots in the lowlands there were small dusky rails (*Porzana tabuensis*) and a fair number of brown wild ducks (*Anas superciliosa*). Though widely distributed in Polynesia, this duck had always eluded us elsewhere.

Interesting plants

While Rapa had not a great many kinds of birds, it delighted me with its variety of plants. The general uniformity of the flora on the other volcanic islands was suddenly broken here. Many old acquaintances like the "purau" (*Hibiscus tiliaceus*), candlenut tree (*Aleurites moluccana*), and "ti" plant (*Cordyline fruticosa*) were here, and in addition a great many plants I had never seen before. One was a *Freycinetia*, like a screw pine (*Pandanus*) but slenderer. Amid its spiky leaves were flowers encased in fleshy red bracts, which were eaten avidly by the natives. Maybe they contained vitamins, to me the taste was not tempting.

A blueberry bush (*Vaccinium rapae*) was a surprise. The tree ferns always delighted me. I would have found many rarities if I had had time to go farther inland and higher. All this suggested a possible connection in the distant past with some land toward the southwest.

Our three busy days on Rapa were not enough for a trip to Perahu, the highest peak, reaching 2077 feet. Early on the fourth day our native pilot climbed down into his outrigger canoe and we were off for Mangareva, in warmer waters.

The Gambier Islands, of which Mangareva is the largest, lie off the southeast extremity of the Tuamotu Archipelago, just within the tropic. They are a small group of about ten volcanic islands, with a great coral reef enclosing them on three sides. Inside it are dangerous beds of corals, and large pearl oysters abound.

Mangareva's great church

We entered this lagoon too late to reach Rikitea, the shady village where the French Administrator resides, and anchored off Mount Duff, a striking peak on the south corner of Mangareva. At its base stands a small building of ecclesiastic form, the tomb of old King Maputeoa. Only after we rounded a headland the next morning could we see Rikitea and its enormous white church, almost a cathedral. On the stone pier we were met by the Administrator, Monsieur Tondon, and his radio officer. The Administrator had practised law for twenty years in China, where he had known our old friend and colleague, Dr. Walter Granger. Our welcome here was naturally most cordial.

The great church at Mangareva was about 100 feet long, built of stone and roofed with red tiles from France. The altar decorations were of mother-of-pearl, and inside the main door hung a painting by Eskridge, author of a book about Mangareva. Although a Protestant mission ship first reached the island and named Mount Duff, it was Father Laval coming from Chile in 1834, who converted King Maputeoa with his people. Then began the stupendous enterprise in masonry. Besides churches, he constructed convents, schools, storehouse, a jail for the mission, and a palace for the king. When the king died, he was laid in a truly royal sepulchre.

Sadly enough, the population of the islands began to dwindle. From thousands it has fallen to a few hundreds. Trees have grown up within the walls of abandoned convents. The church, however, is in perfect condition, and we found Father Ferrier ministering to the people of the Gambier Islands, where he had lived for forty-eight years. Another resident, an American figuring prominently in Eskridge's book, told us also native stories of "tupapaus" or ghosts, and of the mysterious black footprints which always predict calamity when they appear on the beach.

The summit of Mount Duff beckoned to me. As the side nearest the village was uncomfortably steep, I climbed by the gentler northern slope, through coarse grass at first, then shorter grass, ferns, and rocks higher up. From a shoulder near the top we saw a golden plover take wing with a shrill call, and here were dandelions in flower. Eight or ten tropic birds were flying about the peak, which rises some 1300 feet. Two of their nests we located, in crevices almost covered with ferns, each occupied by a single nestling, which protested with a long, trilling screech.

From this airy spot we could look down on the whole island and all its neighbors within the great reef. Off to the southeast we could just see Timoe, nearly thirty miles distant. The colors in the water were jewel-like. We knew how the Gambiers look to frigate birds—two were soaring in our vicinity—and I hated to go down into the heat of the shore.

Mangareva has a few white inhabitants who were born there. Clément Schmidt, who had charge of the dispensary, was the son of a Dane and a Chilean, and served in the army in France during the World War. Two of my evenings were spent developing photographs in the village jail, which had been vacant a long time. Its floor was littered with the skeleton of a goat that had wandered in to die. There had once been prisoners who had amused themselves drawing pictures with charcoal and signing their names on the white-washed walls. At Tondon's suggestion, I added my name to the roster, since I also had been a jail bird.

The old and the new

Modern Polynesia is full of strange contrasts: outrigger canoes and yachts with Diesel

motors, gold crowns on native teeth, sewing machines stitching Polynesian hats. As we threaded our way out between the treacherous corals, Monsieur Tondon was sending a radio message to the "Zaca," wishing us a friendly "bon voyage."

In four hours we were abreast of Timoe, an atoll two and a half miles long with palms and low trees. Here were boobies, frigate birds, red-tailed tropic birds, crested terns, noddies, and white terns, all of which should nest there. Landing through the heavy surf was hopeless. We could see the broken remains of the schooner "Pro Patria," wrecked while bringing Norman Hall back from Pitcairn Island.

It was now little more than a day's run to Pitcairn, two square miles of subtropical island supporting a community of world-wide fame. I expected it to be of far greater interest to Doctor Shapero than to me, for I knew its birds were few, and scarcely suspected the far deeper appeal of its human inhabitants.

The island was in sight on the evening of December 22. About twenty miles away the "Zaca's" motor was stopped, the helm lashed far over to starboard, and we drifted for the night. The electric light hanging in perfectly clear ocean water attracted some flying fish and a number of pelagic water striders (*Halobates*). These frail little skaters are sometimes seen a couple of hundred miles from land where no other insect dares venture.

Lonely Pitcairn

Pitcairn is often a dangerous anchorage. Yet we spent eight days there with good weather. We came in the southern summer, and the rains fall largely in winter. Two big whale-boats, each with fourteen oars, put off from Bounty Bay. Presently we had fifty-four men, one little girl, and a couple of boys crowding our decks. The total population is only slightly over two hundred. Conspicuous among them was Parkin Christian, Chief Magistrate for the year, a natural leader, with appropriate build and voice.

Each day except Saturday, their Sabbath, we went ashore in the islanders' boats, thirty-seven feet long, ideal craft for their cliff-girt home. The road from the boat sheds up to Adamstown was a steep two-hundred-foot

climb, this village being scattered over the sloping plateau above the cliffs along the north shore.

Higher up are wooded slopes and farms, the land rising to a rim about 900 feet above the sea near the south side, and to 1200 feet on the west. Norris Young volunteered to guide me, and over the whole island we tramped with Norris or his son Henry. We looked down the steep southern cliffs where Norris's brother-in-law had fallen while hunting goats, and where one of the first settlers met her death while gathering birds' eggs.

Only two land birds

At the time of our visit there were few sea birds nesting there. Common noddies and the smaller gray noddies do so, no doubt; and perhaps a few petrels. Red-tailed tropic birds were seen but they prefer uninhabited islands for nesting. Few boobies and frigate birds were seen at Pitcairn, and the sea bird breeding population has probably diminished greatly since it was settled.

The islanders told us that they had only two land birds, a "sparrow" and a "hawk." The sparrow proved to be a warbler, closely allied to that of Rimitara, very numerous everywhere in the trees, and exceedingly tame. Although it was breeding at the time, we never heard one of these Pitcairn warblers sing. Rather weak call notes were their only utterance. The so-called hawk was certainly the brown cuckoo from New Zealand that winters here. Of these Jaques saw just one, and I none, for it was the wrong season.

The woods on Pitcairn contain many of the usual Polynesian trees, one known as "miru" being so highly esteemed for its red-brown wood that the supply was running down. The tree called "tapau" was rather beechlike in general appearance. Another conspicuous tree (*Metrosideros*) varies somewhat from island to island, but had been seen in bushy form as far back as the Marquesas. The *Pandanus* forms open groves through which one may walk, and tree ferns (*Cyathea cumingii*) like those of Rapa are scattered through the higher wooded levels. There were at least two groups of very large banyan trees, with innumerable trunks and aerial roots. One introduced tree, the rose apple, was

rapidly spreading upward in the woods, crowding out the indigenous species. The cloth-tree (*Broussonettia*), the bark of which furnished the Polynesian tapa cloth, has almost disappeared. The fine coconut palms bear little or no fruit.

What with farming, goat-hunting, fishing, and the upkeep of their homes, the Pitcairn people find plenty to keep them busy. Produce and wood are trundled down to the village in rugged wheelbarrows. In their spare time the men carve canes and inlaid boxes from wood, which with baskets made by the women are sold on the steamers that stop well off the island on their way between New Zealand and Panama. Each evening after we returned safely to the "Zaca," the men in the boat would sing in chorus as they cast off to turn shoreward. A kindly religious spirit was very noticeable on Pitcairn.

Doctor Shapiro was the busiest of us all at this stopping-place, studying the islanders from every angle, making the very best of an opportunity he had sought for years, while Doctor Lyman, our surgeon, rendered them every possible service. On Christmas Day the annual elections were held, and two days before we left an outdoor afternoon dinner was given in our honor. The copious victuals included soups, fish, chicken, goat, white and sweet potatoes, salad, pumpkin pie, sliced pineapple, and lemonade or tea. Parkin Christian made a pleasant speech, to which Mr. Crocker replied most gracefully.

On the morning of New Year's Day a large share of the populace came out to bid us goodbye. A race was rowed between two of their large boats, and then toward noon came the last farewell, with the singing of "God be with you." These fine people had won our deepest respect and sympathy. A little before sunset Pitcairn was so low on the horizon that it seemed split in two. One half began bobbing up and down behind the swells, then the other appeared to divide in three, and as darkness fell just one small bit remained in view.

Another day of smooth sea followed, and on the morning of the third day Ducie Island appeared, a low atoll with two main sections bearing many low trees and bushes. We speculated as to the possible kinds of trees and other plants we should find. But as soon as we

had waded ashore, it became evident that every tree and bush belonged to a single species, *Tournefortia argentea*, of the heliotrope family. Neither could we discover any other flowering plant or even a fern. Some of the *tournefortias* rose like trees, others branched from the ground up into large dome-shaped shrubs.

Along the beach like a straggling committee of welcome sat white boobies (*Sula dactylatra*) with their young. Red-footed bobbies (*Sula piscator*) and frigate birds (*Frigata minor*) nested in low trees. Noddies and white terns were there, too. Hearing strange noises under the shrubbery, we crawled in and found a small blackish shearwater (*Puffinus nativitatis*) and the slightly larger Kermadec petrel (*Pterodroma neglecta*) nesting there. A few of their eggs were seen and four or five of their fuzzy gray young, like powder-puffs with eyes and a beak projecting from one end.

Equally delighted we were to find red-tailed tropic birds, each with a nestling or a single egg in a shady hollow amid coral fragments. The strawlike middle tail feathers, coveted by natives, can be plucked from the sitting bird.

On the beach of this remote island lay many pieces of timber. Some were old ribs of a ship, with large copper bolts. What a place to be wrecked! A year might easily pass before any ship would come near Ducie.

Heavy weather

Our friends on Pitcairn had prayed for fair weather during our long voyage to Easter Island. For two days beyond Ducie their hopes were fulfilled. Then an easterly wind began to kick up a sea. The spell of bad weather and head winds that ensued lasted a full week. Day after day we tackled, usually with one motor running. Seasoned though we were, we found our sea legs none too steady. A day's run scarcely averaged eighty-five miles and one was only thirty-six.

About midway between Ducie and Easter, late one afternoon, came the cry "Ship ahoy." She was the steamer "Mahana," bound from Wellington for Panama—the first ship we had seen when out of sight of land, after cruising some 6500 miles.

Near noon on January 13 we sighted the northern corner of Easter Island, 1969 feet high without any protruding peak. A couple of hours later the southeast corner, occupied by the great crater of Rano Kao, rose from the sea. Next followed some intervening cones, like little islets between the big ones, and finally the whole mass fused together.

Doctor Shapiro has already described this unparalleled island in *NATURAL HISTORY* for May, 1935, with special attention to its people and their history. I shall deal mainly with its birds. The man who insisted on serving me as guide was Moises Tuki, a step-nephew, as one might put it, of Clément Schmidt of Mangaeva, but with considerable native blood. The elder Schmidt left offspring on both islands.

On foot and on horseback we covered much of the western part of the island, which is roughly triangular, about thirteen miles across. Easter Island was reputed to have two species of land birds, both introduced from South America. One was *Pezites militaris*, a red-breasted troupial, which Moises assured me had become extinct. The other, a tinamou (*Nothoprocta perdicaria*) is now abundant in the open grasslands that cover nearly the whole island. It rises like a partridge on whirling wings, with a reiterated whistling note, but is not easy to put up a second time.

Other birds, however, have been introduced more recently. House sparrows from Europe, probably by way of Chile, are common about the village. Near the groves of trees planted in the vicinity lives a gray Chilean finch, *Diuca diuca*. One of the common birds of prey in Chile, *Milvago chimango*, has likewise been liberated, and a few pairs now frequent the crater rims of Rano Kao and Rano Raraku.

Egging competition

In olden times the people here developed a strange interest in bird study. A yearly competition arose to secure the first egg laid by a sacred bird which returned annually in September to breed on the islets off the southwestern corner of Easter Island. To me these rocks were of great interest as the principal home of the sea birds living about the island. Kao-Kao, nearest to shore, is a single rock, towering up over two hundred feet. Motu Iti (little island) and Motu Nui (big island)

lie farther out, close together. They are lower and broader, and on them live by far the greater number of birds.

There nest the sooty terns (*Sterna fuscata*) still known as "manu tara" or sacred bird because theirs was the coveted egg. Their numbers were hard to estimate. Flocks of considerable size were always going out to fish, and I have counted two hundred flying off at our approach, the air filled with their excited, ringing calls.

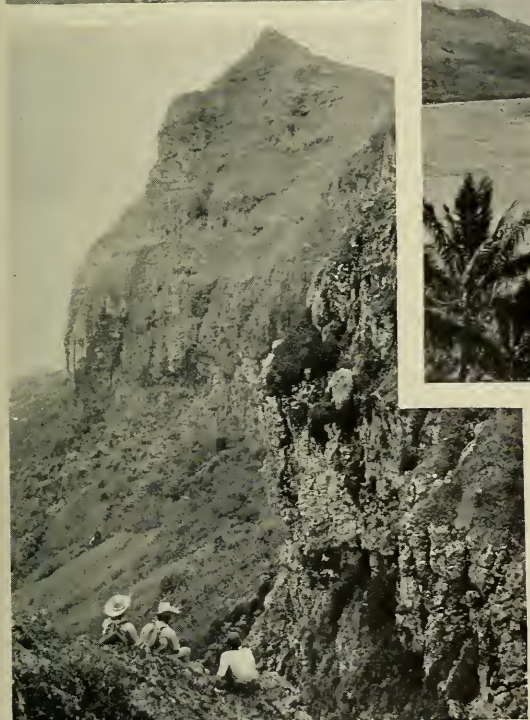
There may well have been five times that number breeding on the two islets. Common noddies must be about equally abundant, and the smaller gray noddies were seen in lesser numbers. A few white terns live there, though there are no trees. Over the waters near by there were usually some gadfly petrels (*Pterodroma heraldica*), and sometimes a dozen flew back and forth over the top of the islets. One day six frigate birds took wing from Motu Nui. About the steep sides of Kao-Kao noddies hovered and cawed, while a half dozen white boobies sat placidly near its summit. Red-tailed tropic birds seemed to prefer the high cliffs of the main island.

The natives, I found, are still interested in the birds of the islets, though the social significance of their egg hunt vanished nearly seventy years ago. One morning I stood looking out from Orongo, the group of stone huts on the mountain where notables used to gather during the "egg race." Down off Motu Iti a rowboat was tied, and some men on the rocks were collecting eggs. A second boat was passing Kao-Kao rock, and landed at Motu Nui. The egging party soon assembled on Motu Iti about a fire, and we saw them return to the village that evening.

It was a real privilege on my last day to visit Rano Raraku, where all the huge images were carved, and where many are still standing. Before these grim relics of a past without history, ornithology was forgotten for a time, until a pair of hawks with a nest in the neighboring cliff came swooping down at us in noisy protest.

Six days on Easter were an experience to be cherished. The next land on which we would set foot, the outer island of the Juan Fernandez group, was 1545 miles away. There lives a large humming bird, proclaiming the land as American.

Through Southern Polynesia



Photographs by Toshio Asaeda

(Top) Coming ashore on Rimitara, Doctor Lyman walks gingerly over the weed-grown reef and around the clear tide pools

(Center) Avera Bay at Rurutu is almost filled by a broad reef, built perhaps in larger measure by algæ than by true corals

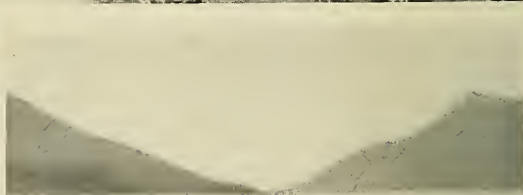
(Left) On the way to Mt. Hiro on Rai-vatae, the party rests and looks ahead from a notch in the ridge



Women of Rapa making "poi" of taro root. The sticky cold pudding is then wrapped in green leaves

Papeete is strangely flyless, but Rapa has plenty. Every return to the yacht adds its unwelcome quota

Ahurei village on Rapa, marked by its large white church, has a background of old volcanic pinnacles



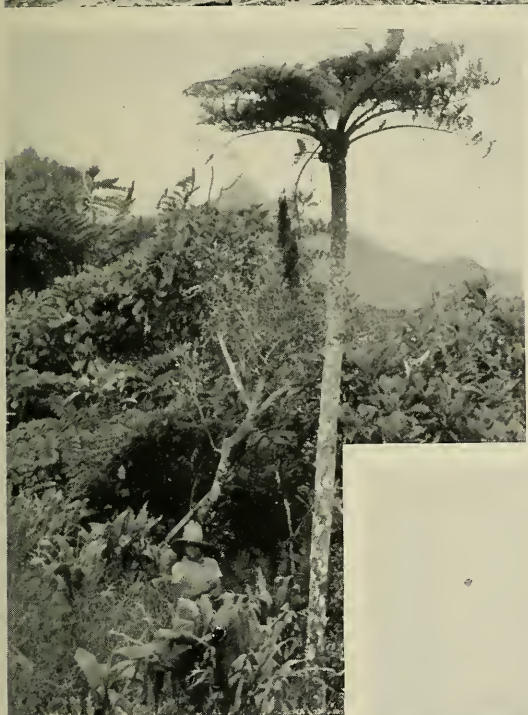
Photographs by Toshio Asaeda





Toshio Asaeda

(Above) The kitchen in Rapa has no roof, and its primitive utensils serve side by side with old iron oil-barrels



(Left) Tree ferns adorn the thickly wooded hillsides on Rapa, where the luxuriant vegetation is a pleasant surprise

(Below) An old fort on a hilltop. Would that ghosts might arise to tell of their battles long ago





Toshio Asaeda

(Above) The mausoleum of King Maputeoa, stands below the cliffs of Mt. Duff

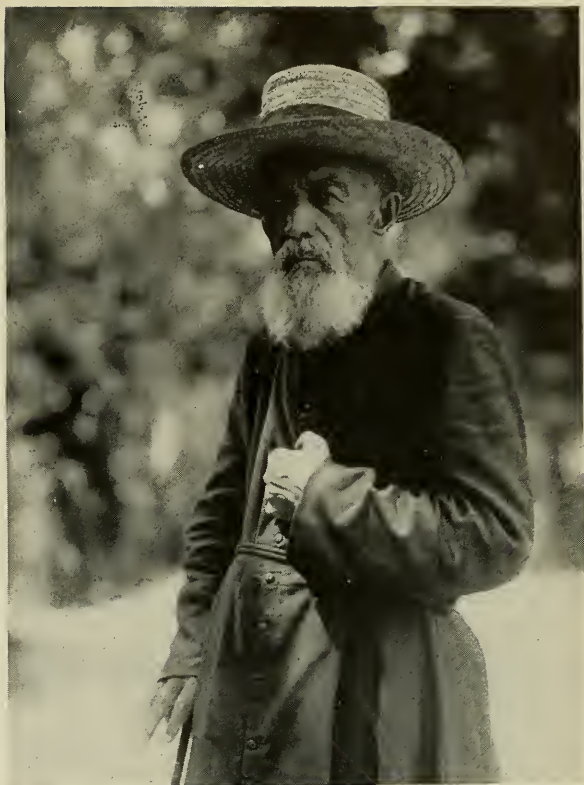
(Left) The sweet-scented Tahitian gardenias are favorites for garlands

(Below) Rikitea harbor, a delight for the colors of its water, and the town hidden in palms



Toshio Asaeda

Father Ferrier, the elderly French missionary to the Gambier Islands, has walked the shady streets of Rikitea for nearly half a century. Many a change has he seen in the life of his once-savage flock



The majestic church of Rikitea fronts on the end of a main avenue traversing the town. It symbolizes the victory of the Christian world over the cannibal customs of ancient Polynesia



Toshio Asaeda



Toshio Asaeda

Pitcairn Island from the northwest, still much the same, from a distance, as it must have looked to Fletcher Christian

Its woods suggest a fertile soil with sufficient rainfall, two of the prime necessities for the mutineers' colony

Parkin Christian, a "first citizen" of Pitcairn, Chief Magistrate in 1934, standing at the prow of his boat

The residence of Edgar Christian, who was elected Chief Magistrate for 1935, with Goat House hill in the background



A Pitcairn warbler at its nest in the crown of a "ti" plant, unafraid of the photographer a few paces away



Under the banyans of Pitcairn. Banyan trees are wild fig trees, introduced by man, and their small fruits are eaten avidly by pigeons on other islands



This warbler sat patiently on its nest all the while the author climbed the spiky Pandanus tree with a heavy camera





Toshio Asaeda

Cultivated fields on the eastern end of Pitcairn where most of the crops of the islanders are grown



Looking down on Adamstown from Goat House hill, about a thousand feet high, to the westward

The central slopes of Pitcairn are only partly farmed, much of the woodland being wisely conserved





Toshio Asaeda

After every landing at Bounty Bay the heavy boats are dragged up conscientiously under their sheds. A rack of heavy poles protects their keels. The risk of leaving them in the water is suggested by the white surf rushing in amid the great rocks

The visitors from the "Zaca" being dined at Adamstown. Parkin Christian sits at the right of Mr. Crocker, while the hosts of both sexes busy themselves serving the meal. Steamship caps are the most fashionable headwear for young Pitcairners



Toshio Asaeda



Toshio Asaeda

Immature masked booby on the beach at Ducie, unafraid of human beings. Birds of this species sometimes dove at

the fish-line trailing from the "Zaca's" stern, mistaking the hook and rag for a fish

Old masked booby sheltering its chick from the summer sun beating with special fury on a white coral strand

A pair of Kermadec petrels under the bushes on Ducie, wanderers of the sea come home to nest





Red-tailed tropic bird incubating its egg in a shady hollow on Ducie. About ten large feather-flies are resting in the

plumage of its neck, without apparent inconvenience to the bird that nourishes them

Downy chick of the Kermadec petrel, well fed with predigested squid, and as fluffy as a bird can be

Male frigate bird on Ducie Island, perched in a brittle Tournefortia tree. A robber baron among birds of the sea





Toshio Asaeda

Downy young of the masked booby, now able to stand up by itself on a rock, with strong wing and tail quills growing rapidly



Toshio Asaeda

Young frigate bird on its nest of sticks in a bush, where it is fed with fish stolen from boobies and terns by its tyrannical parents



(Top) Three bird islets off Easter Island, seen from Orongo on the rim of Rano Kao crater

(Center) Image of a "tangata manu" (bird-man). Its head is very suggestive of a frigate bird, perhaps in reference to the predatory nature of that bird

(Right) An Easter Islander who came aboard wearing about his head a woven band decorated with the white breast-feathers of the once sacred sooty tern





Front of one of the gloomy stone huts at Orongo, where the Easter Islanders used to watch the sooty terns. No wood entered into their construction, and the roof of flat stone slabs was covered with earth

The crater of Rano Raraku, where the celebrated statues were all quarried, holds a fair-sized reedy pond. These well preserved craters furnish the best proof that Easter Island is geologically very young



Toshio Asaeda

Native American Food

What the Indians gave us to eat and how their discoveries influenced the dietary habits of the world

By GREGORY MASON

IN all the story of primitive man, one of his most far-reaching achievements is the invention of agriculture. When man developed the cultivation of crops and thus freed himself from the dangerous and harried existence of a hunter, he spanned one of the broadest gulfs separating savagery from civilization.

It is not surprising, therefore, that the archaeologist, in piecing together the picture of human progress, brings into consultation his confrère the botanist. And in no field of archæology is this collaboration more important than in pre-Columbian America.

The forgotten red man

It was not until nearly four hundred years had passed after Columbus saw that fateful light in the Bahamas on the murky morning of October 12, 1492, that the American Indian was given anything like his due as an originator of crops. Most American plants were misnamed and falsely attributed to Old World origins (as many other American institutions still are), until in 1884 Alphonse de Candolle in his "Origin of Cultivated Plants" gave them something like their rightful place. The United States Department of Agriculture then pressed forward investigations which conceded more and more credit to the pre-Columbian red man and his wooden, stone, or clamshell hoes, until Lyman Carrier, a co-worker in the Department, with such well known men as O. F. Cook and W. E. Safford, published his *Beginnings of American Agriculture* in 1923.

The argument is about over. The red-skinned farmer is belatedly but dramatically vindicated with the reminder prominently displayed in the Southwest Museum, of Los Angeles, that we owe *five sevenths of the world's agricultural wealth* to the American Indian.

A neglected page of history

A historical romance could be written about how we modern Americans and Europeans have come into possession of many food products now in daily use which were bequeathed to us by the so-called "barbarians" who enjoyed the Americas alone before the white men intruded.

Some of the best gifts of the New World, of course, were wild: pineapples and strawberries, many other kinds of berries, plums and persimmons. Edward Winslow wrote to England from Cape Cod in 1621:

Here are grapes, white and red, and very sweet and strong also strawberries, gooseberries, raspas, etc.; plums of three sorts, white, black and red, being almost as good as damson.

Similarly, the Indians ate many nuts which they did not take the trouble to cultivate. Walnuts, pecans, chestnuts, chinkapins, hazelnuts, acorns—these were gathered wild by the aborigines. Probably the whites were the first to plant nut trees and tend them, although this interesting point is somewhat shrouded in mystery. Sunflower seeds gave the aborigines an oil they used as a dressing, as well as a flour which they used for bread.

Some of the nuts just mentioned gave them flour, especially the acorn, and so even did the

common wild cane of the Mississippi Valley. Wild rice was not only popular because it lured the ducks to Indian snares and arrows but because it was itself an excellent food for man. Here we have followed the Indian in both respects. Our hunters plant wild rice to attract ducks to their preserves, and our gourmets consider the grain itself a delicacy.

Few domestic animals

Historians and anthropologists are fond of making much of the fact that the early Americans were very poor in domesticated animals. It seems likely that they had none of importance except the llama, the turkey, and the dog, and of these only the dog was eaten, the llama being valued for his wool and the turkey prized for his feathers. The muscovy duck and the guinea pig were domesticated, but they played no significant part in the economy of the Indians. The curassow and alpaca also might be mentioned, but they are close to the turkey and llama, respectively.

But as Dr. O. F. Cook has pointed out:

The comparative deficiency of the Western Continents in fruit and animals suitable for food is compensated by numerous starchy root crops. Throughout the tropics of America, the Indians, like the Chinese, preferred everything cooked. This habit must have been adopted very far back to have made possible the obviously ancient domestication of Manioc (cassava), Colocasia (taro) and Xanthosoma (yautia) since the fleshy underground parts of these plants contain substances distinctly deleterious until disintegrated and rendered harmless by heat.

It is from about here that Doctor Cook goes on to his surprising contention that since America had six of the seven chief food plants of the Polynesians, and all the root crops which attained any wide distribution in Asia and Africa, "we are not without numerous indications that agriculture proper, together with the agricultural organization of human society which lay behind modern civilization, originated in America and has now completed the circuit of the globe." This conclusion is not subscribed to by the majority of botanists, but it had the great merit, like the work of De Candolle and Safford and Carrier, of giving some justice where justice had long been withheld. American anthropologists, overawed by the fact that the New World has produced no

traces of anthropoid apes, seem to have allowed other aspects of their science to suffer through a sort of hemispheric inferiority complex. Today most botanists admit that irrespective of the difficult matter of estimating comparative age American agriculture was more intensively developed from the wild plant prototypes than that of any other people at the time Columbus set out on his foolhardy voyage.

But there are still some points to be settled. Four important plants, sugar cane, fig, coconut, and banana, are still doubtfully attributed to America by some experts. The last two are perhaps especially important in any attempt to work out the history of migrations and the contacts of ancient peoples. Mr. W. J. Perry and others believe that the Peruvians had two cultivated varieties of the banana, but most experts think that the banana had an Asiatic origin. Moreover, off the West Coast of South America grew a single wild species of coconut unknown in the West Indies when the white man came, and Perry thinks that the coconut originated in America. De Candolle, however, attributes it to the East Indian Archipelago.

In all the discussions of the origin or origins of the peoples of the "South Sea Islands," Polynesians and Melanesians, and of their relations to America—if any—the coconut plays an important part. If proof is forthcoming that America did not get the coconut from Oceania or Asia or Africa and did not get the banana from outside either—as Doctor Cook believes—anthropological argument would develop fresh intensity and a new slant. The weight of opinion, however, attributes both these food plants to non-American origins.

Poisonous plant made edible

If you were brought up in New England, you may, like the present writer, have had an early acquaintance with desserts called tapioca pudding and tapioca custard. The story of this thing we call tapioca is one of the most interesting romances in botanical history. The particular interest, both anthropological and human, surrounding tapioca, or manioc, as a primitive food lies in the fact that the plant is poisonous until it has been treated by a complicated process. Indeed, one can hardly call "primitive" the pre-Columbian American Indians who devised and used this process for

uncounted centuries before the "Santa Maria" broke up on a shoal off Santo Domingo.

Manioc is a root, and the poison it contains is prussic acid. The Indians of the past, and the Indians of today, grate the root and then squeeze it in a basketry press, called a "snake" because of its shape, to remove the juice. The pulp is then formed into cakes and heated until the residue of volatile poison is driven out. What is left is cassava bread, a staple food of many American Indian tribes, especially in South America. The thing the first Europeans to visit Virginia called cassava was really wampee, but like cassava it had to be carefully treated before it was safe to eat.

How many millenniums had human culture developed before man had the ingenuity to get rid of the poison in manioc root? It is questions like these which fascinate botanists and anthropologists, and increase their admiration for primitive man. So, the next time you eat tapioca, pause a second before you put the first spoonful into your mouth and thank some Indian shaman of long ago. Or perhaps you will curse him.

The once "deadly" tomato

One of the greatest gifts of the Indian to the world is the "Irish potato," which is neither Irish nor a potato. *Solanum tuberosum* is really a member of the nightshade family, and hence related to the tomato. Incidentally, the fact that many members of this family are poisonous (for example, the famous "deadly nightshade") is one reason why the tomato was widely shunned except in South America, its home. White people refused it as a "poison apple" right up to the days of our grandmothers.

The true potato is the sweet potato, a member of the convolvulus or morning-glory family, and was probably first encountered by Europeans in the West Indies—when the natives gave men of the first Columbus expedition "some boiled roots to eat not unlike chestnuts in taste. . . . There was a great deal of tilled land, some sowed with these roots." The sweet potato became very popular among the whites and was soon transported to Europe, where it did well in Spain, Portugal, and parts of Africa. A South American origin is attributed to the sweet potato by the United States Department of Agriculture. Research is now

being carried on by the Bishop Museum which may produce valuable evidence for or against this belief. This research is directed toward a determination of the relationship between the American variety and the Polynesian variety of sweet potato, by a study of the chromosomes.

The travels of the potato

The white potato never grew in America north of Colombia until Irishmen brought it to Londonderry, New Hampshire, in 1719, after one of the most remarkable and ironical voyages any vegetable ever accomplished. The first white man to see it was Pedro de Cieza de Leon who, in 1538, in the Cauca Valley of Colombia found the natives living well on quinoa—a cereal much like hominy—and this "kind of ground nut, which when boiled becomes as soft as a cooked chestnut, but which has no thicker skin than a truffle."

About 1580 Spanish ships took this "truffle" to Europe; where via Vienna, with the careful nursing of Charles L'Ecluse, it reached Germany. There it is still known under the misnomer of truffle (*kartoffel*). It made no great stir in Ireland until 1663, but once in the Emerald Isle it was taken up with great enthusiasm, for not only was it recognized as a good substitute for the staple oatmeal (potatoes dipped in salted milk became the daily diet of the Irish peasantry), but the sons of Erin found that it made a good whiskey.

A few years after the Irish sent the white potato to New England they sent it to the West Indies—only a few hundred miles north of its origin. Thus, thanks to white adventurers, in two hundred years this prosaic looking tuber had circled the civilized globe. And wherever it has since gone it has held its own, really, in many respects, the most remarkable plant man has domesticated.

As the Irishman learned to use the Indian's white potato both for food and drink, the red man himself was well aware that another crop could provide drink as well as sustenance. The reference is, of course, to "Indian corn," or maize, the most important gift of the red man to world agriculture, and possibly the oldest cereal in the world. Just how long it took the Indian to develop corn from the wild Mexican grass called *teocintli* it is impossible to estimate; but that *teocintli* was the wild prototype

is practically certain. Tizin, or maize beer, was a favorite drink of the Aztecs of Mexico, who inherited it perhaps from a much earlier people. Today in Central America the degenerate modern Mayas still hold "maize masses" at planting time—ceremonies religious and bibulous, not entirely unlike corn-husking ceremonies in Nebraska.

Usually, when primitive man travels, he carries some food plants with him. But if man first came to America from Asia, as is the orthodox belief, he came at such an early stage of his development that he brought no Old World cereals with him. So he developed his own cereals, quinoa, maize. Perhaps he used root flour before grain flour. Well, he had all the root crops which attained any wide distribution in Asia and Africa and many others besides. His languages, like his agriculture, show no indication that they were brought to America from Asia, Africa, or Europe.

Varieties of maize

The Indians had more varieties of maize than we have today. In Canada they had one which ripened in three months, while the subspecies they used in Texas took five months. Such freak varieties as the flint maize of New England and the dent maize of our Middle West we owe to these Indians, as well as that delight of our children, popcorn.

We owe to the Indian not only our varieties of corn but our methods of planting and tending it. And we borrow the habit from the Indian of planting other American vegetables with corn, such as squashes, pumpkins, and varieties of beans. Listen to this tribute to Indian husbandry from an Englishman named Wood writing in his *New England Prospect* in 1629:

They excede our English husbandmen, keeping it so cleare with their Clamme shell-hooes as if it were a garden rather than a corne-field, not suffering a choaking weede to advance his audacious head above their infant corne, or an undermining worme to spoile his spurnes.

Not even a cursory account of American Agriculture like this could omit the subject of rubber. Few of us modern Americans realize that rubber is just one more thing in our everyday life that we owe to the Indian. Like another Indian product, quinine, to be sure, rubber

has been transplanted and is today produced most successfully in Asia. But the material we use in our automobile tires is the same that the Indians used in making a ball for a game which they played resembling basketball. The Aztecs played this game, Tlachtli; and the Mayas or Toltecs before them may have invented it.

Cotton, however, is one of those plants which both the Old World and the New World had before they met. The Mayas and Mexicans had cotton so fine that the Spaniards took it for silk, and cotton so strong that it was used as armor against wooden swords armed with the sharp volcanic glass (obsidian). The best modern commercial varieties of cotton are the so-called Sea Island and the misnamed Egyptian varieties. Both of them were developed by the American Indian.

Drinks and drugs

So was cocoa, ipecac, cascara, balsam Peru, and other drinks and drugs which we take for granted. The pulque of the modern Mexicans is a descendant of the *octli* of the Aztecs. The Caribs, that great South American people, did their fighting on beer made of the cassava already mentioned. The peculiar institution we modern Americans have attempted to establish, known as Prohibition, had no appeal to any ancient Americans except the Aztecs, who imposed this and other austerities upon themselves such as might appear to be related to what we today call "Puritanism."

The list of drugs we owe to the Indians would not be complete without mentioning cocaine, which is derived from coca—a plant indigenous to South America. There is quite a little evidence to indicate that the first use of local anæsthetics was made in South America, probably in the pre-Inca region, and that the drug used was coca.

The leaf of this plant is still chewed by South American Indians who find that, particularly when mixed with lime, it gives them a great renewal of energy for mountain trails. United States doctors recently made the same discovery about the relationship between coca and lime, and were much surprised when informed that bush red men in South America already knew all about it.

Another product for which the world owes thanks to the American Indian is tobacco. The

weed was originally tropical, and the art of using it spread from tropical America until its culture was more widespread than maize. Tobacco was smoked, eaten, and drunk. Today semi-liquid tobacco is still eaten or drunk by the Kagaba-Arhuaco Indians of northern Colombia, being carried by the men in a viscous state inside a small gourd.

In aboriginal America the use of tobacco was not confined to men, however. Inasmuch as the "noble weed" was considered good for the health it was used by both sexes and at almost all ages.

The first European to see it was Columbus, who found the natives of the West Indies very fond of cigars. In Middle America a leaf was often rolled into a rude cigar and then pushed into a hollow holder of wild cane. Similarly in the region which is now the Southwest of our country the hollow reed method was employed. To the East and West of this region the white explorers found that this reed had developed into a tubular pipe of pottery, stone, or wood, which had to be smoked almost vertically. A way around this inconvenient posture was found by Indians in the Central and Eastern part of what is now the United States when they put a bowl on the pipe.

The chewing of tobacco was popular in the Andean region of South America, although in many parts of this area the custom of chewing coca (from which we get cocaine) drove it out. However, this writer found that the Kagaba tribe of Colombia, above mentioned, still absorbs both coca and tobacco through the mouth. In much the way these Indians eat coca with lime, red men on the Pacific Coast of North America swallowed lime with tobacco. The lime increases the effect on the human system of both drugs.

Tobacco as money

The white colonists took up the tobacco habit with such avidity that in Virginia the weed once passed as currency, and some of the Elders were worried lest so much land be given to tobacco that the food crops would prove insufficient.

Before this the Spaniards had carried tobacco to Europe. (Sir Walter Raleigh was not the first person to do this, as some of us were taught in childhood. The first Englishman to get the weed obtained it from sailors of John

Hawkins). From Spain it went to Portugal. In 1560 Nicot, French Ambassador to Portugal, carried the fragrant herb to France and modestly gave it the botanical name of *Nicotiana*—whence comes our word *nicotine*.

Spanish, Portuguese, and Arab traders, sailors, and adventurers introduced the smoking habit into ports of Asia, Africa, and the East Indies. From there it went inland, so that years later explorers found natives of Africa and New Guinea growing and smoking tobacco although they had never seen white men. They told the white discoverers that their ancestors had had the weed time out of mind. Thus there came out reports denying the sole American origin of tobacco. But we know now that the first tobacco was American, and Dr. A. L. Kroeber has pointed out that the foregoing facts indicate how short-lived is group memory and how unreliable is oral tradition.

It is interesting to note that smoking reached the American Eskimo only after making a circuit of the globe—the pipe with peculiar flaring bowl used by the Eskimo having reached them from the Siberian Chukchi who were taught to smoke by Russians. Another curious item is that stone pipes in the form of tomahawks used by the Sioux and Blackfeet actually were imitations of metal hatchets in the form of pipes introduced on the Atlantic Coast by early English traders. The indigenous pipe of the Sioux and Blackfeet was an outgrowth of the tubular pipe—with bowl set well back from the end of the stem.

Fortunately at long last we modern Americans are beginning to recognize the splendid, independent accomplishments of aboriginal American agriculturists. At least five sevenths of the products we consume at any big dinner in the United States today are made up of things we owe to the American Indian, from the pre-prandial tomato juice to the post-prandial cigars.

Tastes and fads may change, but the basic products upon which our nourishment depends are the same that primitive man so laboriously won from the wilderness. Civilization allows us to enjoy culinary arts that are far more complex than theirs were, but let us not forget the first farmers of the Western Hemisphere, who all unknowingly did so much toward prescribing our diet.

NATIVE AMERICAN

Not until nearly four hundred years after Columbus discovered America was the Indian given anything like his due as an originator of crops. It has been estimated that we owe five sevenths of the world's agricultural wealth to the red man

(Left) Maize, or corn, was probably the most important gift of the Indian to world agriculture. The Indians cultivated more varieties of this cereal than we do today, and even provided that delight of our children, popcorn



The Irish potato is not Irish but Indian. White man did not know of it until 1538, when it was "discovered" as a staple of the Indians of Colombia. About 1580 Spanish ships took the potato to Europe, but it was not until almost a century later that it began

to make a name for itself in Ireland. Potatoes dipped in salted milk became the daily diet of the Irish peasantry; and the sons of Erin also found that the potato made good whiskey. In many respects the white potato is the most remarkable plant man has domesticated

One of the most astonishing food discoveries man ever made was that the poisonous tapioca plant could be rendered edible by a complicated process. The persons in the photograph at the right are scraping and grating the manioc root, as it is called, prior to subjecting it to the process which the primitive Indians almost miraculously hit upon. The grated root is squeezed in a basketry press to remove the juice and then heated until the last of the prussic acid is driven out



Ewing Galloway Photograph

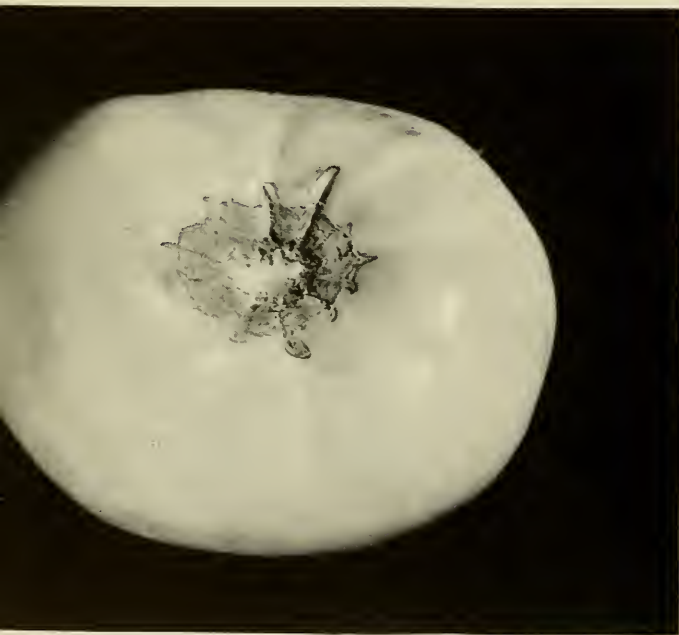
(Above) The lima bean, like several other varieties of beans, is native to America

(Right) The sweet potato was probably first encountered by Europeans when natives offered it to men of the first Columbus expedition





The turkey was domesticated by the Indians, not as food but for its feathers



ing Galloway Photographs

The tomato, a native of South America, was shunned elsewhere by white people as a "poison apple" right up to the days of our grandmothers





Living Galloway Photographs

(Right) A choice native American food which grew wild—the pineapple



Globe Photograph

Squashes (left) and pumpkins (above) are among the many other products that the first American farmers gave to civilization



Ewing Galloway Photogr

Before the discovery of America only the Indians used tobacco. Englishmen first got the weed from sailors of John Hawkins (not from Sir Walter Raleigh). The use of it has spread to every land on the globe

A native of the upper Amazon tapping a rubber tree. Rubber is another product that the Indians were the first to use. The Aztecs played a game like basketball with a rubber ball

Wings Over Waves

A review of a monumental work, "Oceanic Birds of South America," by Robert Cushman Murphy

By WILLIAM VOGT
Editor of "Bird-Lore"

EARLY in the summer of 1912 the New Bedford whaling brig "Daisy," setting out on a cruise to the South Atlantic Ocean to secure sperm whale and sea-elephant oil, carried with it a young ornithologist, Robert Cushman Murphy, who represented the American Museum of Natural History and the Brooklyn Museum. By agreement with the owners of the brig he was to collect birds at sea whenever an opportunity offered, and to have three or four months during which he might study and collect birds on South Georgia, an antarctic island.

Some six months later Mr. and Mrs. Rollo H. Beck departed from the United States, to which they did not return until September, 1917, on the Brewster-Sanford Expedition. During these four-and-three-quarter years the Becks virtually circumnavigated South America—collecting as they went—and made many tangential journeys to island bird communities, as well as into the interior. Their scientific spoils included nearly 8000 specimens of birds.

Absorbing and exciting

In the making of this book, these were the most important field investigations. There were others, that contributed greatly, but the South Georgia expedition gave Doctor Murphy his fundamental field experience with insular and sea birds; and the Becks provided an enormous amount of study material, systematically accumulated over a wide area.

For nearly twenty-four years the studies have germinated. The author has, meanwhile, attained international eminence as an ornithologist and geographer; he has followed the

deepening trail of his own investigations through publications from both hemispheres; and, perhaps most important of all, he has had sufficient time to submit his wide-ranging speculations and enthusiasm to the test of his own maturing critical faculties. The result is not only an ornithological work of the first magnitude, but one of the most absorbing and exciting publications in the field of natural history.

A new world revealed

If the word "exciting" seems too undignified for such an important contribution, it is the fault of the English language. A volume that stirs the imagination, quickens one's pulse, makes one long for horizons wider even than the geographer's, and permits one to look forward and backward along the corridors of time, is exciting whether the word sounds dignified or not!

The destiny that shapes our ends, is, in the long view, not very different from that controlling the shearwater passing Jones Beach on its way toward Tristan da Cunha. The bird's vicissitudes are, to a large degree, ours. We are compounded of the same elements and derive our existence, by not so different a route, from the same sunlight, air, and chlorophyll. If we so far lose sight of essentials that, to use a timely example, a strike of "service" employees—forcing us to climb an unwonted eighty-five feet—seems of more serious import than the "Niño" on the coast of Peru, we have become myopic indeed, and need such a book as this. Whether we need it or not, through its pages we may roam distant seas and enter the same social set as an emperor penguin or a sheathbill!

A reader need not be an ornithologist to lose himself in this work. Indeed, the author says, at the outset:

Let us preface and mingle our account of the bird life with notes upon the structure of the South American coast, and also upon drainage, meteorology, ocean currents and other phenomena that help to make the littoral and pelagic environments what they are. Let us include, furthermore, a running description of the salient coastal features, seeking the impressions that circumnavigators of the continent would gain if their craft might hug the bends of the highly varying shore throughout the whole voyage of some 27,000 kilometers. Only by such attempts to correlate life and its physical background can we hope to comprehend the place of the native sea birds in the scheme of nature.

We shall draw our information from any available source—manuscript notebook, periodical, work of travel, geographic text, mariners' pilot book, or even fiction if the descriptions seem warranted.

After a brief introduction to the South American continent, the author discusses in lucid detail its general meteorology, an especially important factor on this area of starkly delimited aridity and rainfall. The effects of hurricanes upon birds are considered in a fashion that will be especially interesting to New Yorkers, in whose region many storm-borne waifs are prone to appear.

Life zones

Under "The Hydrology in Relation to Oceanic Birds," Doctor Murphy considers such factors as the following:

Life zones governing the distribution of birds at sea are ultimately determined by physical properties of the surface waters. The well-nigh inexorable control of certain special types of oceanic environments upon birds has not yet been generally realized by either zoologists or oceanographers. The distributional boundaries and barriers of animals inhabiting land areas, such as mountain walls, deserts, broad rivers, lines of abrupt change in temperature or rainfall, etc., are accepted as a commonplace. . . . But oceanic birds seem, in the main, to have been regarded somewhat naïvely as aerial rather than aquatic animals, notwithstanding that their relationships to sea and land, as concerned with feeding and breeding, respectively, are precisely the same as those of the seals among mammals or the sea turtles among reptiles. . . .

In this book we shall have abundant opportunity to note how the majority of oceanic birds are bound as peons to their own specific types of surface water. . . .

In support of his contention he describes the various zones of surface water about South

America, ranging from the Antarctic to the Tropical, and with well chosen, often vivid phrases, summarizes the life conditions that obtain in each zone. (In none of the book, it should be well noted, is man forgotten; man's existence is often interwoven with that of the birds and, in any case, the human element furnishes a vivid key to understanding that is repeatedly and skillfully used.) Ocean currents, often modifying surface water zones and dominating them, are next considered in relation to the birds. Admirable diagrams and charts make understanding easy, and here, once more, facts emerge that make the earth a more interesting habitation. For example:

Cephalopods, of all oceanic invertebrates, make up the greatest single food resource common to widely varying zones. In cold waters the chief combination of importance to birds is probably cephalopods, crustaceans, and small schooling fishes; in warm water cephalopods and flying fish take high rank. But cephalopods and fish are at least ten times as abundant in the surface waters beyond 40°S., and in coastal currents, as they are within what we may call collectively the Sargasso regions; and the corresponding ratios with reference to crustaceans are nearer ten thousand to one.

The Humboldt Current, that great cold oceanic river that flows up the western coast of South America, is treated in detail, as it deserves. One of the most interesting of terrestrial phenomena, it thrusts typically cold-water animals and plants northward until penguins are found breeding almost on the equator. "El Niño," the equatorial counter-current, provides Doctor Murphy with the opportunity for some of the most dramatic writing in the work. At long periods, this current that flows southward from the tropics gathers impetus and impinges on the broad safety-belt of the Humboldt Current—

Catastrophe to sea life

The immediate result of an advance of El Niño is to raise the temperature of the littoral ocean water by five or more degrees Centigrade. The normal plankton of the cool Humboldt Current waters next succumbs, perhaps because of the increased temperature, perhaps in part because of a different composition of salts in the water. The common schooling fish leave the region or die, and less familiar species such as flying fish, dolphins, and other tropical types, invade the shore waters and even enter harbors. Later, if the incursion of tropical waters is marked and widespread, disease attacks the population of cormorants, boobies, pelicans, and other guano birds belonging to the nor-

mal Humboldt Current fauna. Carcasses drift ashore in vast numbers, and the survivors of such species are driven southward.

On the occasion of the last cataclysm of this nature, Doctor Murphy had the grim good luck to be in Peru. It is thought to have been the most far-reaching shift of "El Niño" within historic times and this author's descriptions of the *bouleversement* of the vital equilibrium of the region read like something out of Jonathan Swift. It is unfortunate that the account is too long for quotation here.

This is as appropriate a place as any to comment on the writing of the book. There is a tradition among many scientists that if they have something to say, the manner of saying it is quite unimportant. As a result, some scientific journals read, at times, as though their contributors had not passed beyond grammar school; indeed, so badly have some recent ornithological papers been written that certain sentences were literally meaningless.

High literary merit

In the matter of presentation of material, *Oceanic Birds of South America* is a model. It often concerns itself with difficult, involved problems that will be new to many non-professional readers. So logically is the story given, however, and in such felicitous language, that the mind absorbs this "intellectual pemmican" as easily as the eye runs over the words. The text is refreshingly free from the argot that forms the only sort of "conspicuous consumption" to which many scientists can ever hope to attain. There is humor, color, and a wide range of quotation. Long association with affairs of the sea has given the author a vocabulary whose natural and authentic saltiness often serves to flavor a passage that might, otherwise, seem mere nourishment.

To many readers, unquestionably, the most interesting part of the book will be the 212 pages entitled "An Ornithological Circumnavigation of South America." In introducing this section, Doctor Murphy says:

The journey upon which we are embarking has never before been undertaken. I propose to skirt the continental coast line with full disregard of distance, time, and circumstance. Neither weather nor current need retard us; no island of the surrounding seas shall be too remote for us to reach within a twinkling; moreover, we may view the

successive prospects, as preference dictates, either through eyes of today or those of generations long departed. To describe the topography in detail would lead us too far afield. Let us in the main travel fast, halting only to picture a series of well-chosen localities along the ocean front, and at islands offshore. At each such station we may select the time of year best suited to our purpose of observing the bird life or the periodic natural phenomena concerned with the distribution of birds.

Travelogue rich in interest

From the mangrove tangles of the northern coast, where many birds familiar to visitors to southern Florida and the Gulf coast of Texas, are found, the reader is conducted on an idealized Cook's tour that not only touches on every region on the mainland, explaining it in the light of the geographic information that has already been presented, and "lining up" species of birds as week-end observers are wont to do in Bronx County, but the fanciful expedition goes as far a-sea as Ascension and St. Helena islands. In the region of the Straits of Magellan Darwin takes the reader's one hand while Doctor Chapman takes the other. Strange phenomena are reported. At various islands are encountered "rollers," gigantic combers whose origin may lie hundreds of miles away in unknown meteorological disturbances. At Tristan, we are told, the introduced cat was exterminated by the introduced rat!

There are tales here, scientific truths and seaman's yarns, to make one wish to linger—but 27,000 kilometers are long and the entire west coast with its Humboldt Current, and its amazing guano industry, are waiting. Arrived at Panama, we have covered only 322 pages, and 800 remain before us!

This is the portion of the book that treats the birds in detail. One hundred and eighty-three species and subspecies "are more or less formally considered." In the instance of each bird, material is given under the following headings: scientific name and original citation; vernacular name in all languages, including the aboriginal; description and diagnostic characters; eggs; distribution; general word picture; historical and economic status; American Museum specimens and field experiences during Museum expeditions; systematic relationships; place in the South American region; migrations; habitats, with geographic and ecologic correlations; breeding season and be-

havior; relations to other animals, including man; the young; moults; voice; food; enemies and diseases.

Ten species of penguins are thoroughly discussed, and the accounts of the behavior of these highly social birds furnish especially fascinating reading. Little, relatively, is thus far known of the penguin mind and some ornithologist still has before him the engrossing task of making experimental studies of how these birds live, on their breeding grounds.

With various Procellariiformes—albatrosses and petrels—we roam the seven seas. Along the American coast we follow the fortunes of pelicans, boobies, and cormorants. We read Doctor Murphy's solution of the old problem of the steamer ducks, and watch a skua eat its own young because, apparently, it had been prematurely helped from its shell by a watching ornithologist. We read of the incredibly awkward nesting habits of the lovely fairy tern and, finally, encounter a startling suggestion that the black skimmer, a familiar of New Jersey and Long Island waters, does not use its extended lower mandible to scoop up food, but that it serves as a lure—that the bird is a sort of avian Izaak Walton. Of richness and variety there is, here, far too much to be more than hinted at in this review. I can only urge anyone who is interested in the manner of life upon this earth to secure a copy of the book before the edition has been exhausted.

Paintings by Jaques

Sixteen color plates by F. L. Jaques include some of that distinguished artist's most impressive work. In 1925, after a period of work on Barro Colorado island in the Canal Zone, he went to Callao, Peru, to make field sketches. In 1935 he visited the Juan Fernández islands, Valparaíso, San Felix and San Ambrosio islands, Pisco, Peru, the Chincha islands, Hormigas de Afuera, and the Galápagos. Besides his acquaintance with the west coast, his experience in the Arctic stood him in good stead in painting the hard-surfaced waters of the far-southern hemisphere. His extraordinary ability to see, and interpret in color, the quality of light, atmosphere, and sky, has never

been more of an advantage than here. It has often been said of his painting that his landscapes would stand alone—that they do not need the birds that, to a naturalist, make them particularly alive. The wildly dramatic terrain of Tristan da Cunha, South Georgia, Peru, and Falkland Sound are possessed of an austere and colorful beauty that has found his brush responsive. The blue-footed boobies, fairy terns, wandering albatross, kelp goose, and Atlantic petrel seem, to this reviewer, especially fine.

Copiously illustrated

There are a number of maps and charts that are helpful to the reader. One lack the book seems to have, and that is a map giving the names of political subdivisions. Doctor Murphy inevitably refers to them, in his text, and while the small diagrams are useful as one "circumnavigates" the continent, it is bothersome to have to hunt for a small segment of the coast when one desires to locate oneself.

If a serious stricture may be levelled against this book it is, I think, because of the small size of the edition. Only 1200 copies were printed and according to rumor there will not be a second edition. This means that the report on more than two decades of fine work by outstanding scientists, and by collectors who repeatedly risked their lives to secure specimens, will be in the hands of a few fortunate individuals and some of the larger libraries. Those responsible for the printing of these volumes should—and must—realize that such works as this are the very tools of science; Doctor Murphy's text contains so much of zoogeography and life history material that it will be invaluable, for years to come, to ornithologists. Will be? Should be. Ten years from now it will not be available, except at the impossible prices brought by collectors' items. The high cost of printing the first edition can scarcely be sufficient reason; most people to whom this book will appeal would rather pay 50 per cent more now than 150 per cent more a year from now.

The book deserves as high praise for the excellence of its manufacture, as for its writing and illustration.



WINGS OVER WAVES



A selection of eleven color illustrations by Francis L. Jaques, Staff Associate, Department of Arts, Preparation, and Installation, The American Museum of Natural History.

They are from *Oceanic Birds of South America*, two volumes, by Robert Cushman Murphy, of the Department of Ornithology, American Museum.

PUBLISHED BY THE AMERICAN MUSEUM
OF NATURAL HISTORY, NEW YORK, 1936

Fairy Terns and Black Noddies South Trinidad Island

"Most ethereal of sea birds are the delicate and gentle Fairy Terns. Their plumage is white, but with subtle ivory or creamy tones and with a barely perceptible reddish gleam visible in certain lights on the feathers of the belly. The last is all but illusory, and yet I find that most persons can see it if they are asked whether the ventral surfaces of specimens show a bloom of any sort. In the air these terns are ghostly creatures, their exceptionally large black-rimmed eyes sometimes seeming like empty sockets. Moreover, when they fly overhead against the brilliant tropical sky, only the bones and flesh of their filmy wings fully obstruct the light. At such times the Fairy Terns resemble tiny flying skeletons, except that their lightness and grace are more suggestive of disembodied spirits. . . .

"The curiosity of the Fairy Terns is notable, and Meliss . . . states that they are particu-

larly attracted by white objects. They have a way of fluttering just in front of one's face in a manner that soon becomes disagreeable—not attacking, but merely staring, hovering like overgrown mosquitoes, and wheezing in a way to suggest the buzz of some such noxious insect. . . . As I sat in a whaleboat on the heaving swells close against the cliffs of the . . . island, a succession of these birds fluttered just in front of my nose so that I was able to pick them out of the air by hand. After being captured, they made no resistance except for a very mild and brief struggle, and they did not attempt to use their potentially dangerous bills. . . .

"The egg of the Fairy Tern is so precariously balanced on rock or bark, or even in a slight hollow of a smooth and slender branch, that it has often been wondered why more of them do not come to grief. . . .

*Pacific Fairy Tern, to illustrate the translucence of the wings
Ducie Island, southern Polynesia*





King Penguins, South Georgia Island

"With its large size, graceful lines, and golden ornamentation, the King Penguin is one of the handsomest members of its family. Although less impressive in stature and bulk than the Emperor, its dignity of behavior suffers nothing by comparison, while in color pattern it is an even more striking creature. . . .

"Incubating King Penguins can shift about slowly in spite of the egg on their insteps. They drag themselves along, maintaining a hunched posture, and hitching the feet with short steps so that the egg may not roll out. If they chance to trip, or if they are bowled over, they fall as stiffly as a statue, with the egg still in place. . . .

"The sitting Kings are fond of crowding together, as if to facilitate quarreling. . . . When one bird budges, trouble is in store. With the beginning of movement, the adjacent sitters may be seen to glare at each other with sinuous necks twisted and heads cocked, and then to deal resounding whacks with their flippers, or lunges with their sharp bills, unto all their neighbors. Whole groups may become engaged in an indiscriminate skirmish, as if with both rapiers and broadswords . . . only occasionally

is one knocked off its pins. Even then the egg is usually unharmed. Bearing upon this is Wilson's interesting comment: '. . . so tightly were they held that although we lifted the birds bodily from the ground, yet the egg was very seldom dropped.' . . .

". . . Courting couples were often seen strolling off alone, in a most human fashion, and making their way to the tops of hillocks or snowbanks, or even up glaciers. The usual pattern of caresses is for the birds to cross necks and sway from side to side, while facing each other, and then for the cock to step aside and press on his mate's nape until her head is bent quite to the ground. . . .

". . . Quarreling because of triangular complications seems to be invariable in the early stages. . . .

"King Penguins deport themselves in an amusingly 'lofty' manner toward human beings, paying slight attention to a man's quiet intrusion. If they are annoyed, they march slowly and with an air of indifference, until they have been actually frightened by abuse, when they fall upon their breasts and scurry on all fours. . . ."

*King Penguins incubating and quarreling
Bay of Isles, South Georgia, February, 1913*





Guano fowl of the Humboldt Current: Peruvian Pelicans, Boobies, and Cormorants

"In comparison with the spell of the interior, . . . the appeal of the long, shining coast of Peru seems to have been felt by few. . . . Of the extremely profuse wild life of this coastal ocean . . . [the voyager] may chance to observe no more than sea-lions and vast flocks of birds; and if he seeks a traditional product of the waters which can compare in importance with the marvels of the interior, he finds only guano, the ammoniacal smell of which strikes his nostrils whenever the steamer draws into the lee of bird-inhabited islands. . . .

"The bird life, both resident and transient, is the most spectacular feature of the coastal waters. For a characteristic glimpse of it we may call . . . upon the talented pen of Dr. Chapman:

"As for the birds, who can describe them in their incalculable myriads? . . .

"Seaward, like aerial serpents, sinuous files crawled through the air in repeated curves lost in the distance, while low over the water processions passed rapidly, steadily, hour after hour, with rarely a break in their ranks during the entire day. . . .

"But the most amazing maneuver in all this astounding spectacle was the instantaneous disappearance from the air of flocks of 500 to 1,000 Boobies that chanced to pass over a school of fish. Then, as one bird, they plunged seaward and the sky, which a moment before seemed full of rapidly flying birds, was left without a feather. . . . When we left Salaverry late in the afternoon there was no apparent decrease in the numbers or activities of the winged fishers; but I could look at them no longer without a feeling of confusion and dizziness; for the first time in my life I had seen too many birds in one day! . . .

". . . as matters stand today, three species far outweigh all others together as producers of guano at the Peruvian islands. These, in the order of their contemporary importance, and listed under their native as well as their technical names, are the following:

1. Guanay (*Phalacrocorax bougainvillii*)
2. Piquero (*Sula variegata*)
3. Alcatraz (*Pelecanus occidentalis thagus*)"

*Residual stacks of guano at the central Chincha Island, about 1860
The layers are here in excess of 20 meters thick*





Guanays, or Peruvian Cormorants

Santa Rosa Island, Peru

"The Guanay, first in importance among the famous guano birds of Peru, has been called the most valuable bird in the world. . . .

". . . It is a long-winged cormorant, capable of flying strongly for hours against the brisk southerly breezes that blow every afternoon throughout the greater part of its range. . . .

". . . the Guanay is in effect a machine for converting fish into guano. A relatively small proportion of this is deposited upon the islets, where it becomes available for human use; the remainder returns to the sea where, however, it is not 'lost,' for it restores to the water the fertilizer of the marine pasturage. . . . Schweigger, as quoted by Schott . . . has computed that, whereas the people of Peru capture and market annually about 4000 metric tons of fish, the sea birds of the country devour 5,500,000 tons! . . .

". . . dark flocks of guanayes form rafts which can be spied miles away. Slowly the dense masses of birds press along the sea, gobbling up fish in their path, the hinder margins of the rafts continually rising into the air and pouring over the van. . . .

"At other times, when the guanayes are moving toward distant feeding grounds, they travel not in broad flocks but rather as a solid river of birds, which streams in a sharply marked, unbroken column, close above the waves, until an amazed observer is actually wearied as a single formation takes four or five hours to pass a given point. . . .

"Toward evening of . . . October days, most of the guanayes would be courting, after strenuous hours at sea during which all their energies had doubtless been devoted to winning the sustenance of life. Privacy does not enter into their notion of fitness, and while six or seven birds occupy each square yard of ground, the love-making antics are often in full progress. . . . Two guanayes stand side by side, or breast to breast, and ludicrously wave their hands back and forth or gently caress each other's necks. . . .

"Visible actions, rather than unusual sounds, alarm the courting birds . . . the firing of a gun straight into the air produces scarcely a stir provided the weapon is not brandished. The effect of human conversation is, however, most amusing. Whenever a man, sitting perfectly still, begins to talk to the guanayes in a loud voice, a silence falls over all the audience within hearing. Their mumbles and grunts die away, and they listen for a while as if in amazement. . . ."

*A Rock Shag colony. East Island, Falklands
December, 1915*





Peruvian Pelicans Ancón, Peru

"The Peruvian Pelican, or 'Alcatraz,' is by far the biggest and most conspicuous bird to be encountered in flock formation along the desert coast of western South America. It instantly reveals its identity as far as the eye can reach. It is, indeed, one of the world's largest pelicans, exceeding in size even the White Pelican of North America. . . .

"There are reasons for believing that in past times the pelican was an extremely important guano-producer, perhaps even the bird of first rank at many islands along the whole length of the Peruvian coast. Certainly the Incas and their predecessors held it in high regard, as indicated not only by the traditional laws for its protection but also by the preponderant use of the pelican design in . . . artifacts . . .

". . . The pelicans invariably give the impression of being the shyest and stupidest of the guano birds. . . . Before taking flight, they usually open their great bills wide and empty themselves of a bellyful of fish. Sometimes even those soaring overhead express their excitement in the same way, sending down a

fearful rain of anchovies or anchovy paste! . . .

". . . Afloat they seem less timid than while at the nest, and they soon learn to ignore the close proximity of small craft and swimmers. In the smooth water just outside the line of breakers they may often be seen riding sedately, and reaching the bottom life with their long mandibles instead of diving from flight. At times they will also join with other sea birds in hot pursuit of a rapidly moving shoal of anchovies, under which circumstances the pelicans usually swim and scoop instead of plunging. . . .

"Only on the ground, at the moment of leaving it or descending to it, and during performance of the dive, does the pelican lose its grace and dignity. . . . The sighting of fish causes it to apply the brakes, tilt up in front, spread the tail, and tread the air with its feet. The beginning of the plunge may be accelerated by one or two strong wing strokes, after which the bird hurtles headlong, with the wings at least half extended, and strikes the water with a vast, resounding splash. . . ."

Brown Pelicans at the Pearl Islands January, 1935





Piqueros, or Peruvian Boobies Pescadores Island, Peru

"'Piquero' is the Spanish word for lancer, an appropriate appellation for this booby, the spectacular plunges of which are familiar sights throughout the length of the Humboldt Current. It is thrilling to see one bird descend straight from the blue and vanish in a jet of foam which seems to leap to meet it, so swift is the fall. But a Piquero is rarely alone, and the scene of thousands striking the ocean like hissing hailstones is one that beggars description. . . .

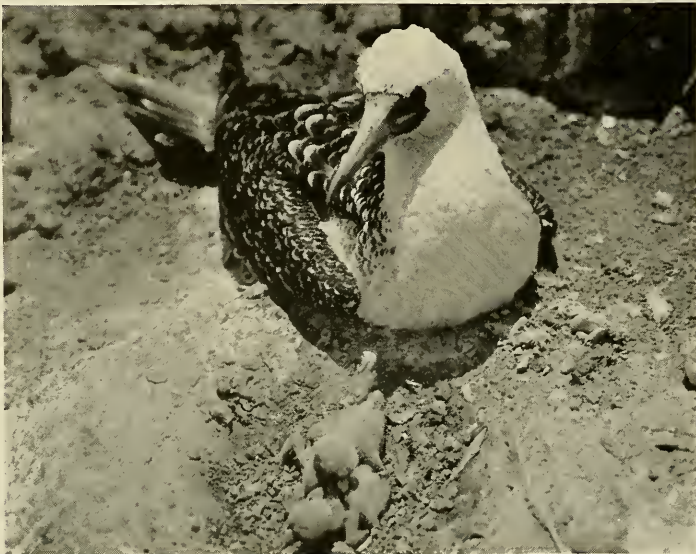
"The Piquero is the most abundant of the guano birds, and, as a producer of available fertilizer, it has undoubtedly won the place of closest rival of the Peruvian Cormorant or Guanay . . . a thousand Piqueros would produce more than ten available metric tons a year, or a million birds 10,000 tons, which might be close to a million dollars' worth. . . .

"I have seen . . . nothing more exquisite than the pantomime of adult Piqueros hanging on the wind above the cliff of Guañape. The innumerable white birds would come sail-

ing up over the nest on the plateau and, when they had reached the brink, the updraft would lift them like kites. Then for minutes they would poise, hardly changing their positions, but twisting their necks to look toward me or to glance at their hopeful chicks below. Some of the graceful, living seaplanes were hardly more than arm's reach from me, and beyond they stretched away until the distant birds seemed like a flurry of snowflakes. . . .

". . . the chicks seem to be rather chummy companions, often stroking or nibbling each other, while making soft grunting sounds. When the parents return, well laden, a considerable stimulation of coaxing seems to be necessary before food is relinquished. The heads of the youngsters then disappear down the gullet of the old bird. Replete chicks are likely to sleep for a while on their sides, curled up like kittens, with the bill tucked under the wings. The return to consciousness and renewed appetite is accompanied by prolonged yawning. . . ."

*Piqueros, Parent and young, south Guañape Island
January, 1920*





AQUIS

Wandering Albatross and Wilson's Petrels and a double circular rainbow sketched by the author in the South Atlantic

A wing-spread of about $11\frac{1}{2}$ feet leaves the albatross in a secure position as king of the air in our modern world.

"By July or August the oldest of the young albatrosses are nearly as large as their parents, and so fat that they are probably every bit as heavy, though still enveloped in an exceedingly dense coat of gray down. Then something happens which is so extraordinary and spectacular that the early accounts of it found little credence, although we know now that it is paralleled in greater or less degree among all Procellariiform birds. With the setting in of the antarctic autumn, the adult albatrosses completely abandon their nestling offspring, not for a matter of days or weeks but forever. . . .

". . . For three months or longer the young albatrosses receive no visits from the adults and subsist entirely without food. Toward the end of this time, they begin at last to amble down off their nests and to try first their legs

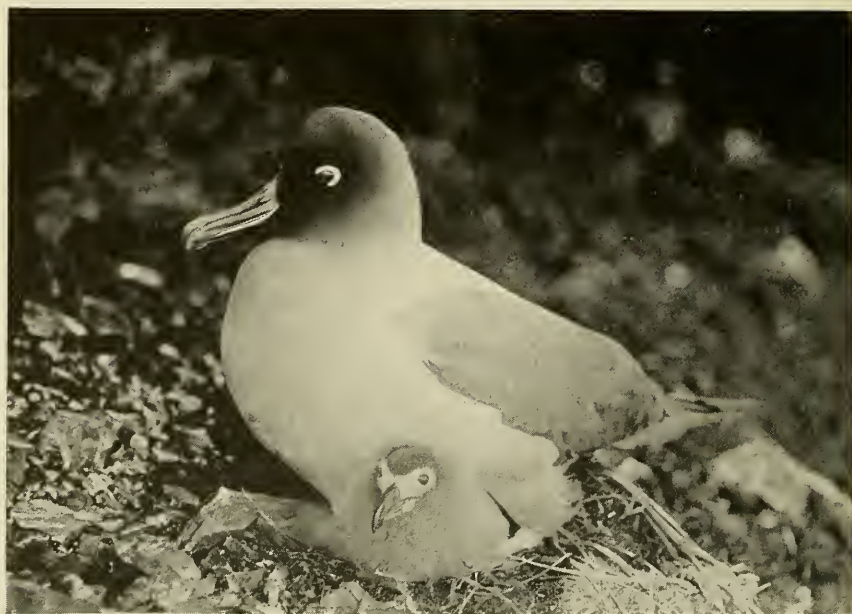
and afterwards their wings. Flight practice involves a long course of what might be called ground-training. . . .

"Wilkins says that . . . the absence of wind brings the adults to grief when they finally come down among the grassy hammocks. At least half of them make a faulty landing, striking the ground violently with their breasts and turning turtle. This usually causes them to vomit their stomach contents, after which they have a very dejected appearance. . . .

"Finally, there are a number of tales, doubtless mostly apocryphal, of men in the water being attacked by Wandering Albatrosses. The only one that seems to be worth citing is the highly circumstantial account by Green . . . of a

". . . sailor who was swooped at by an albatross after falling overboard in 42°S. , 90°E. The man seized the bird by the neck and drowned it, and then used the buoyant body as a float until he was rescued nearly an hour later. . . ."

Male Light-mantled Sooty Albatross brooding its nestling on the ledge of a cliff. Bay of Isles, South Georgia, January, 1913





Peruvian Penguins at the mouth of a sea cave, Independencia Bay

"No sea bird, apparently, surpasses the Peruvian Penguin in exclusive attachment to the Humboldt Current region. . . . Its range is substantially the length of coast line along which the Current is in contact with the continent. . . .

"At the Chincha Islands, in Pisco Bay, Peru, I found during October and November, 1919, several burrows, each containing a pair of adult penguins or one bird covering eggs. All such holes had been dug with difficulty in the sand, pebbles, and fine talus at the junction of a narrow strand and the base of a granitic cliff. . . .

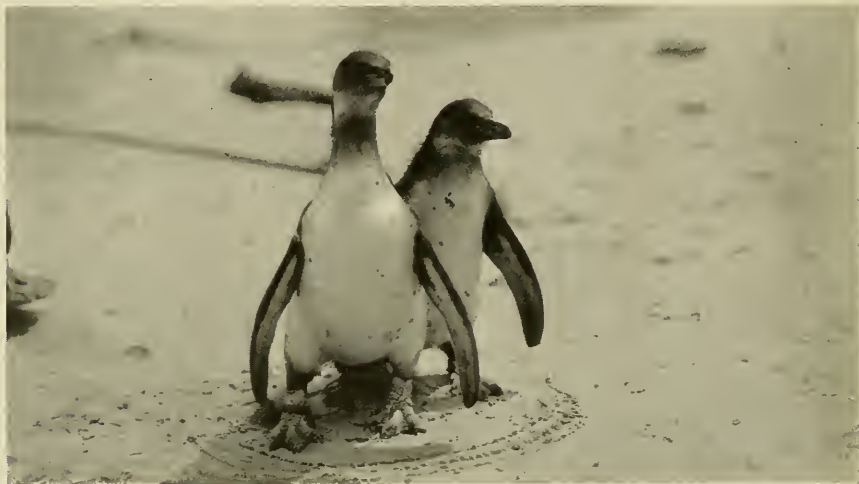
"At Vieja Island, Independencia Bay . . . I found the Peruvian Penguins nesting in burrows, but of a very different type. . . . A high and steep bank behind a shingle beach along the western shore of Independencia Bay was riddled with two horizontal and parallel rows of burrows. The first-floor apartments, so to speak, were underneath a well-marked stratum, half a meter or less in thickness, and about seven meters above the present mean level of the bay. . . . Thirteen meters higher up the bank was a second, similar layer of dark shells

forming, in the same manner as the one below, the roof or ceiling of another tier of penguin burrows. In front of each row of black holes a worn, level promenade, like a porch, had been formed along the face of the silty bank. . . .

"Paessler . . . writes of a fledgling which he caught on the Chilean coast, and which, for the first few days of its confinement, he had to feed forcibly with fish and raw meat. . . . Within a surprisingly short period, however, this captive became reconciled, and began to seek its new source of subsistence. Next, without a struggle, it would allow itself to be tied by the leg, carried down the landing stage, and tossed overboard to catch its own fish. Even when tethered by an eight-meter length of cord, it took plenty of prey, and grew fat. Twice it slipped the line completely, but came back to the steps, nevertheless, and called until it was hauled out of water. . . .

"The Peruvian Penguins often join unwittingly with many other kinds of birds, and with such creatures as bonitos and sea-lions, in pursuing the great shoals of small fish that are so characteristic of the Humboldt Current region. . . ."

*Captive fledgling Peruvian Penguins
Chincha Islands, November, 1919*





Fuegian Oyster-catchers Falkland Sound

"At the Falkland Islands, the type locality of this handsome Oyster-catcher, it is known as the Black and White Curlew. As a matter of fact, its long-drawn wailing cry, which sometimes sounds extremely melancholy as it rings across the moorlands, very much resembles that of the true Curlew in the British Isles. It is shrill and ear-piercing at close range, but plaintive and silvery when heard at a distance. This call is quite different from the steely, rapid-fire note of alarm often uttered. The latter is entirely 'oyster-catcher-like' and when seventy or eighty of the birds are flushed while feeding together, they can make an amazing amount of noise. . . .

"In moments of composure the Fuegian Oyster-catcher may rest upon one leg, with the bill turned back under the wing coverts but with one golden eye kept open for the slightest movement of a watcher, which will send it off again and bring forth a new tirade. The birds spend much time preening and invariably look well-groomed. When they are

angry, they point their wings straight upward and hold them there in the proud manner of skuas. During their breeding season their wide-awakeness is redoubled. . . .

"Cobb states that in the Falklands the eggs are sometimes laid among beach pebbles without any attempt at nest-making, while again nests lined with dry grass are found in the tussock bogs. Once in a while, he goes on, a site may be chosen well inland, among low thickets of the diddle-dee or native heath. Doubtless the commonest type of nests are on the beach, not far above high watermark, but among dry seaweed so speckled with lichens as to show that the water is unlikely to reach it.

"Observations upon the young and their care are scarce. As among other species of oyster-catchers, however, the chicks begin to move about while they are still small; but they are quick to 'freeze' at the sharp signal from the parent birds, and do not stir again until they receive the announcement of 'all clear'. . . ."

*Sheath-bills. Bleaker Island, Falklands
December, 1915*





Belcher's Gull (*with banded tail*) and Kelp Gull, Santa Rosa Island, Peru. The other birds are Peruvian Boobies

Belcher's Gull

"Throughout the guano islands of Peru, the Simeon [as this Gull is locally called] is generally regarded the most serious enemy of the guano-producing birds. . . ."

Kelp Gull

"This handsome black-backed gull, the largest member of its family in South America, has one of the most extensive ranges among sea birds. . . ."

"Distrustfulness seems to be a strongly marked temperamental character of the Kelp Gull. Whenever at South Georgia I was bent upon stalking a sleeping albatross or seal with a camera, and was at the point of accomplishing my object, a self-appointed sentinel in the form of a gull would be almost certain to fly by and to warn my prospective subject with its annoying cackle. But while the gulls would render me no assistance, they were always ready to profit from the slaughter of sea-elephants by members of the crew of the brig 'Daisy.' . . ."

"The Kelp Gull has feeding habits of the most diverse kind, its staples depending very largely upon place and circumstance. Its old mode of life in many places has been changed by human activities, such as those of shore whaling stations and plants for the slaughtering of sheep or cattle. For such reasons, the Kelp Gull is no doubt now vastly more of a scavenger than it was in primitive times. . . ."

"Carrion-feeding is only one step removed from the eating of live stock, and in Patagonia and the Falklands the Kelp Gull is roundly hated because of its attacks upon young lambs. Even dogs and cats go in terror of it about ranch stations. In carrying off eggs or the young of various birds, it is almost as adept as the skua. . . ."

". . . The gulls seem always to be on the alert for the turn of the tide, which will expose their feeding grounds. Hard-shelled creatures, such as they cannot readily break with their bills, they drop from a height in the usual gull manner. . . ."

*Kelp Gulls following a shoal of fish in the Strait of Magellan
November 22, 1914*





Atlantic, or Schlegel's, Petrel off Tristan da Cunha

"Oceanic birds of several groups still belong in greater or lesser degree within a . . . category of uncertainty, but perhaps none so much as . . . members of the Procellariiformes, the order comprising the albatrosses, fulmars, shearwaters, and petrels. Spending most of their lives on the high sea, usually at a distance from the land, these birds are even more essentially pelagic than the penguins. Certain species may abound off any coast, but, unless they are blown ashore by severe storms, or attracted to the littoral waters by peculiar concentration of food, we may be unaware of their existence. While the Procellariiformes are distributed over the salt waters of the globe, they are more numerous in the southern oceans than elsewhere. Here they breed in part at islands so remote or inaccessible that the nesting places of certain species are yet to be discovered. . . .

"That this handsome and extraordinarily abundant petrel should still be so little known is somewhat astonishing. Between the Cape of Good Hope and the neighborhood of the Brazilian coast close to the tropic of Capricorn, and from these latitudes southward to the northern boundary of the Antarctic Zone of surface water, it has been noted by many observers, though collected by few. During my own work in the South Atlantic I logged the species every day, and often in vast numbers. . . .

"Our sailors on the brig 'Daisy' knew the Atlantic Petrel as one of several 'mutton birds,' and we found the skinned bodies of this species to be excellent eating. . . .

"The young stages have never been described, and the only recorded egg, referred to in the text below, is not certainly to be associated with this species."

*A Shoemaker at the entrance to its burrow
South Georgia, November, 1912*







*Courtesy of
Whitby Museum*

Part of old Whitby, the center of the fossil hunter's activities on the Yorkshire coast. The parish church of St. Mary's overlooks the harbor

Among the most plentiful fossils along the Yorkshire coast are the ammonites, an example of which is shown in the photograph at the left. Specimens can be found ranging from half an inch in diameter to over twenty inches. (Photograph about one-fourth actual size)



Staithes, at the northern end of Yorkshire's rich fossil field. Ichthyosaurs and other extinct reptiles have been found in the cliffs to the right; while under the cliffs in the foreground ammonites and other invertebrate remains are abundant

Fossil Hunters' Holiday

Picturesque Yorkshire coast reveals a paradise for the amateur collector. Featuring the ammonite, whose closest living representative is the chambered nautilus

By GEORGE H. RICHARDSON

MANY a person touring England might increase the interest of his trip greatly if he would visit the extraordinary fossil beds of northeastern Yorkshire.

The fifteen-mile stretch of coast between Staithes and Robin Hood Bay, with Whitby as the center, is perhaps one of the most productive fossil beds in the world. It is a veritable paradise for the amateur collector. Glorious beaches and awesome cliffs with thousands of prehistoric specimens invite the traveler to put aside his worries, take up his hammer and bag, and explore to his heart's content.

Life of ancient seas

Ammonites in particular can be found here in abundance, but as will presently be seen, an astonishing variety of other forms are also plentiful. Ammonites are the variety of extinct molluscs which resemble the modern nautilus, the shells being coiled in a flat spiral and divided into chambers. Along this stretch of coast lying fully exposed or partly revealed in nodules are ammonites by the hundreds, measuring from one-fourth of an inch in diameter to more than twenty inches.

Then there are belemnites (fossil cuttlefish) in such profusion that great blocks of shale are covered with them inches deep and one cannot put his fingers down without touching them. Some blocks are literally masses of shells.

A particularly attractive feature of many of the fossils is that they are fully pyritized.

That is to say, they have been converted to a metallic substance, so that they shine with a bronze or brassy luster. Beautiful pyritized lamellibranchs (bivalves, such as the oyster and mussel) and tiny coiled ammonites flash out in the sunlight as if revealing themselves specially for the benefit of the collector. The elongated wedge-shaped pinnae, another kind of bivalve, project in great numbers from the shale as if still alive and partly buried in mud.

Now and then one stumbles on a relic of a much higher form of life. One may find remains of the *Ichthyosaurus*, a gigantic porpoise-like reptile which had four paddle-like limbs and a large head tapering forward into an elongated snout. As the writer saw on his last visit, one may find the whole spinal column and skull of a young ichthyosaur measuring three feet in length. Stranger still, there is a collector at Robin Hood Bay who proudly exhibits the bone of a *Pterodactyl*, a flying reptile.

Dinosaur footprints

At times a fossil fish may be revealed, measuring anywhere from fourteen to twenty-four inches in length, the large scales appearing as though carved out of jet. And at two places as one descends the cliffs one can see footprints of dinosaurs on great blocks of stone. Also there are fossil plants and beautiful leaf impressions in abundance.

At some points one can see blocks of jet, a rich black variety of coal which takes a high polish. The carving of this material has made Whitby famous throughout the world.

The collector will begin his journey from

the famous Old-World town of Whitby. The town is divided into two parts by the river Esk, and the quaint old section is found on the right side of the river. Here stand some ruins dating from the time of the ancient Britons. The streets are not more than four or five feet wide and the principal thoroughfare is so narrow that it is scarcely wide enough for two motor cars to pass each other even though their wheels are on the sidewalks.

Overlooking the ancient town is the old parish church of St. Mary's, built in 1110 A. D., by William de Percy. To reach this historic landmark 199 steps must be climbed. It is approached by way of Church Street, the center of the old town, where the jet is worked and where fossils can be purchased by those who dare not risk the cliffs.

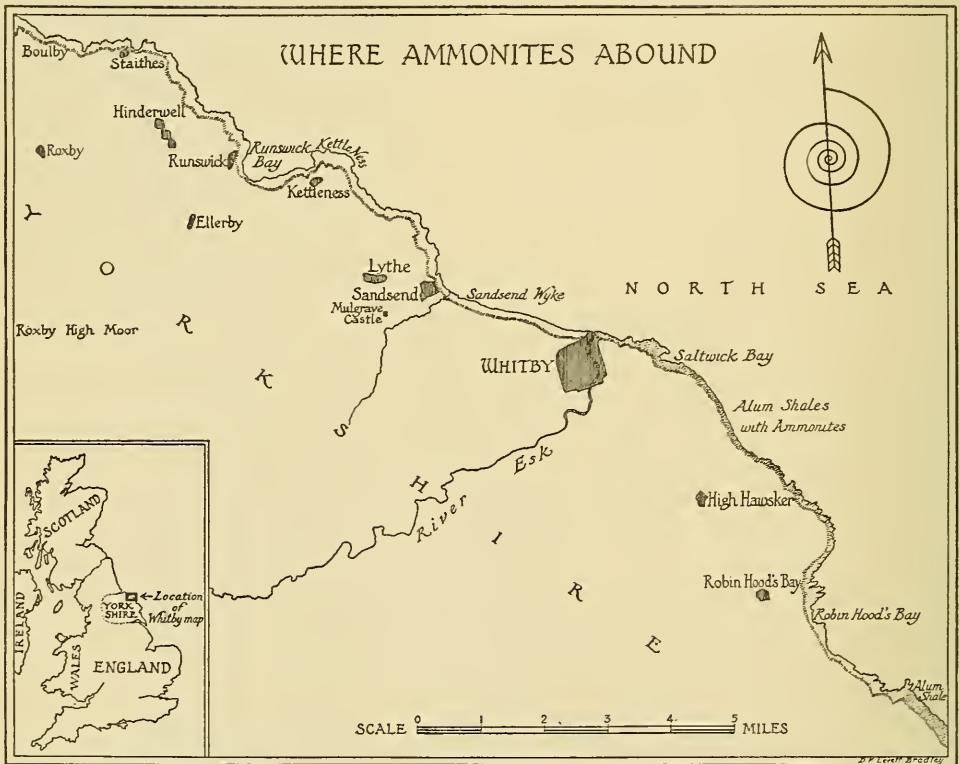
Still higher than the parish church are the famous ruins of St. Hilda's Abbey. The Abbey rose out of the Monastery of Streonshalh,

which was founded by Oswy as the result of a vow in 658 A. D., and was presided over by his daughter Hilda.

According to an old legend, revived by Sir Walter Scott in his *Marmion*, it was St. Hilda who caused the ammonites to occur in this section. She transformed to stone the troublesome snakes infesting the region, after the people had complained to her of their danger and annoyance.

They told how, in their convent cell,
A Saxon princess once did dwell,
The lovely Edelfeld.
And how of thousand snakes, each one
Was changed into a coil of stone
When Holy Hilda prayed.
Themselves within their holy bound
Their stoney folds had often found . . .

Even today the coat of arms of the town of Whitby bears three ammonites, and on traders' tokens of the seventeenth century one can see three ammonites incised.



GLEAMING FOSSILS ARE FOUND HERE

Many of the fossils found along this fifteen-mile stretch of Yorkshire coast shine in the sun like brass or bronze owing to their having been pyritized. This section has supplied the

museums of the world with saurian and invertebrate fossils, and is one of the most picturesque and productive fields in the world for the amateur collector

When the tide makes it impossible for the collector to go on the beaches, he can ramble round this old town which is unique in England, exploring the tiny streets, quaint buildings, jet shops, or the beautiful and helpful museum with its wonderful collection of local fossils, particularly saurians.

Treasure ground of fossils

Going to the bridge which crosses the Esk, the collector can find fossil beds to the north and south as far as Staithes and Robin Hood Bay. If the tide allows, he should follow the beach to both extremities of this fifteen-mile stretch, for every foot of the way is full of geological and palæontological interest.

Beginning at Whitby, he will descend to the beach and walk under the brow of the cliffs on which stands the parish church. Here, where the cliffs reach a height of over two hundred feet, the collector will come to the shale sea floor, and his fossil hunting will begin to bring good results. Whenever he sees a round flattened nodule, he should look on the outside for any signs of ammonites, and if he does not see such signs, he should break the nodule lengthwise, for often the cephalopods are in the middle.

Particularly under the east pier will the opportunities command attention, for at this point of the cliff base the ammonites are very common, as are also belemnites. Oval masses of shale are also common and these should be broken, for invariably they contain shells and belemnites. If one will walk at lowest tide toward the edge of the water, one is likely to find ammonites stripped of all their matrix by action of the tides; many of these are in beautiful condition, not needing any cleaning. Days can be spent on a few yards of these shales and each evening will see the collector return with a full bag.

Proceeding to Staithes, he will encounter at the entrance to the village, if he drives overland from Whitby, one of the steepest hills he ever tried to negotiate. At the bottom of this hill the visitor will come to the "Cod and Lobster," a public house where a youth often sat well into the night listening to tales of the sea, which so fired his imagination that he left his apprenticeship to a grocer and draper, went to sea, and eventually became the famous

Captain Cook. Staithes is still rightly proud of its former apprentice, though the house in which he lived has been altered out of all shape so that one cannot be certain one is looking at the actual building where this youth read and pondered on the life of a sailor.

Nestling in its quiet harbor, this quaint and beautiful spot is a paradise for artists during the summer months, and they can always be seen before their easels. The people here are distinct from all others in Yorkshire, and the carriage of the women as they balance their fish baskets on their heads has often been remarked upon by visitors.

To the north of the village and round the big cliffs saurian remains are likely to be found. Many splendid ichthyosauri have been discovered in the Alum Shales at Boulby cliff, while others have been found to the south of the village. Following the beach to the south of the pier, one is likely to pick up numerous fossils, many of which lie fully exposed without any matrix. Perhaps it is not too much to state that there is not another spot along the English coast where fossils are so numerous. The nodules here are particularly hard and the greatest care is necessary when hammering, for splinters fly off and are apt to cut deeply. More than one eye has been sacrificed at this place because of the flying chips, the great Sedgwick of Cambridge being one of the sufferers.

Colorful fish auction

Always interesting to see, before going down on the beach, is the auctioneer selling the lobster and crab catches of the fishermen. The crustaceans are brought to the quay and thrown down in heaps on sacks where they writhe and crawl while being sold. The pincers of the lobsters are securely tied before they leave the boats, so there is no trouble handling them. To follow the fish auctioneer is quite an education in fish lore, for every kind of fish brought in by the local fishermen is sold on the quay and any person can purchase small or large quantities.

A few miles to the south lies one of the quaintest villages in England, Runswick Bay. How the houses in this village were ever built is always a puzzle to the visitor, but their positions, their tiny but beautiful gardens, finely graded terraces, and red-tiled roofs give the

village a charm one scarcely expects in this work-a-day world.

With a minimum of effort the collector can pick up fossils to his heart's content all along the beach, and particularly at Port Mulgrave, a small hamlet on the way to Runswick Bay.

On our first visit to Port Mulgrave we felt amply rewarded for the awful climb down the hundreds of feet of cliffs to the beach, because it almost seemed as though some person had gathered fossils and thrown them about the beach especially for our benefit. The tide would not permit our walking far on the beach, but there was one stretch where it was possible to collect fossils in spite of the rising waters. In order to reach this we had to go down an exceedingly steep and narrow path with steps cut into the shale cliff by miners years ago, which however are now too badly worn for comfortable walking. At some points the path cannot be seen below, but walking by faith rather than sight we finally reached the bottom. What a glorious time we had there with the fossils.

The first fossil we picked up was a good-sized, magnificent fragment of a very large ammonite fully pyritized and shining like a piece of chased brass. It was beautifully ribbed

and measured ten inches on the outer curve, four inches in depth, and two inches thick.

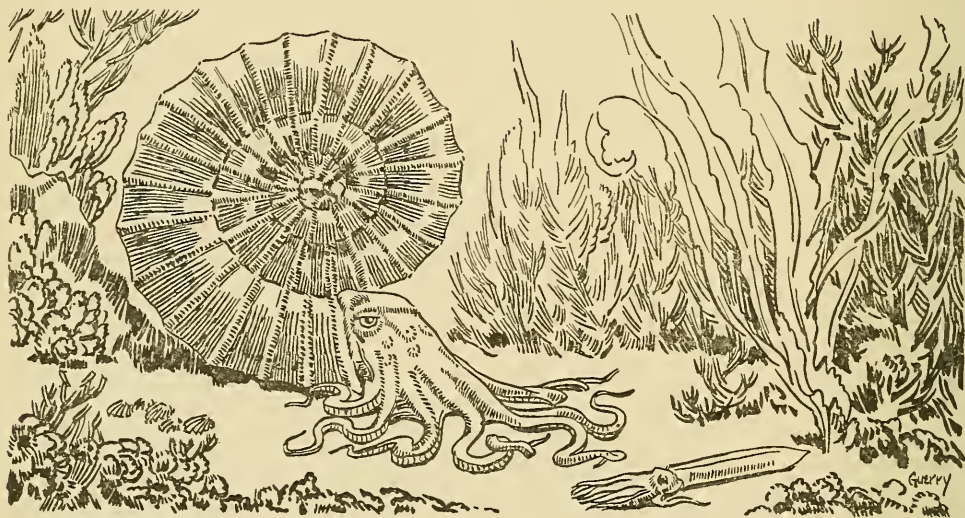
There is a strange thrill in taking out fossils while the tide is coming in and the waves are washing almost to your feet, and it is a thrill one should not seek unless he is certain of a way of escape should the tide rise hurriedly.

All along the coast from Staithes, through Port Mulgrave, Hinderwell, Kettleness, Lythe, and on to Sandsend, there is the most delightful scenery, so that while the scientific interests of the collector are being satisfied, his æsthetic nature is also being fed.

It is quite impossible to give the names of all the fossils found in this part of the coast north of Whitby, but particularly the seeker of invertebrate fossils will have the time of his life.

Returning to Whitby, our collector should proceed at his leisure to Saltwick. We suggest that he follow the upper path on the outward journey, for along it nothing interrupts his view of the sea. As he travels along these towering cliffs, unless his soul and mind are sodden, the sight of the boats, ships, sails, sea-birds, etc., is bound to give him a thrill he will always remember.

Descending the cliffs by a narrow path, the collector will come to a wide-spreading beach



RESTORATION OF GIANT AMMONITE

Lying fully exposed or partly revealed in nodules, specimens of this extinct mollusc can be found along the Yorkshire coast by the hundreds. Cut and polished, the fossilized shells

reveal their separate chambers in a beautiful pattern. The creature in the lower right-hand corner of the picture is a fossil cuttlefish (belemnite)

of shale on which are to be seen great masses of belemnites lying one above the other five and six deep. Some of these beds measure many yards square, while ammonites in abundance peep out of the shale, denuded of practically all their former matrix by tide action.

If the collector is fortunate he is likely to find remains of the prehistoric lizard-like reptiles. Many ichthyosauri, for instance, have been taken out, gigantic fossil reptiles of porpoise-like form. Many of the ichthyosauri measure as much as twenty-five feet in length. These remains are found in the Alum Shales which are well exposed here. Among the saurian relics in the writer's possession from these shales are a part of an ichthyosaur jaw with teeth, and some vertebræ both of ichthyosaur and plesiosaur, the latter being a long-necked marine reptile of Mesozoic times.

A dizzy descent

To the south of Saltwick and under steep cliffs, lie the beaches of Hawsker, but here the tides are especially treacherous and the collector must inquire carefully before venturing forth. There is only one path by which he can ascend from the beach, and this should not be attempted by any whose heart and lungs are not in the very best condition. Finger and toe holds offer the only support the greater part of the way, and the projecting shales are sometimes treacherous. Should one be caught by the tide, he could get out of reach of the water, but it would mean some weary hours before he could find deliverance.

Leaving the beach at the end of the Alum Shales, the collector should take the path leading away from Saltwick. He should keep his eyes open for some large blocks of stone at the left-hand side of the path, for on these are to be seen the footprints of dinosaurs. Following the path through the fields at the top of the cliff, he will come to Hawsker.

At Hawsker, jet has been found for many years and carried into Whitby, the latter town being famous throughout the world for its associations with jet and the manufacture of numerous articles out of this velvet-black mineral. An example of this work stands beside the writer's typewriter, a most beautiful miniature ornamental table made of jet, two and one-half inches high and most wonderfully carved. A

polished ammonite (*A. communis*) is inlaid in the top, showing every chamber perfectly because of the polishing. A number of shops in the old part of the town have their windows filled with objects in jet, many of them glorious works of art, and if one is favored, one can get into the workshops where the jet is polished and carved.

While talking with one of the workers, who was carving a picture of the Abbey in a piece of jet designed for a brooch, we were amazed to notice that he carried on the conversation without ever stopping his work. Without any apparent effort he carved the figure without the tiniest slip. In this man's shop we looked with envy upon a large and magnificent chessboard, perhaps the most unusual one in the world. It is three feet in length by about twenty-two inches in width, and four inches deep, carved out of a mass of jet. The squares are laid out in ivory, and every alternate square is inlaid with beautifully polished ammonite. Around the broad, beveled border Greek mythological figures are carved, and the workmanship is perhaps as fine as any we have seen. The areas at either end are exquisitely carved, and at one end there are three tiny pyritized ammonites from Hawsker forming the insignia of Whitby. One does not hesitate to believe this gentleman when he states that it took four years to carve this marvelous board. No description can adequately reveal the glories of this work of art, but how the soul of a palæontological chess player would rejoice as he vanquished his opponent while playing on such a board.

Found and lost

Soon the jet trade of Whitby will be a thing of the past, for no one is learning the trade today and the supply of jet is becoming less each year. The places once famous for the supply are barren. Occasionally but not often a fall of cliff reveals a mass. A few days before our last visit there was such a fall, and an old jet hunter found a splendid deposit. Taking out sixty pounds' (three hundred dollars) worth, he brought it in to Whitby and sold it to two carvers. Rich beyond his dreams he decided to celebrate his new fortune, and going into a public house he soon became merry in his cups. As the alcohol worked so did his tongue, and

it was not long before he was telling all and sundry of his fortunate find. In spite of the lateness of the hour, his assertion that he had left more than he had brought into Whitby caused some of his listeners to set out with lanterns in search of it. They located the treasure and brought it to Whitby, where they sold it for seventy English pounds. The original discoverer learned of his mistake the next morning when he returned and found the supply gone.

Whereas a few years ago fifteen hundred men and boys were employed in the jet industry, today there are only two men pursuing the carving of jet for the market, and one of these is an old man lamenting the passing glory of that ancient trade.

Glittering fossils

Many of the fossils from Hawsker are fully pyritized, and most of the specimens found by the writer shone like polished brass as they lay exposed on the beach. Whole blocks of hard rocks can be found whose tops are covered with these beautiful fossils.

Continuing on the beach to the south, one finally comes around a boldly projecting cliff and finds himself in Robin Hood Bay. This is even more picturesque than Runswick Bay. Visitors are invariably charmed as they find their way up and down countless steps and walk along streets often not more than four feet wide. It is no exaggeration to state that there are thousands of steps in this little village perched on the cliffs of the bay. Leaving the hotel at the top, one begins the descent to the village down a great flight of steps, past every kind of cottage, and thence to the beach.

Here is a beautiful bay making a complete half-circle, and on its beach the collector can expect to find any kind of Jurassic fossil.

Many of the specimens of ammonites found here likewise have the metallic luster which results from pyritization. A fully exposed one which the writer picked up as soon as he stepped on to the beach on his last visit flashed like a piece of molded brass. Various ammonites are to be found here in abundance (*A. semicostatus*, *raricostatus*, *oxynotus*, *gagasteus*, *capricornus*, *jamesoni*, etc.) ; and, in the shales forming the sea bed, gryphaea, belemnites, and a host of small fossils are to be seen stick-

ing out everywhere. In the shale masses that have fallen from the cliffs, *Pinna folium* is a very common fossil. Many of these are huge in size, and lie as though still alive in the mud. It is no exaggeration to state that in places bivalves and gastropods are as common as pebbles on the shingle.

Someone else's luck

While we were breaking out some ammonites partly exposed in some nodules, and at the same time keeping one eye on some very fine *Pinnae* which we intended to take out of the shale next, a well-known collector came along and unconcernedly announced that he had taken a perfect Pterodactyl bone out of a shale nodule. His unconcern was almost irritating, for we particularly wanted to find bones of the Jurassic period, whereas he was an invertebrate palæontologist. How we would like to have suggested making an exchange, but something in his eye, in spite of his apparent unconcern, warned us that the specimen he had discovered would be his very own for life. Of course, we should have felt exactly the same way if we had found it, but we nevertheless felt that fortune had discriminated against us rather badly. We recalled an experience in the Badlands of South Dakota, when a gentleman from New York found without any difficulty a saber-tooth tiger skull in a small hill to which he had been directed by the owner of a filling station. The owner of the filling station had collected fossils for years and had particularly hunted for such a skull, but without success. Such are the fortunes, or misfortunes, of a fossil-hunter.

This is but the briefest sketch of a subject large enough for a number of books. But when we think of these miles of glorious cliffs and sea beaches which have supplied the museums of the world with saurian and invertebrate fossils, and when we recall those beautiful villages with their whitewashed, red-roofed cottages perched on seemingly perilous cliffs and nestling so beautifully in quiet harbors, it is no exaggeration to say that this fifteen-mile stretch of coast on the northeast of Yorkshire is one of the most fascinating and productive regions of the world for the fossil collector.¹

¹ The reader will thoroughly enjoy *The Official Guide to Whitby*, published by Horne and Son, Ltd., Bridge Street, Whitby, England. 1/—(twenty-five cents).

Color Records of the Badlands

Two artists journey 9000 miles in the interests of science to bring back geological data expressed in terms of light, form, and color

By JOHN AND LOUISE GERMANN

*Staff Artists,
Department of Vertebrate Palaeontology*

THE average museum expedition collects something fairly bulky—such as modern animals, birds, reptiles, or fossil bones. The specimens arrive in the museum at the end of the season in impressively large crates. The expedition we are about to describe came home with a package no larger than a suitcase to represent the season's work.

A picture, according to a Chinese proverb, is worth ten thousand words. Experience has shown that the museum visitor is always quick to appreciate the dramatization of scientific data in terms of light, form, and color. The pictorial method applied to geologic data by means of the new charts just installed in the Osborn Hall of Tertiary Mammals at the American Museum is a practical application of the above principle.

Prehistoric animals plus geology

These new charts were planned to show the relation of the animal types exhibited in the hall to the various Tertiary strata in which their remains were found.

For years this fascinating information was displayed by means of two bleakly conventional diagrams. No visitor gave them more than a passing glance and the real significance of the exhibit as a whole was lost.

The unusual details of the mounted specimens continued, year after year, to draw exclamations of amazement and pleasure, but there was a definite need for some sort of key to give at least a hint of the marvels of evolution, showing not only the orderly march of primitive forms advancing to a final state, con-

trolled by changing climate, but also the survival of adaptable forms and the extinction of others.

Because scenes of classic fossil localities were to form the main attraction of the new charts, it was decided to arrange these scenes centrally, with a column to the right containing pictures of typical animals found in each formation. Wherever possible, the well known Knight restorations were employed. The scale of 1/20 natural size was used for all animals to convey the comparative size throughout.

Charts necessitate expedition

The drawing of the scenes was a simple matter of transferring the pick of many excellent field photographs to canvas. But the color? Confusion! The descriptions furnished by scientists were many and varied. One man remembered colors as seen on a bright day at a distance, another retained impressions of color seen after a rain. Finally, driven to despair, two determined artists told Doctor Granger that their ethics were being badly strained and that they had to see the actual country, at any cost. Doctor Granger took the declaration calmly enough, and admitted that first-hand information is ever the aim of science, but asked on what the artists intended to travel. Promptly a plan was revealed for his consideration. A tried-and-true sedan formed the basis of the scheme, and when this was matched by a leave of absence from museum duties, the expedition was practically under way.

Doctor Andrews' motto "Adventures are a mark of incompetence," became the watchword; and the impressive title "The Germann Badlands Reconnaissance Expedition" was

adopted to cover the scanty equipment hastily gathered for the trip.

Everyone knows that an artist is happiest when depicting atmosphere, color, and form. It is not hard to imagine the eagerness with which we planned this trip. One widely traveled, slightly cynical, but very much amused scientist remarked that there was enough planning going on to carry a truly scientific expedition to the headwaters of the Amazon.

Doctor Granger insisted that we take with us most of the literature on the geology of the region (ten pounds of it including maps). This was stowed away under the other dunnage only to be dug up frantically two weeks later by a couple of artists badly in need of specialized geologic information. Doctor Colbert furnished us with a list of selected localities, sufficient to give a true story of the geology.

The Doctors H. E., F. D., and A. E. Wood furnished road directions sufficiently detailed to land us time and again at a specific scene although, often enough, the location was no more than a small erosional cut in the general center of an all but howling desert. Harold Cook, of Agate Quarry fame, performed the miracle of making clear to us the stratigraphy of the Nebraska Tertiary deposits.

Equipped for rough country

Our painting equipment consisted of sixty canvas panels, thirty pounds of paint, and our sketch boxes. Two light canvas beach chairs with sunshade attachments served as portable studio equipment. A light six foot by eight foot miner's tent, Hudson Bay blankets, a gasoline cook stove, and a railroad lantern formed the bulk of our camping equipment. The car was rigged with a homemade folding shelf bed, which could be extended on the back of the seats—this proved a blessing when sand storms with high winds might have sent us over the prairie chasing a runaway tent. An army engineer compass worn at the belt also saved much time when dust storms wiped out all trails. It will be of interest to Boy Scouts that, due to carefully taken compass bearings, we never were lost for a moment. However, it must be admitted that the places to be sketched were often strangely mislaid—one time for two days!

Four days of travel from the American Museum took us over the Mississippi and into Nebraska. The engine was boiling over and we were in the field at last, in the midst of drought-stricken prairies which reached in all directions as far as the eye could see. Our first port of call, Ainsworth, somewhere ahead, was to be reached by nightfall, over a rough road fenced in with barbed wire. Later, with emergency engine water exhausted, we cheered faintly as we pulled out at last on to hard-surfaced roads.

A wind storm

In Ainsworth we bought straw sombreros and a three-gallon water keg. With these final details attended to we headed for the sand hills south of the Niobrara River. The sun was overcast by dark clouds as we drove down a sandy wash and came out on the level rim of Devil's Gulch. As we unpacked our equipment in the semi-gloom, a strong wind sprang up and with it a whispering noise made by fine dust blowing against sage and yucca. By the time we had eaten supper, the whispering had increased to a shrill whistle. We went to sleep thinking of the significance of the figures showing fractions of a person per square mile given for some of our western states.

The next morning at sunrise we were hard at work on the first sketches of the trip.

Our real initiation in modern badlands running was given us by a local field man. We had returned to Ainsworth after two days at Devil's Gulch completing our sketches. The field man was M. F. Skinner. We accepted his invitation to spend an afternoon with him getting instruction and information for future reference. We started out mildly enough, down the local idea of a surfaced road—but not for long.

"Want to see our old quarry in the canyon?" we heard him say.

Bump! Right off the road diagonally down the side of a ditch, up the other side and right out over the prairie. Then we slowed down to cross an eight-inch cattle trail cutting our path at right angles; a pick-up of speed and soon the car was running in ruts cut in the surface of the prairie. Then another trail joined and the ruts became so deeply worn that the car had to be driven astride, instead of in them. All this at forty miles an hour!

Just as we were becoming accustomed to this startling type of road, we again slowed down to go into second speed and descended a grade, the surface and pitch of which fairly took our breath away. Five minutes of level going and we skidded to a stop on the rim of a cliff with the floor of the valley far below. We had arrived at the Quarry. Once out of the car, we expressed a desire to get a sample of the matrix (the rocks in which the fossils are found). Our guide with a brief "I'll get some for you" literally jumped off the cliff. We rushed to the edge to find that our friend had landed on a huge sand slide and was taking ten-foot steps down to the old quarry hole halfway to the valley floor below. Later in the trip we, also, used this technique to startle a number of newly made friends. We practiced this method of descending cliffs boldly until one day your artist was deceived by a hasty glance over the cliff. Upon landing, he found that he had come into violent contact with a hard clay slope instead of sand. After a hot, fast slide, he landed with most of his breath gone and his pride as a badlands runner badly bruised.

Certain rules were made with a view to keeping the many details of the charts uniform. The most important detail was the direction from which the light would fall on the scenes. As each chart would contain many separate localities, a difference of lighting would prove confusing. At first glance this seems a very simple matter to take care of; however, other requirements of uniformity built up a very nice problem. In the West, midday sunlight is especially intense, so much so that the glare completely robs the country of any definite coloring. This makes it almost impossible to make color notes from about 11:30 to 2 o'clock. The third problem is that of constantly changing shadow patterns. The sun moving calmly through the heavens takes no pity on the draftsman. Shadows are forever shortening or lengthening, and even experience will do little to overcome this difficulty.

Plan of attack

Early in the trip we worked out a mode of procedure which would lengthen our sketching time. Upon arriving at a formation we would scout around to determine a composi-

tion that would best fit into the finished chart proportions, keeping in mind the need for picking the typical coloring in each case. Having determined these factors, we would draw the main outline, block in the general color, and finally paint the shadow pattern, so necessary to show erosional details. Even with this system an occasional two-hour session of work was the best we could attain. The observance of these details caused us to follow a most peculiar schedule at times, and probably did much to strengthen the belief of many local people that artists are queer folk at best. Sunrise often found us in our beach chairs with most of a sketch drawn in. Passing sheep-herders and cowhands could never resist riding over to investigate two beach chairs set up in the midst of nowhere. One cowboy we met near the mouth of Pat O'Hara Creek solemnly informed us that he knew about fossils called dinosaurs, and that he had been told that they had been known to eat cowboys in the old days. Being forewarned about western humor, we gracefully side-stepped the issue and do not know to this day whose leg was being pulled.

A three-day rush

The best example of the schedule we often were forced to adopt, because of light restrictions, was in southwestern Wyoming. This country contains the Bridger Series of geology. Our list called for three sketches: "Bridger A," the earliest in the time scale, buff cliffs, streaked with gray, located at Carter; "Bridger B," central in the series, a ghostly brown, tan, and green-gray formation to be painted at a spot about ten miles from Mountain View; and "Bridger C, D, E," the third location, a series of colorful grays to be painted at a point midway between the towns of Lone-tree and Burnt Fork. The exposure forming "Bridger A" runs north and south with the cliff face toward the west. Adherence to the rule of the light coming from the left meant we would have only three quarters of an hour before sunset in which to work. "Bridger B" was so located that 10:30 to 11:30 would give us the light coming from the left, but also formed the limit before the sun-glare would become so intense that colors could no longer be matched. "Bridger C, D, E" was located for early afternoon painting. Being really a

series of three formations with an additional capping of sandstone "chimneys," it needed all the time we could give it to get a true record. We made a reconnaissance trip and found that our three sketching localities formed a triangle with the town of Lyman near the center. A round trip of this course would involve ninety miles of driving over some fairly steep grades, so we took a cabin at Lyman and unloaded the car enough to insure fairly fast going. Then started a three-day rush.

Cutting corners

In the morning we were off to Mountain View, through the town to the "Bridger B" location. Out of the car to set up the equipment, work until 11:30, then the material reloaded and off for Lonetree. Lunch eaten on the road, one hand for the wheel, the other for the canned tomatoes. Just past Lonetree, out of the car again to paint "C, D, E"; then another loading, and off on the longest leg of the course, Lonetree to Carter, to paint "Bridger A" at sunset. Three days of work finished the series, thanks to a light automobile and a heavy pressure on the accelerator.

The roughest country was encountered toward the end of the expedition. Northeastern Utah contains high mountains, in whose foothills are deeply eroded lands, the high points covered with gravel and the dry washes between deeply filled with fine sand. After locating an area of typical Duchesne River Formation, we tried to find a road that would take us to the far side of the Green River. This jaunt was attempted to save two silver dollars and a lot of time. The regular method of reaching exposures of the Uinta formation would take us back over our route and involve the use of the Ute-run ferry at Ouray. The ferryman would charge a dollar each way if sober, three to five dollars if half-inebriated, and there is no ferry at all when he is fully drunk.

We started from the sketching point on Deadman's Bench, a ridge twenty miles long, taking a trail along the rim of the bench for a few miles, then striking downward and out on the flats, over an endless series of wavelike ridges of red, green, and tan sun-baked clay. As we jounced along, the ridges became sharper and the sand-filled gullies deeper. Re-

peatedly our gas tank scraped as we climbed the far bank in low gear. We kept going, heartened by a lone set of clean-cut auto tracks that wound out challengingly before us. If another car could climb over these slopes we would do the same. The sun was getting hotter and the grades out of the gullies steeper, until finally reason prompted us to examine these lone auto tracks closely and try to read the trail ahead, as did the plainsmen of old, to determine whence came the strange grade-climbing power of this auto we were following. Sure enough, half obscured by the tread marks were the prints of horses hoofs! We had been making our trail-weary auto follow a light team-drawn wagon. The horses were harnessed in such a manner that the following tires obscured the hoof prints as fast as they were made.

A fallen bridge

Our binoculars now showed us, far to the right of our path, a thin green line of trees marking the river we wished to cross. The ground between us and the river being even rougher than that which we had already crossed, we reluctantly turned back. Our gas supply low, we started to back-track and reached our base with an all but empty tank, the bottom brightly scoured by the sand we had ploughed through in each ravine. The walls of these gullies were so steep, and the sand in the bottom so deep, that we were forced to dash at the crossings at full speed in order to make them at all.

The next day we devoted to sketching at Deadman's Bench. We painted by the mid-morning light and so the afternoon found us free to try out a new hunch as to a route to the country back of Ouray without paying two silver dollars. The new direction lay more to the east and the going was fairly smooth with only an occasional drift of fine sand to slow us down. At last, emerging from a low spot in the trail, far ahead of us loomed the banded purple, pink, and gray Uinta country. But, alas, our joy was short lived—a deep gully barred our way. The bridge that should have been there was missing. Yes, it had fallen in and no one wanted to use it badly enough to rebuild it. This would have been difficult under any circumstances, but was made more so here since most of the remains of the old

bridge had been taken away for fuel. The failing light turned us back toward our base again. The next morning found us heading for Ouray not only willing, but eager to pay the Ute ferryman two silver dollars!

In order to attend to the many details so necessary for scientific accuracy in the short time at our disposal, we divided the main points to be covered between us. One artist painted each scene with special reference to composition, while the other concentrated on the proportional widths of color bands and erosional details. To give our studies further authenticity we painted as though a test were being given in a classroom. The sketch boxes were turned so that the canvases were hidden, and comparisons were made only when the work was finished.

Forty-six sketches

Due to the drought conditions of 1934, all sketches were made from perfectly dry formations, doing away with any chance variation in color intensity. Altogether we had time to do forty-six sketches of twenty-four forma-

tions in five general Tertiary regions of the west, the Big Horn, Bridger, Wind River, and Uinta Basins and the Great Plains area. Nine thousand miles of driving and sketching in the eleven weeks allotted, and we were back in the East, unpacking the car and literally shaking the dust of the West from ourselves and equipment.

Colorful memories

Long after the sharper details of the trip have faded we will retain the memory of those all too brief weeks—day by day wandering through cattle ranges, along parallel wagon ruts that wound in and out through sage brush prairie, along rim rock, down through the breaks and out on the flats where the heated air made the landscape wave and flow like an underwater world. No record could truly tell of this world of wine reds, green grays, and vivid yellows that custom designates as our Tertiary badlands.

This is the country which we have tried to bring home to the visitors of our Museum in these four charts.



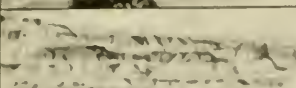

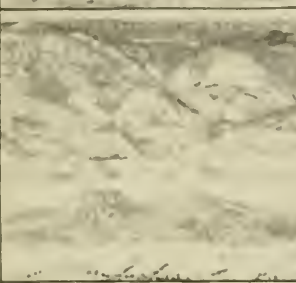








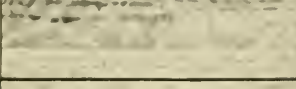

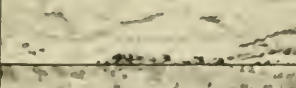

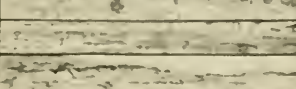







(Left) Green River ferry run by Ute Indian—the route that the artists had to take after encountering a fallen bridge

(Right) The transportation unit of the Hermann Badlands Reconnaissance Expedition. Sixty canvas panels, thirty pounds of paint, ten pounds of geological literature, and camping equipment comprised their luggage



COMPOSITE SECTION OF THE PALEOCENE
EOCENE DEPOSITS OF NORTH AMERICA

B R I O G E R	OSCHERNE RIVER		
	UINTA C		
	UINTA B		
	A		
	D		
	C		
	B		
	A		
	WIND RIVER	LOST CABIN	
	WIND RIVER	LYSIE	
W A S A T C H	GRAY BULL		
	CLARK FORK		
	TEFFANY		
	TORREJON		
	PUERCO		

Color Record

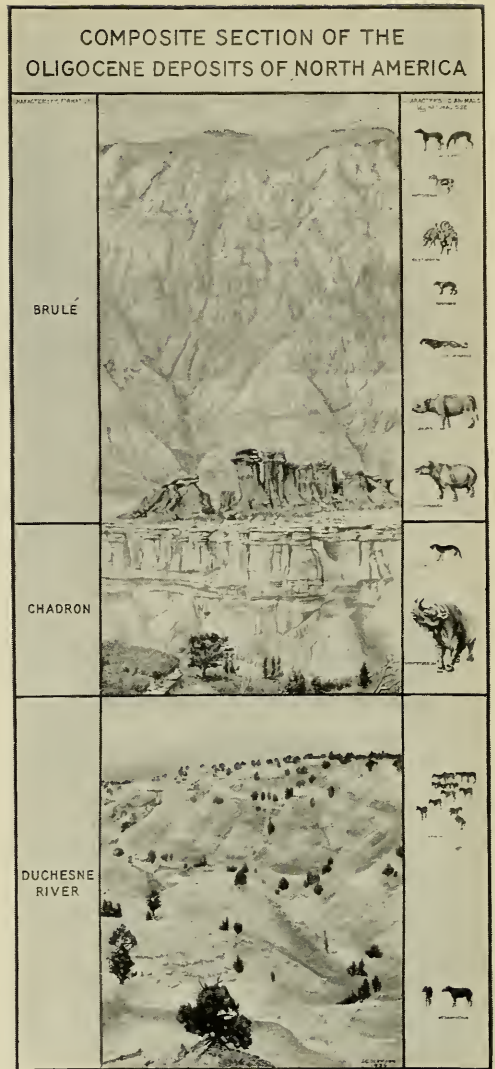
The unusual charts shown here and on the following pages represent a new attempt to show the relation between pre-historic animals and the rocks which yield their remains. Recently installed in the Osborn Hall of Tertiary Mammals at the American Museum, they are the work of John C. Germann

(Below) Fantastic shapes rising like ghostly castles out of the prairie—a scene along the artists' route



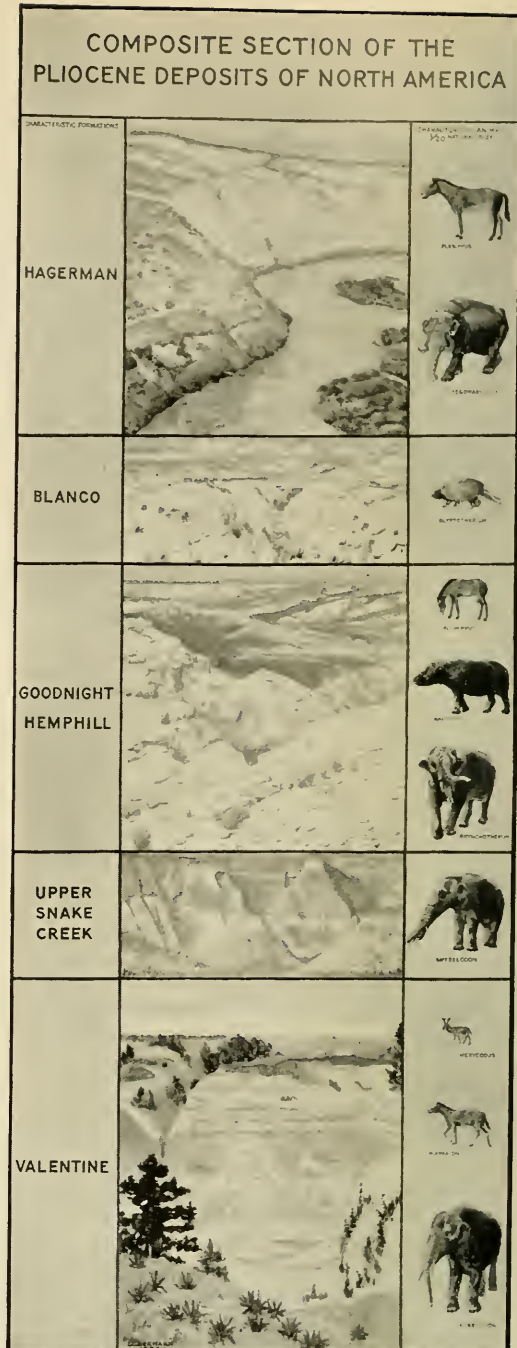
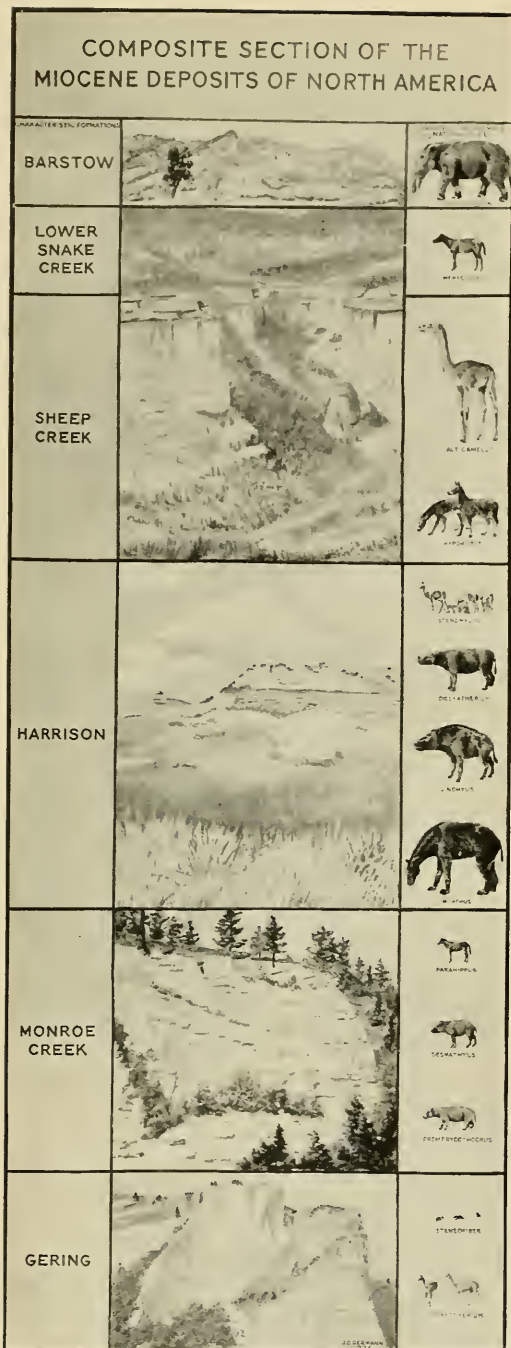
the Badlands

The artists traveled 9000 miles in a "tried-and-true sedan" to get authentic color records of the Badlands. The charts show the orderly march of animals from the primitive types to the more highly evolved. The period of time covered by the four charts is about 60,000,000 years



(Below) Sheep Mountain near Scenic, South Dakota, chosen to represent the Brulé formation





Eighteen million years of evolution are compressed into the above two charts. The animal forms include mastodons of varied types, the extraordinary clawed ungulate *Moropus*, three-toed and one-toed horses, and a variety of camels small and large. The most recent animal represented on the charts is *Plesihippus*,

shown in the upper right-hand corner, a near ancestor of the modern horse. About 2,000,000 years have elapsed since this animal walked the earth, a time comprising the Glacial Period, with its advances and meltings of the ice, during which the fauna has evolved into the modern familiar forms

sions of the periods represented. At the extreme left the time scale is given. The diagram reproduced below goes with the Pliocene chart shown on the preceding page

[illegible]

A black and white photograph of a large, eroded sandstone cliff face, likely a butte or mesa. The cliff shows distinct horizontal sedimentary layers. The foreground is rocky and uneven, with some small shrubs. The background is a flat, open landscape under a clear sky.

A Fish That Made History

William Forster's Burnett salmon—a strange Australian fish that led naturalists to a surprising adventure in evolution

By WILLY LEY

AT THE entrance to the Hall of Ocean Life in the American Museum of Natural History a group of exceedingly queer fish may attract the visitor's attention. These fish are mounted in a false aquarium in such a manner as to appear to be swimming near the surface of the water. But the feature of the exhibit that will perhaps catch the eye of anyone who knows his natural history is the fact that one of the fish is resting with its snout protruding above the surface of the water. This posture was not introduced into the group merely by chance. It illustrates a habitual practice of this fish. The fish is not in quest of food but of air. The Australian lung-fish, for such is the type, comes to the surface about every hour to renew the air in its lung.

Romance in science

The story of this fish begins almost like a Jules Verne novel.

In 1869 an Australian squatter, Mr. William Forster, who had lived for a number of years on a farm near the Burnett River in Queensland, moved to Sydney and settled there. Looking over the city which was to be his home, one day he visited the Museum of Natural History and there met the curator of the museum, Gerard Krefft. They became engaged in conversation, and Mr. Forster asked the curator why the museum did not exhibit a certain big fish from the Burnett River with which he was familiar.

Gerard Krefft did not understand the question.

"What big fish?" he asked.

"Well, the farmers around there call it the Burnett salmon, or something like that," replied the squatter, "and the natives call it *Barramundi* or *Barramunda*."

Threshold of discovery

Krefft was not familiar with these words and asked for a specific description. Forster described the fish as well as he could, and Krefft concluded that he had not had the pleasure of making the acquaintance of this strange creature; indeed, that it was probably unknown to science. Forster promised to try to secure specimens of it, and wrote to his cousin, who still lived at the farm near the Burnett River.

The cousin granted his wish, and a few weeks later a barrel arrived at the museum, containing a few specimens of "*Barramundi*," salted well to prevent the Australian heat from doing too much harm to his gift.

Krefft took the fish out of the barrel. It was a big fish—so much was sure. About five feet long it stretched, with comparatively large scales of greenish color and with several very pronounced features. The tail, for example, was not the forked tail of regular fishes, nor was it a tail of the kind sharks have. It was a so-called diphyceral tail: simply a rim of fin material around the end of the spine, difficult to describe but easy to remember once seen. The pectoral fins of the new fish which Krefft was to describe for science were most extraordinary, too, for they were more paddle-like than the fins of any other living fish then known.

But then the great surprise came—a surprise that might almost be compared to the surprise a scientist would experience if he opened a shipment supposed to contain Australian kangaroos and found among them a surviving dinosaur. Krefft opened the mouth of the new fish and looked at its teeth—they were an exact replica of the teeth of fossil fishes that had been found in a very old geological formation.

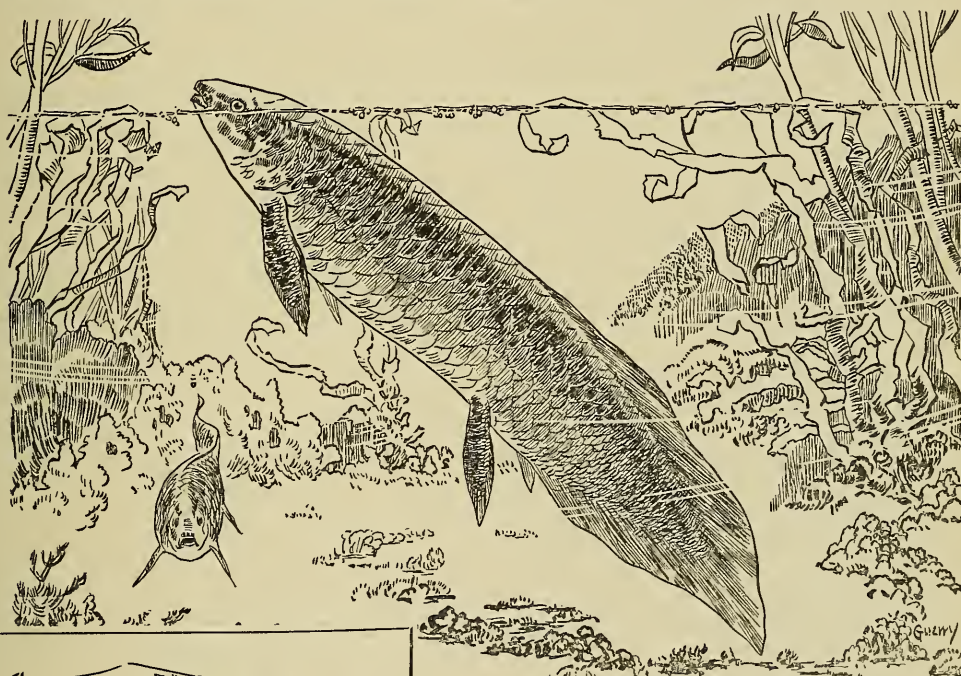
Everything pointed to the fact that the strange new fish from the Burnett River was a survival of a very primitive type from the middle ages of fish history.

Before the fish from the Burnett River had been discovered, the fossil teeth which show a relationship with it caused some perplexity among scientists. It was at first suggested that they were the dental apparatus of fossil sharks; then it seemed more probable that they had belonged to a relative of our sturgeon,

although the latter has no teeth at all. The great authority Agassiz christened the unknown fossil fish possessing these teeth *Ceratodus*, meaning the “horn-toothed one.”

Krefft realized that the teeth of the fish from the Burnett River were so similar to the teeth of the fossil fish that he did not dare to give a new name to the new fish, but applied the same name that its distant relative bore, *Ceratodus*. The specific name, *forsteri*, was given in honor of the original discoverer. And when the name of the scientific discoverer Krefft is included, the designation becomes *Ceratodus forsteri* Krefft. The names *Neoceratodus* and *Epiceratodus* have also been used to distinguish the recent fish from the fossil *Ceratodus*; and the question of generic distinctions has caused some confusion.¹

¹Heber A. Longman discusses the nomenclature in *Memoirs of the Queensland Museum*, Vol. IX, part II, page 168.



AUSTRALIAN LUNGFISH

An Australian squatter discovered this strange fish which breathes both air and water. Gerard Krefft of the museum in Sydney recognized the fish's teeth (indicated at left by arrow) as a replica of fossil teeth from a very old geological formation. Subsequent study showed that it had evolved in the direction of land animals without becoming one of them

The common name "lungfish" refers to the fact that *Ceratodus* possesses a lung besides its gills. Interesting and important as this may be, it has to be noted that the teeth are a far more important feature, so that the admittedly difficult scientific name of this creature is much more descriptive. There is only *one* fish with archaic teeth like *Ceratodus*, whereas there are three fishes known that have lungs. All of them, of course, are reminders of forgotten ages and have rightly been termed "living fossils."

Gerard Krefft, curator of the Museum of Sydney, knew all these things, as far as they were known in 1869. He knew that two different lungfishes were already known. Lungfish No. 1 had been discovered in 1833 by the Austrian collector Johann Natterer in South America. It looked like a fat eel, was about two feet long, and showed a pair of lungs aside from its gills, both organs fully able to function. The natives called the creature *Caramuru*; Natterer invented the scientific name *Lepidosiren* for it. Lungfish No. 2 had been found a few years later in the White Nile in Africa. It looked very much like *Lepidosiren*. The native name was *Comtok*; the scientific name became *Protopterus*.

Scientists wondered

Both of these forms caused annoyance among zoölogists before Darwin's time. True, they chiefly resembled fishes, but if they were placed among the fishes in the systems of classification, it was hard to see what should be agreed upon as distinguishing amphibians (frogs, salamanders, etc.) from fishes. Here were fish that had lungs. According to the old criterion this placed them above fishes. But they could not be placed among the amphibians either, because they had scales. The third alternative was to classify them with the scaly reptiles, but this was impossible because the lungfish had gills.

Actually these two lungfish illustrated the evolutionary process by which the power to breathe air instead of water was developed. Nothing like *Lepidosiren* or *Protopterus* had at that time ever been found in a fossil state, and the great drawback to an understanding of their true significance was the fact that the very idea of convergent evolution had at that time not yet been developed.

Then *Ceratodus* was discovered, the third and largest lungfish, growing to a length of almost six feet in its largest specimens. It had a lung; at the same time its other features proved that it was of vast age. Most important of all, its teeth had already been found in a fossil state.

Lungfish and evolution

This fish was discovered in Australia just ten years after the publication of Darwin's *Origin of Species*; and the story of it is closely connected with Haeckel's name. Following Darwin's principles, the great professor of Jena had been the first to construct "family trees" to show the evolutionary story. This was an entirely new procedure, and much in these trees was, of course, only theory or conjecture. There were gaps where the branches of Haeckel's tree forked into two lines of evolution. It could only be hoped that these gaps might be filled in with animal forms, alive or fossil.

However, there was a principle emphasized by Haeckel which in the absence of fossil specimens, became of value here. This was the biogenetic rule. This rule enables zoölogists by studying the growth and development of an animal in the embryonic state, to learn certain things about the evolution of its species. The rule states that "ontogenesis repeats phylogenesis," in other words that the individual development reenacts, in much more rapid sequence, the evolution throughout the geologic ages.

Haeckel was not the discoverer of the biogenetic rule, but it is closely identified with him. So greatly did he popularize it that for a time every schoolboy in Europe knew these terms, even before they were introduced in school. More recently it has been learned that this rule is not so simple or comprehensive as it was then thought to be. But it remains an important principle in biology; and in the case of the Australian lungfish, as elsewhere, it provided the incentive for valuable research.

Because of his emphasis on the biogenetic rule, Haeckel in particular was eager to learn more about the development of the lungfish. The zoölogy books did not yield much information. *Ceratodus*, they said, is called *Barramundi* or *Barramunda* by the natives; it lives in Queensland in brackish water; it feeds

on water plants, and buries itself in the mud during the hot and dry months of the year. The latter fact was not really known, but it applied to *Lepidosiren* and *Protopterus* and was believed to be true also of *Ceratodus*. It was known with certainty, however, that *Ceratodus* laid eggs; and herein lay the important research problem.

A fish with a secret past

One of Haeckel's pupils, Prof. Richard Semon, was willing to make a special trip to Australia to investigate *Ceratodus*. And a manufacturer in Basel in Switzerland, Paul von Ritter, who had often donated large sums of money for Haeckel's scientific work was willing to pay the expenses of the expedition. So Semon set out for Australia to hunt *Ceratodus*, in order to study its development from the egg.

In August, 1891, he arrived in the country of the "living fossils." The books said that *Ceratodus* preferred brackish water, and therefore most probably would be found where the Burnett and Mary rivers flowed into the Pacific Ocean near the city of Maryborough. So Semon went to Maryborough.

The first letter Semon wrote home related his discovery that *Ceratodus* lives only in fresh water, a fact which necessitated his going inland to find it. His next stop was the little village of Gayndah on the Burnett River. This place was somewhat more promising from a zoological point of view: a specimen of *Ceratodus* had even been recently caught. But better opportunities lay beyond; and besides, Semon was anxious to escape from well-meaning but bothersome reporters and from the other guests of the Gayndah Club Hotel. So he went still farther inland.

Ten years earlier an Australian scientist, Doctor Caldwell (the same who discovered that *Ornithorhynchus* lays eggs) had tried to investigate the development of *Ceratodus*. He had not been successful but he had announced that the eggs of *Ceratodus* were laid on water plants. This was about the only true thing published about the mode of life of *Ceratodus*. Semon was to find out that all that Kreffit had published—aside from the very correct anatomical description—was wrong. *Ceratodus* lived only in fresh water, in the Burnett and Mary rivers. It did not feed on plants,

but on small animals of all kinds, and it did not sleep over the summer in a mud cake like *Protopterus*. Eventually, it was discovered that even the name *Barramundi*¹ was wrong—the native word for the fish was *dyelleh*.

While Semon was busy hunting *Ceratodus* eggs, a visitor arrived—Professor Spencer, biologist from Melbourne, spending his vacation on research. Object: the evolution of *Ceratodus*! The two scientists shook hands and tried to work together—but without success. There was nothing to work on, no *Ceratodus* eggs. Eventually Professor Spencer's vacation ended and he had to return to Melbourne.

A full month later three eggs were found; Semon ordered at once a thorough investigation of every plant in the river. The first day brought twenty-three eggs. Then for several days new material continued to come in, and the real job began, that of watching the development of the embryos in the eggs and putting them in alcohol at the right time in order to have a series of prepared specimens in all stages of development. But soon the supply of fresh material ceased. Semon found the reason for this interruption of his work. Though he had forbidden it strictly, the natives had been catching *ceratodi* to eat them and the one female fish which had produced all the eggs had also become a victim of native appetite.

A serious delay

This little accident delayed the work for a full year. One morning Professor Semon found himself alone, the natives had left their jobs without giving notice. And the rainy period was beginning. The time at Semon's disposal for his Australian adventure was three-quarters gone. He went to Thursday Island, halfway between Australia and New Zealand, where there were a few smaller zoological observations to be made. In the main task he had failed—what was to be done? Go home with very little to show? Or wait for the next opportunity, which would be September of the following year?

Semon decided to wait. Cables from Europe assured him that his vacation would be extended for this purpose. In July of the fol-

¹The real *Barramundi* (*Scleropages leichhardti*) does not live in the Burnett River.

lowing year, he returned to Gayndah and hired other natives, who to his surprise and delight followed his orders and left *Ceratodus* alone. But they required high pay—twenty-five dollars for the first eggs.

On September 16, 1892, eggs were brought, paid for, and the money was exchanged for alcohol. Luck was much better this year, and the collecting went ahead apace. In all, about seven hundred eggs were secured.

The breeding presented no difficulties either; but after a while it became evident that the growth of the young fishes was too slow for the amount of time that was still at Semon's disposal. He had to think about going home. Friends and colleagues promised to care for the young and to embalm specimens in alcohol at the various stages of development.

Once again ceratodi were shipped to a museum in kegs and barrels, but this time the museum was in Jena and the young ceratodi were preserved in a scientific way. Semon was able now to work out his observations and notes and studies, and did it with classic German thoroughness. All the important facts on the development of this fish from the egg are contained in Semon's work, and if a great drought in Queensland were to bring *Ceratodus* to extinction, it would now be a bearable loss from the purely scientific standpoint. Later, the whole evolution of *Ceratodus* through the geological periods became known through the studies of Louis Dollo and others.

A "living fossil"

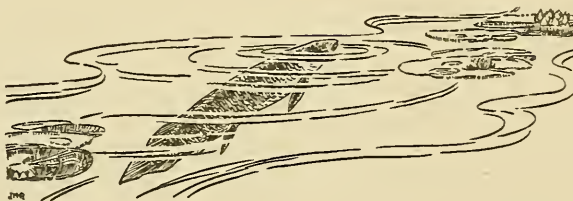
Forster's "big fish from the Burnett River" was one of the great zoölogical finds of the century. It represented the purest type of the original lungfish, while *Lepidosiren* and *Protopterus* had changed considerably in the intervening period of more than 200 million

years. *Ceratodus* exhibits features which indicate a common ancestry with the amphibians, which were the first back-boned animals to live on land; and in certain respects it resembles the salamanders, which are of the latter division. Though the Australian lungfish is not directly ancestral to the amphibians, it is an ancient form that has evolved in their direction.

This was the most important result of Semon's Australian expedition. The other facts revealed about *Ceratodus* were mostly corrections of the wrong notions that had found their way into all natural history books from the first narratives. They have been discussed already, and only one other thing about the lungfish need be said.

High but not dry

Ceratodus, unlike the two other lungfishes, has only one lung, which is somewhat less developed than the lungs of the other two. The Australian lungfish cannot live on land as had been claimed. It is essential that its gills be kept wet. But when in the Australian summer the rivers evaporate until only a chain of small lakes and puddles is left and all inhabitants of the water are collected in them, *Ceratodus* is able to survive. Often many of the true fishes die in these periods because the water soon becomes foul and unbreathable. *Ceratodus*, however, needs only moisture on its gills, no matter how small the oxygen content is, and then is able to breathe atmospheric air by means of its lung. In fact, even in aquariums where the water is perfectly fresh and rich in oxygen, *Ceratodus* comes to the surface about every hour to renew the air in its lung. In this respect, too, it represents an intermediate stage, for even the amphibians breathe water or air; *Ceratodus* always breathes water and air.



Science in the Field and in the Laboratory

Exploration, Astronomy, Broadcasts, Lectures, Field Study, Fishes, Crystals

Edited by A. KATHERINE BERGER

*Mrs. Mary L. Jobe Akeley
Returns from Africa*

Dr. Mary L. Jobe Akeley, wife of the late Carl Akeley, African explorer and naturalist, has just returned from a seven months' expedition in Africa. She made a comprehensive survey of the wild life in the great game preserves of the Kruger National Park, Transvaal, in Northern Zululand, Natal, and also in Portuguese East Africa, for the Akeley African Hall of the American Museum of Natural History which is to be opened to the public sometime this year.

Mrs. Akeley spent two months in studying the Swazi peoples, who are still among the most primitive of the Bantu in South Africa. She attended many of their feasts and ceremonials in the Royal Kraals, and found the natives quite willing to have her learn of their customs and manner of living. The native King, Sobhuza II, was particularly interested in her photographs of the animal groups in Akeley African Hall and her description of the methods of mounting the animals in the American Museum in lifelike attitudes. Besides securing many beautiful pieces of primitive wood carving, weaving, and pottery, Mrs. Akeley also brought back a complete miniature Swazi village especially constructed for her by skillful native chiefs and corresponding in every detail to their kraals or villages. It required nine weeks of steady work for two men to build this miniature village for her. These Swazi huts are constructed of coarse grass and reeds, and young saplings. The miniature village later will be placed on exhibition in the African Hall.

Mrs. Akeley was successful in securing excellent motion pictures of some of the rarest of the animals of this part of Africa, among which are the greater koodoo, sable antelope, stembok, oribi, and blesbok, as well as unusual photographs of lions. In addition she filmed both leopards and cheetahs—animals extremely difficult to photograph because they are rarely seen in daytime. Mrs. Akeley also made a journey into the dense swamps of Portuguese East Africa where live the great elephant herds. In one

herd she found thirty newly born youngsters not yet able to travel through the swamps. The females and young were guarded by two old bulls which stood on the alert in front and back of the herd and trumpeted loudly as soon as they got the wind of the Akeley party. Both herd and party stampeded.

In South Africa Mrs. Akeley found the most remarkable examples of conservation she had witnessed anywhere on the continent. In the Kruger National Park and in the Hluhluwe game reserves the animals, since their protection, have quadrupled in numbers in a period of about twenty to twenty-five years. One notable private reserve is on the estate of General Smuts, who is one of the most ardent wild life conservationists. Here Mrs. Akeley was a guest for several days and trekked over the mountains and plains with the General and photographed his herds of wild game.

On her expedition Mrs. Akeley received the greatest assistance from the Prime Minister of South Africa, General Hertzog, as well as from General Smuts, in securing special permits for her work.

Mrs. Akeley says that she has never seen elsewhere anything to equal the beauty of the flora in the South African spring and summer, and nothing to compare with the hospitality of its people.

In a future issue of NATURAL HISTORY the story of Mrs. Akeley's African Expedition will be graphically described.

Planetarium Demonstrations for Schools

In order to have a closer correlation between the lectures in the planetarium and the courses of study for the respective grades, the Hayden Planetarium staff is giving, during the spring term, a special series of astronomical talks and demonstrations adapted to school needs. The program is as follows:

	GRADES
March 23-27	4, 5
March 30 to	
April 7	7, 8
April 20-24	4, 5, 7, 8
April 27 to	
May 1	6, 7, 8
May 4-8	5, 6, 7, 8
May 11-15	4, 5, 7, 8
May 18-22	6, 7, 8
May 25-29	5, 6, 7, 8
June 2-5	4, 5, 6, 7, 8

While the particular subject of the lecture will be stressed, there also will be sufficient general astronomical information to interest any class or grade.

The free showings are reserved for classes from the public schools, the free parochial schools, and the municipal colleges—all within Greater New York.

The lectures are given at 10 A.M. and 1 P.M., Mondays to Fridays, inclusive.

The Hayden Planetarium

During the month of April the lecture given at all public performances in the Hayden Planetarium will be on the subject of "The Southern Cross," dealing with the southern constellations and individual objects in the southern sky. The April lecture, as is true each month, will begin on the first Sunday of the month, April 5. At each performance during the week from Palm Sunday, April 5, to Easter Sunday, April 12, a brief demonstration will take place at the beginning of the lecture, showing the way in which the date of Easter is determined each year.

Amateur Astronomers Association

During the month of April the Amateur Astronomers Association will hold its regular meetings on the first and third Wednesday of the month, at 8:15 P.M., in the large auditorium of the American Museum of Natural History. All those interested are most cordially invited to attend.

April 1—Dr. John C. Duncan, of Wellesley College, will speak on a subject to be announced later.

April 16—Mrs. Emily Ford Russell will speak on "Romance of the Zodiac."

Educational Broadcasts and Tours

The program for the American Museum Educational Broadcasts and Tours over WNYC during April is as follows:

April 2—When Birds Travel; April 9—Dog Heroes; April 16—The Antiquity of Astronomy; April 23—The Celestial Sphere; April 30—The Solar System.

These broadcasts are given on Thursdays at 5:30 P.M. and the tour time is announced over the radio. The Radio Tour Group meets in the main foyer of the Museum.

American Museum Lectures

For the month of April the following lectures are scheduled:

MEMBERS: Thursday evening April 9, at 8:15 o'clock, "To Shigatse and Lhasa in the Land of the Lamas."

PUBLIC MOTION PICTURES: Saturdays, at 2:00 o'clock, April 4, "Simba"; April 11, "Peoples of Arabia and Africa"; April 18, "Hopi Indians of the Southwest"; April 25, "Eve of the Revolution."

CULTURAL APPRECIATION OF GEMS: By Herbert P. Whitlock, Saturdays, at 4:00 o'clock; April 4, "Chinese Carving in Jade and in other Decorative Stones"; April 11, "Russian Carving in the Decorative Stones and Japanese Carving in Ivory."

SCHOOL CHILDREN: Fridays at 10:30 o'clock; April 3, "The Story of Transportation"; April 24, "Fur Trading in American History."

Schedules for other spring lectures have already been published in the February issue of NATURAL HISTORY.

Field Course in Natural History

The Field Course in Natural History which was sponsored by the American Museum last year was so successful that it has been decided to repeat it this year. The course will be given by Miss Farida A. Wiley, staff assistant in the department of education of the American Museum of Natural History, and Mr. George T. Hastings, chairman of the biology department of Theodore Roosevelt High School. Miss Wiley has directed courses in nature study for New York City teachers for several years. Mr. Hastings has been on the staffs of several camps and has given field courses for teachers. Both Miss Wiley and Mr. Hastings are on the staff of Pennsylvania State College Nature Camp. Headquarters for the course are at the State Institute for Applied Agriculture at Farmingdale, Long Island. Near by are the Cold Spring Harbor Laboratories, Roosevelt Bird Sanctuary, State Fish Hatchery, Jones Beach Bird Sanctuary, Massapequa and Belmont Parks, all of which will be visited.

Registration must be made in advance with Farida A. Wiley, American Museum of Natural History.

Camp Leadership Course

Farida A. Wiley, staff assistant in the department of education of the American Museum, has been asked to act as director of the Nature Lore Section of the Camp Leadership Course given by Teachers College.

The course aims to give demonstrations and suggested means of presenting a nature program in camps.

The sessions are held at Teachers College at 7:30 o'clock on Monday evenings, continuing through April 27.

Others giving assistance in the course are Mr. and Mrs. John R. Saunders and Mr. John Orth of the department of education, Miss Dorothy Bennett of the Planetarium staff, and Mrs. Ada K. Burns, director of the School Nature League.

Junior Astronomy Club

The season's activities of the Junior Astronomy Club draw to a close with the April meetings when James B. Rothschild, past president of the club, addresses the members on "Astronomy and Other Sciences" and the club advisor, Miss Dorothy Bennett, speaks on "Comets and Meteors."

Research in Dutch Guiana

Dr. Morton C. Kahn, associate professor of public health and preventive medicine, at Cornell University Medical College, returned recently from Dutch Guiana. Under the auspices of the American Museum and the former institution he has repeatedly visited Dutch Guiana for the primary purpose of continuing his intensive studies of tropical diseases, and secondarily to study the Bush Negroes and make ethnological collections for the Museum. On this, his latest expedition, he visited the Upper Aucaner Bush Negroes on the Tapanahoni River, making tuberculin tests and determining their blood groupings. The Museum already possesses a comprehensive collection from the Bush Negroes of Dutch Guiana. Doctor Kahn's latest contribution contains samples of unusually fine woodwork in the form of paddles, combs, and food stirrers from the Upper Aucaners and gives us a representation of artifacts from an additional Dutch Negro group not heretofore represented in the collections.

On the Upper Palumen River Doctor Kahn encountered a group of Alukuyana Indians who appear to have been almost entirely uninfluenced by any white contact. The Alukuyana trade, however, with the Aucaner, obtaining knives, machetes, etc., in exchange for hunting dogs which they breed and train. Doctor Kahn succeeded in securing for the Museum an Alukuyana bow and arrows and two jaguar bone flutes.

Fishes

Word has been received from Mr. William J. Morden, now in South America, that he is making contacts with a view to obtaining certain marine fishes desired by the department of ichthyology of the American Museum for study. Material is still being received from his last winter's stay in Honolulu and has made possible various conclusions now being published in *Novitates* and elsewhere.

Mr. Henry W. Fowler's first volume on the marine fishes of West Africa (605 pages; 275 text figures) has just appeared. The text figures were made by the author and show many strange and interesting forms. This work brings together the scattered literature on the fishes of that area and, when complete, will be invaluable to anyone working on collections from there.

Mr. Albert S. Pinkus, who has already deposited in the American Museum a collection of more than five thousand fishes from British Guiana, sailed again last month to do further collecting in that region. Mr. Boris A. Krukoff, whose large collection of Brazilian fishes is in the department of ichthyology, is still in the interior.

Exhibit of Classic Type Crystals

During the Annual Meetings of the Geological Society of America and the Mineralogical Society of America, the department of minerals and gems displayed in the Morgan Hall of the American Museum a series of type crystals, selected from the

Bement Collection because they have been figured in crystallographic papers by celebrated scientists of the nineteenth century. In many instances autograph and signed labels and original sketches accompanied these "Classic Type Crystals."

Penguins

Inadvertently, the penguins that formed the decorative motif for the cover of the March issue of *NATURAL HISTORY* were designated on the Contents page of that issue as "emperor" penguins. They are really "king" penguins, are next in size to the largest species of these flightless aquatic birds, and stand about three feet high. They occur at various antarctic and sub-antarctic islands.

George M. Wright
Roger W. Toll

The death, on February 25, 1936, of George M. Wright, chief of the Wildlife Division of the National Park Service since its establishment in 1933, and Major Roger W. Toll, superintendent of Yellowstone Park, who was another highly valued official of the Park Service, in an automobile accident near Deming, New Mexico, is a great shock to the many friends of both men and a misfortune to the National Park Service and to wild life conservation in general. They were on an official inspection tour at the time.

Mr. Wright was born in San Francisco, California, in 1904, and was a graduate of the College of Forestry of the University of California.

While studying forestry at the University of California, he accompanied Joseph S. Dixon, at that time Economic Mammalogist of the University, on an expedition to Mount McKinley, Alaska, where he discovered the nest of the surf bird. This nest, the first to be recorded, was found on a rocky ledge about one thousand feet above timber line.

After graduating, he served in the National Park Service as Ranger and Park Naturalist, but soon made himself such an authority on the wild life of the Parks that he was entrusted with developing the policies and directing the work for its conservation. His two reports on the Fauna of the National Parks, and the section on Recreation of the Report of the National Resources Board are outstanding contributions to conservation literature. Mr. Wright was a member of many forestry, scientific, and conservation organizations.

Major Toll was born in Denver, Colorado, in 1885, and received the degree of Civil Engineer from Columbia University in 1906. His career was a varied one, including service in the Army during the war. In 1919 he entered the National Park Service, of which he was one of the most able administrative officers.

Mr. Toll was a mountaineer of note, having climbed all the fifty mountain peaks in the Rocky Mountain Park and made, with three others, the first ascent of Mount Rainier by the Kautz Glacier Route.

Reviews of New Books

Astronomy, Birds, Conservation, Mammals, Distribution of Whales

STARS AND TELESCOPES. By James Stokley. (Harpers, 1936.)

ALTHOUGH the author of this book on astronomy is head of the Fels Planetarium at the Franklin Institute in Philadelphia and consequently a teacher of the subject, this is not a textbook, but a volume to be read, and it is interesting reading.

The treatment embraces the entire history of the science, and the gleanings of the important and the dramatic episodes has been done in a thoroughgoing manner. In fact we have here a combination of the story of the development of astronomy with an up-to-date and lucid discussion of the present status in all its various phases.

The author is peculiarly well fitted for the task he has undertaken. He has had for many years a special interest in the history of astronomy, and has collected in his private library many rare and valuable old volumes of interest in this his favorite field. Before the opening of the Fels Planetarium he was astronomical writer for Science Service,—thus keeping alive in himself the layman's point of view. This work together with his writing as special correspondent for the *New York Times* has kept him in close touch with the rapid development of astronomy. And finally, in directing the Philadelphia Planetarium since its opening, he has had abundant opportunity to learn what the general public wants to know, and he has profited by this experience.

While *Stars and Telescopes* is not a textbook, teachers of astronomy will find it a veritable *vade mecum* as a reference book, but to call it a reference book would be to give a very wrong impression. It is a most readable book telling the layman and the amateur astronomer what they want to know.—CLYDE FISHER

THE SOLAR SYSTEM AND ITS ORIGIN. By Henry Norris Russell. The Macmillan Co.

WITH that discipline of thought and brilliance of expression which distinguishes his performance with the pen or on the platform, the director of the Princeton University Observatory has discussed the problems of the solar system in a most thorough and readable book. He finds the system unusual in its isolation (it has no near star neighbors), in its complexity (there are more than 100,000 members of the family not counting the meteors), and in the distribution of its mass and movement.

A consideration of the earth's age, based largely on radio activity, yields a clue to its origin, for "about two billion years ago, or a bit more, something happened, and the earth was started on its present career. . . . Something happened, not only to the earth, but to the whole solar system." In fact, "It begins to look as if something had happened to the material universe at large. . . . The solar system is most evidently not a product of chance."

What, then, was the origin of this unique star family? Professor Russell dismisses the early ring theory of LaPlace with the words "It might form a swarm of asteroids, but not a single planet." What now? According to the author, "We are driven to the belief that the planets were separated from the sun . . . by the action of some external force." And yet, he states, "all forms of the encounter theory labor under grave difficulties," most of which hinge on the problem of angular momentum. While the sun claims 744 times the mass of all the planets put together, it supplies very little of the angular momentum of the system—the four major planets carrying the burden of it. To sort this with certain difficulties added by the satellites and the other members of the system, is the problem of a working theory.

Step by step, this leading astronomer, who is also research associate of the Mount Wilson Observatory, examines the leading theories of the origin of the sun's family in the light of recent research. Of the three sections of this short book (it is less than 150 pages in length) the first deals with the dynamical properties of the system, the last with its origin, and the second with its physical and chemical properties. The excellent new material on the planets and the sun in this second division, combined with the complete summary quality of the first, gives soundness to the final chapter which deals with theory. Piece by piece Doctor Russell takes these theories apart and finds all of them wanting. Even the dynamic encounter theory of Chamberlain and Moulton which had been quite satisfying, he is forced to regard with doubt in some of its aspects.

"But the solar system must have had an origin of some kind," says Doctor Russell, and then he proceeds to offer two suggestions. One is somewhat novel—but so is the solar system. It proposes the sun as a binary star with a small companion. At the close approach of or collision with a passing

star, the consequent breakup of the companion provided materials for the formation of the planets and other members of the system. Having advanced this idea, which is really a modification of the encounter theory, Doctor Russell shows its disadvantages and moves to his second startling thought that "at the start, all matter of the universe, perhaps, was tightly packed together in one great Atom. With this as a start, almost anything may have happened during the furious years and centuries in which the present universe began to take shape, and we need no longer worry about the details. . . . We conclude then, that no one can yet say how our system originated in detail, but may reasonably regard its birth as the merest incident in a far vaster process,—the shaping of the material universe as we know it."

With unusual completeness, clarity, and restraint, the dean of American astronomers has set a wealth of facts in order, and anyone who wishes to think intelligently on the subject will welcome his book.

—D. A. BENNETT

A PARADE OF ANCIENT ANIMALS. By Harold O. Whitnall. Thomas Y. Crowell Company, New York, 1936; 136 pages, 32 illustrations by H. C. Millard; \$2.00.

THIS is another addition to the already long list of books for children on prehistoric animal life. It is up to the average and will fill its purpose as well as any other available. The text is lucid and, on the whole, interesting, and the illustrations are clear and active.

At the same time it suffers from all the usual faults of such books. It does not show any of these in exaggerated degree, and in pointing them out, the purpose is not condemnation of this particular book. With so many works for children on natural history, and even on this very special branch of it, already on the market, it is certainly both fair and necessary to urge that a new book should eliminate these faults. This may be to demand a work of genius, but even if so, this is not an unreasonable demand after such a flood of works decidedly not of genius.

Simple scientific accuracy is surely the first essential, so what are we to say when we hear of *Eohippus* in the same scene as ground sloths, saber-tooth tigers, and other creatures no *Eohippus* ever saw? Or when we see a restoration of *Macrauchenia* labeled and discussed as being a camel? The restorations in general must also be noted as being purely imitative, without any evidence of real anatomical knowledge, and falling into most of the pitfalls set for imitators. The genius for whom we call would be able to interest children without introducing the big-bad-wolf and moral motifs into his narrative. This text bristles with such words as "bad," "lazy," "selfish," "horrible," "terrible," "monstrous," "cruellest," "blood-thirsty," "evil," "hideous," and the like, and it barely misses the Elsie-book moral that "good" animals survive and "bad" animals become extinct.

Our genius will also be simple in language with-

out being simple in thought, and he will not fall into discredited scientific clichés (like supposed extinction of dinosaurs by egg-eating mammals) just because they are simple.

But until such a work of genius appears, Professor Whitnall's book will serve very well on the whole.—G. G. S.

THE BOOK OF THE SEASHORE. *The Life Experiences of a Naturalist on the Beach.* By Howard J. Shannon. Illustrated by the Author. Doubleday, Doran and Company, Inc., Garden City, N. Y. 1935. \$3.50.

WITH the turn of the year toward spring, there is a familiar Spirit that begins to beckon above the horizon to all those city dwellers and others, too, housebound, who love the Sea,—to all those who feel that they can draw their deepest and most life-giving breaths only where the tangy breezes of Old Ocean race and whip and tear, and like fighting gladiators, come to grips with the waves as they strike upon the shore.

Engulfing the sands in their foam and surging out again, only to renew their resistless attacks, the waters suck back with them everything that seeks a foothold in the moving, grinding, slipping whirligig of sandgrains—seaweed, vegetation, shell-fish, insects, birds, mice—and sometimes even man.

There is life, and living everywhere; not a dull moment, not a moment to spare in the feverish struggle to win and hold a place in the race for survival.

But there is beauty, too, of color, form, and sound, and surging through it all, there are infinite courage, patience, skill, cunning, pitiless might and pitiful helplessness, evident to the eye and mind keen to note such things. Such keenness is possessed by Howard J. Shannon. He proves this by his story of the life experiences of a naturalist on the beach, in *The Book of the Seashore*.

For twenty-six years he has studied the pageant of Nature along the Atlantic Coast from above Wood's Hole south to the tip of the New Jersey peninsula, and particularly along the south shore of Long Island. What he learned became a part of himself, and now he sends it forth to whomsoever would learn also. As revealed through his eyes and sympathetic understanding the life along the seashore lives again in all its profound simplicity and complexity, its beauty and ugliness, its joy of living and terror of annihilation.

No more authoritative tribute to the value and dramatic interest of Howard Shannon's contribution to man's knowledge of the life of the seashore could be written than the Foreword to the volume, by Dr. Roy W. Miner, curator of living invertebrates, at the American Museum. Doctor Miner writes:

There are poets. There are artists. There are naturalists. But it is not often that the attributes of all three are combined in one person.

Howard J. Shannon is an artist. Many years ago, he walked upon a Long Island beach. Its wild beauty tempted his brush. He began to transfer it to Bristol board. The long vista of snowy shore, the shifting dunes, the rolling of the surf, the drowsy, summer days of mellow sunshine, alternating with the grandeur of the stormcloud and

menace of the tempest-tossed sea—all these inspired his soul, so that eloquent word pictures covered the pages of his notebooks. He became a poet.

His keen powers of observation opened his mind to the surging plant and animal life about him. He noted the desperate struggle waged by the hardy beach vegetation against the far-flung and aggressive battle line of the mordant sea waves, and the scars both tree and shrub bore of the conflict. He saw the valiant endeavor of the beach insects to build their homes in the uncertain soil; the foraging sea birds snatching their food from the turmoil of boiling surf; and witnessed the ingenious methods by means of which the animals beneath the ocean's margin wrought their tumultuous environment into protective structures for their own use. Howard Shannon became a naturalist.

Thenceforth he lived upon the beach. His observations extended through the seasons, through the years! The phenomena of the mysterious migrating journeys of insect, bird, and fish absorbed his attention; the physical changes of the shoreline from year to year engrossed his mind with the past history of the beach. He spanned the centuries. Not content, he unearthed fossil remains of strands of bygone geological ages, which opened to his investigating, poetic mind vistas of pre-glacial days; and before that, the old, Cretaceous beach with its lush tropical jungles that existed in that very region a hundred million years ago.

Howard Shannon lived the life of his beach for more than a quarter of a century, and, in this book, with brush and pen, he has pictured it for his readers by means of an abundance of luminous illustrations; and, even more vividly, by imaginative and poetic word pictures, which because they have caught both the visible and invisible spirit of his world by the sea, present the vital throbbings of its heartbeats and the embattled struggles of its inhabitants far more accurately than any cold statement of listed facts.

Many of Mr. Shannon's observations are original and distinct contributions to science. He has discovered new species and new facts of life history; while his investigations of seasonal insect migration, as presented in previous publications, have attracted the interested comment of careful students of that subject.

I am sure that Mr. Shannon's readers will find the perusal of this volume a delightful experience, whether they are seated comfortably in an armchair by a winter fireside, or lazily stretched out of a summer's day on the sands by the resounding sea, bathed in the atmosphere which permeates both book and physical environment to blend in a mutually illuminating whole.

It was such an observer that Bryant must have had in mind when he wrote in "Thanatopsis" the never-too-often-quoted words:

"To him, who, in the love of nature
Holds communion with her visible forms
She speaks a various language."

—A. KATHERINE BERGER

THE LONDON CONVENTION FOR THE PROTECTION OF AFRICAN FAUNA AND FLORA. *Special Publication of the American Committee for International Wild Life Protection, No. 6, Cambridge, Mass., 1935.*

THE London Convention for the Protection of African Fauna and Flora met in the House of Lords in October, 1933. It attracted considerable attention at the time of the meeting, and when a full report of the proceedings reached the American Museum of Natural History, the Scientific Staff passed a resolution, at a meeting held on March 13, 1934, commending the high purposes and achievements of the Convention.

The American Committee for International Wild Life Protection, John C. Phillips, chairman, in a special publication, No. 6, 1935, has recorded in permanent fashion the story of the London Convention of 1933. This special publication is an attractive brochure of large format containing a large folding map of Africa. In a foreword, the background for the meeting is given and it is stated that the Convention of 1933 "was in reality a revival of the London Convention of 1900 on the same subject, which unfortunately was never ratified. More recently, a resolution calling for another

Convention was passed at the International Congress for the Protection of Nature which was held in Paris in 1931."

"Of the many accomplishments of the Convention, none are more important than those which define and recommend the four types of parks and reserves. Perhaps the second most important accomplishment is the agreement found in Article 9, which aims to control the commercial exploitation of animal products.

"The so-called Protocol is extremely important as it provides for the holding of periodical International Conferences in the future and also refers back to Article 1, wherein provision is made for the extension of the treaty to countries which do not hold territory in Africa."

The plenipotentiaries who attended the Convention represented "The Governments of the Union of South Africa, Belgium, the United Kingdom of Great Britain and Northern Ireland, Egypt, Spain, France, Italy, Portugal, and the Anglo-Egyptian Sudan."

"Considering that the natural fauna and flora of certain parts of the world, and in particular of Africa, are in danger, in present conditions, of extinction or permanent injury:

"Desiring to institute a special régime for the preservation of fauna and flora;

"Considering that such preservation can best be achieved (i) by the constitution of national parks, strict natural reserves, and other reserves within which the hunting, killing, or capturing of fauna, and the collection or destruction of flora shall be limited or prohibited, (ii) by the institution of regulations concerning the hunting, killing, and capturing of fauna outside such areas, (iii) by the regulation of the traffic in trophies, and (iv) by the prohibition of certain methods of, and weapons for the, hunting, killing, and capturing of fauna;,"

After printing in full the series of 19 Articles upon which the Convention agreed, the report of the American Committee includes the Annex authorized under Article 8, to which it has added, however, illustrations of the various species concerned. The protection of the species mentioned in the Annex was declared to be especially important. The Annex groups animals (and plants) into Class A, those to be protected as completely as possible, gorilla, giant sable, okapi, whale-headed stork, et cetera, and Class B, species not to be hunted except under special license, colobus monkey, chimpanzee, giraffe, white-tailed gnu, ostrich, secretary bird, et cetera. A list of the African game reserves and parks concludes the report.

The London Convention through the joint efforts of the plenipotentiaries working in harmony has made a very auspicious attack upon a problem of great interest to nature lovers and conservationists throughout the world. While it cannot be denied that in many sections of Africa exploitation of wild life has already gone so far that irreparable damage has been done, nevertheless it is encouraging that there is a recognition of this very fact and that the powers concerned are aroused and desire to enact protective measures.—H. E. ANTHONY

NOTES ON THE SOUTH AFRICAN WILD LIFE CONSERVATION PARKS AND RESERVES. By *Thomas Barbour and Margaret D. Porter*. Publication No. 7. *The American Committee*.

THE American Committee has followed up the report of the London Convention with a special publication, No. 7, entitled "Notes on South African Wild Life Conservation Parks and Reserves," by Thomas Barbour and Margaret D. Porter.

This publication reports on a brief visit to South Africa, including about a week in the Kruger National Park. A map shows the location of some sixteen South African Parks and Reserves which may be classified under three headings typified (1) by the Kruger National Park "which perpetuates over a large area a sample of the sort of conditions which once obtained over a large part of South Africa," (2) by the Drakensberg National Park "which was originally established to preserve and make accessible magnificent national scenery," and (3) by the Bontebok Park which represents "what might be called last resort efforts to preserve a particular species on the very verge of extinction."

Some of the points brought out in this report demonstrate the need for prompt action such as that initiated at the London Convention. Comments on the ease of obtaining a license to kill everything, except a few species known as royal game, indicate that it is high time more stringent restrictions are placed upon the privilege of hunting. The securing of land to fill out existing boundaries will be easier now than at some future time. "The golden opportunity exists right now."

The mountain zebra is catalogued as a vanishing species, the numbers of which are stated as "probably not over a hundred." "Three animals of the High Veldt are among the most extraordinary and interesting of all African antelopes. Their status varies somewhat." "The white-tailed gnu, commonly called the black wildebeest, suffered frightfully from the drought of the last few years and unless something is done to establish a special Park for this animal, with adequate artificial water supply, its outlook is very gloomy." "The case of the blesbok is not as unfavorable as that of the black wildebeest. However, with the exception of some six hundred animals in the Sommersville Reserve of the Orange Free State, all blesbok are in private hands." "The third animal in this category is the springbok—an animal of extraordinary beauty and grace—once the most abundant of all South African animals—now pitifully reduced in numbers."

The reader of this report will find his sentiments swayed between gratification that so many reserves have been created in South Africa and regret that the destructive forces of recent years have taken such a heavy toll of the primitive wild life.

—H. E. ANTHONY

As a timely commentary on the topics covered by the two foregoing special publications of the American Committee, a newspaper article appears in the *Natal Mercury*, January 1, 1936, under the name of Dr. E. L. Gill, director of the South

African Museum. This newspaper account bears the headlines, "Doom of the Precious Cape Mountain Zebra—Dying Species Which the State Has Declined to Reprieve."

Doctor Gill writes, "Another blow has fallen—quite possibly the final blow—on the ill-fated mountain zebra."

"If this is not its obituary notice that we are writing it is something desperately near it. Little short of a miracle is needed now to save it. That has, in fact, been the position for a year or two, except that till now there has been some hope that the miracle would be given a chance to happen. That hope has now been dashed by a pronouncement from the Minister of Lands."

"The mountain zebra has had a strange history. Until half a century ago it was a common inhabitant of the mountain ranges of the Cape. It was the first kind of zebra to become known to European naturalists, and as such it is the sole possessor of the name zebra in scientific nomenclature."

"... In 1922 there were 400. Now there are between 40 and 50, about half of them in the Cradock district and the other half near Oudtshoorn."

"Fifty or sixty is a perilously small number to count upon for saving the species from extinction, especially since there is no hope of bringing the two herds together and little prospect that both can be maintained much longer. ... There is only one hope of saving either of them permanently, and that is to turn their natural range into a reserve."

"For two years now the wild life protection organizations of Europe and America have been anxiously watching to see what we are going to do about the mountain zebra. Our Government provided for the bontebok, but in the much more urgent case of the mountain zebra all our efforts seemed to have failed to arouse the slightest interest."

"At length, in the last six months, we began to think our appeals were being heard. We hoped it was a question, not of setting up a reserve at all, but as to whether the reserve was to be at Oudtshoorn or Cradock. Now the Minister of Lands announces that enough has been spent for the present on wild life protection and that it will not be possible to do anything 'next year' for the mountain zebra. Not even next year!"

In the same newspaper, an editorial, "Wasting Nature's Heritage," comments favorably upon Doctor Gill's appeal and utters the following sentiments which have a familiar sound to conservationists the world around, as the conditions decried by the editorial are not peculiar to South Africa.

"This sounds to us very much like apathy of the most shortsighted kind. Providence endowed South Africa with the most wonderful and varied wild life in the world. For the past century we have been busy, with every means at our disposal, exterminating this fauna as rapidly as possible. Indeed, but for the public-spirited action of a handful of individuals who were sufficiently farseeing to realize what a precious heritage was thus being thoughtlessly dissipated, there would have been practically no wild life at all left today."

"Fortunately the National Parks Trust was created in the nick of time and steps were taken to throw the Kruger Reserve open to the public. Efforts to preserve game were made in other directions. But there is still much to be done, as witness Doctor Gill's warning concerning the precious mountain zebra and the still unsettled problem of the Zululand game reserves."

Conservationists in the United States should scarcely presume, in view of what has happened in their own country, to go very far in telling peoples of other lands how to handle their wild life problems, but at least they may be privileged to hope that some constructive measures to save the mountain zebra will be taken before it is too late.

—H. E. ANTHONY

THE DISTRIBUTION OF CERTAIN WHALES AS SHOWN BY LOGBOOK RECORDS OF AMERICAN WHALESHIPS. By Charles H. Townsend, *Zoologica*, Vol. 19, No. 1, Apr. 3, 1935, New York Zoological Society.

DOCTOR TOWNSEND has compiled a most interesting series of records and made available to naturalists a great accumulation of observations which have, in the past, been buried in the logbooks of the old-time whalers.

In his introduction he writes, "While examining logbooks of old-time whaling vessels in the New Bedford Public Library a few years ago, it became apparent to the writer that they represented a supply of hitherto unused records available for much additional information on the distribution of whales. The logbooks, hundreds in number, show clearly where the nineteenth century whaler made his catches of sperm, bowhead, right, and humpback whales. It appeared that by plating on charts the positions where large numbers of whales had been taken, much could be learned of their distribution and something of their migrations."

The author proceeds to analyze the platted data, and a glance at the maps makes it very apparent that these platings afford a very good insight into the distributions and moves of certain whales. The movements of whales are to be correlated with feeding habits, and a map of the ocean currents is

given in order to afford the student a background for attempting to correlate the positions of the whaling grounds with ocean currents. This relationship has been discussed at considerable length by Wilkes (1845) and Maury (1855) and Doctor Townsend states that he "after much study of recent oceanographic literature, abandons his attempt to set forth what is known of their relationship."

The charts are large, folded documents, and Charts A and B give the distribution of the sperm whale based on logbook records dating from 1761 to 1920. On these two charts are platted a total catch of 36,908 sperm whales. Chart A records the take from April to September, inclusive, and Chart B from October to March, inclusive.

Chart C shows the distribution of northern and southern right whales based on logbook records dating from 1785 to 1913, and the positions represent catches of 8,415 right whales.

Chart D gives the distribution of bowhead and humpback whales based on logbook records of mostly nineteenth century and represents catches of 5,114 bowhead and 2883 humpback whales.

These charts must be studied to be appreciated. The plating of these thousands of records has called for infinite patience. Doctor Townsend, with his knowledge of the Seven Seas based upon personal observations over a number of years, has had an able collaborator in Mr. A. C. Watson. Furthermore, this report could not have attained such a high degree of excellence had not the owners of the logbooks cooperated in making the data available. Doctor Townsend concludes his paper with a list of the sources from which data has been drawn, and with a table giving the names of the vessels, the dates of the voyages, and the number of whales taken.—H. E. ANTHONY

Recent Museum Publications

Oceanic Birds of South America. Volumes I, II.
By Robert Cushman Murphy.

BULLETIN

Vol. LXX, Part 1.—The Marine Fishes of West Africa. Based on the Collection of The American Museum Congo Expedition, 1909-1915. By Henry W. Fowler.

RECENTLY ELECTED MEMBERS

A REPORT from the membership department lists the following persons who have been elected members of the American Museum:

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NATURAL HISTORY

JOURNAL OF THE AMERICAN MUSEUM OF NATURAL HISTORY

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NATURAL HISTORY

The Journal of the American Museum of Natural History

VOLUME XXXVII

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PUBLICATION OFFICE: American Museum of Natural History, Seventy-seventh Street and Central Park West, New York, N. Y.

EDITORIAL: Edward M. Weyer, Jr., Ph.D., Editor; Thomas Gordon Lawrence, M. A.; Frederick L. Hahn.

Manuscripts should be sent to the Editor, The American Museum of Natural History, New York, N. Y.

SUBSCRIPTIONS. NATURAL HISTORY is sent to all members of the American Museum as one of the privileges of membership. Membership Supervisor, Charles J. O'Connor.

ADVERTISING: Sherman P. Voorhees, The American Museum of Natural History.

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The water can be seen plainly in the natural "bottle"

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THE INDOOR EXPLORER

★

By GORDON LAWRENCE

IT SEEMS that it did not take the Indians of the eastern seaboard very long to realize the advantages of clothes cut in an approximation of the European manner. Until the country was settled by the whites the Indians wore a sort of poncho or night shirt made of two skins for an upper garment, and hip-length leggings in lieu of breeches.

But the costume of our eastern Indians changed quickly after white settlement, according to Dr. Clark Wissler. To illustrate this, the department of anthropology recently installed a costumed life-sized figure of an Indian of the New York region during the period of the American Revolution. This brave is carrying a gun almost as tall as himself, a knife, and a tomahawk, all bought from white traders, and wears a sash of beads and bead ornaments procured from the same source. His black hair is done up in two braids tied up with red cloth.

The rest of the Indian's costume, moccasins, fur cap, rawhide coat, skin breech cloth, and leggings, and the shell ornament on his neck, as well as his powder horn, are obviously of home manufacture, but the design of the coat

is, of course, to some extent imitative of European clothing, and the cap has a cloth sweat band.

To the layman, it seems curious that while the Indian was taking over the coat, he did not also adopt what seems to be the most practical garment ever devised, that is, trousers. As Doctor Wissler points out, "Even today Indians on some reservations wear long cloth leggings instead of trousers."

Natural water bottles

THE SKEPTICAL youth who had been staring at the semi-precious gems was polite but reserved when Curator Whitlock assured him that opals did have water inside them, even if you couldn't see it or feel it. The boy complained that the glassy surface of the opal didn't seem in the least wet to him.

But his air of world weariness lightened when Mr. Whitlock drew forth some of his natural water bottles. The Museum has a lot of them and the water in them is assumed to be potable. You pick up a large blob of dull white quartz—shake it, and you hear an in-

ternal gurgling like that of the milk within a ripe coconut. Some of these naturally sealed containers are semi-transparent and when they are held up to the light the water inside looms up like the horizon through a January fog.

None of the water bottles in the Museum has yet developed a leak, according to Mr. Whitlock. They are to be discovered wherever geodes are found—which is wherever silica-impregnated water has filtered down through certain rocks, basalt, for example. The water drips down into any cavities in the rock, and if these are at a considerable depth, and consequently under heavy pressure, the mineral matter in suspension in the water eventually crystallizes around the sides of the cavity, to form a more or less rounded container for the pure water left inside. When the bottles are sawn in two, the quartz crystals are seen lining the interior like the amethyst crystals of a grotto. As a matter of fact, as Mr. Whitlock points out, these water bottles are grottos in miniature.

The farthest south in fish

THE MUSEUM has received what is presumably the most southerly specimen of a fish ever collected, and considering that this inch and a half long individual was found by Mr. James M. Sterrett of the Second Byrd Antarctic Expedition in a seal hole in the ice at Echo Canyon, some sixteen miles southwest of Little America, it is not likely that living fish can ever be found much farther south.

The fish, which looks pale and homely enough reposing in alcohol, has been named *Pagothenia antarctica* by Mr. J. T. Nichols and Miss F. R. LaMonte. In life it apparently spent most of its time close to "narrow crevices or pockets in the wall of the crevasse" into which it retreated when disturbed.

Pagothenia was taken in approximately lat. 78° 45' S. From a very short distance farther north the Museum received a series of a somewhat larger fish, *Pleuragramma antarcticum*, which, according to Mr. Paul Siple, of the Byrd Expedition staff, is apparently the major food of the Weddell seal. One seal was found to have about 400 of these fish in its stomach.

As Mr. Nichols points out, "This *Pleuragramma* held the record as the most southerly fish ever captured by man prior to the last Byrd expedition—and it was known only from

a few fragmentary specimens. From the abundance of sea birds and the numbers of seals in the Antarctic it is evident that the fish life of these waters must be a rich one."

Fossil hunting at home

WHEN AFRICAN HALL and the Roosevelt Memorial were erected, the Museum received a large accession of fossil specimens without sending out any expeditions to procure them. These fossils, one might say, were thrown in with the buildings. The smooth and creamy Pandora marble that panels the upper hallways and stairways of the Roosevelt Memorial entombs what remains of many an ancient creature that once fringed old sea beaches.

The numerous irregular figures that show so plainly in the polished surface of this rock are cross-sections of calcareous algæ (*Lithothamnium*) most closely related to the lime secreting algæ of the mid-Tertiary periods, according to Dr. Chester A. Reeds, Curator of Geology and Invertebrate Palæontology. More striking are the occasional elongated shells, with a structure that vaguely resembles a corkscrew to the uninitiated. These were identified by Doctor Reeds as univalves (Gastropoda), a group that was very abundant during the Mesozoic and Cenozoic eras and are still found in large numbers along our present-day seashores.

The beautiful slabs of the mottled reddish Spanish marble, the so-called Catalan Red, which serve as base-boards in the Roosevelt Memorial Building, reveal, on close search, the wheel-shaped outlines of fossils which represent cross-sections of cup corals with radiating septa. Some millions of years ago these coral animals were leading the same uneventful life in placid marine waters that their cousins do today.

A still richer field of fossils is found in the Napoleon Grey marble in the lavatories in African Hall. This stone is brownish-grey in color, and its glassy-smooth surface shows a subcrystalline close-grained rock representing vanished beaches almost as plainly as when the waters of ancient seas lapped over them. The history of the beach can be read plainly in the alternating deposits; some bands show grains so small that they can hardly be seen.

Scattered through these bands are a vast

number of single curved valves of the brachiopods *Spirifer logani*, *Spirifer orbicularis* and *Syringotheras subcuspidatus*, which made an easy living by placidly straining out the tiny animals and plants abundant in the shallow seas of middle Mississippian time. Then there are a large number of round objects, that look something like ancient coins, which represent transverse sections of crinoid stems and cup corals, according to Dr. Reeds. The most striking of the oblong and slightly curved shells with radiating partitions that divide the shell into chambers represent longitudinal and tangential sections of the cup coral *Zaphrentis centralis*.

The Department of Geology has on display rocks in which fossils are much more thickly crowded than in these. A good example is the *Nerinea* limestone, from Syria, the polished surface of which is so packed with the carrot-shaped shells of *Nerinea fleurbaeui* that the chalky limestone seems merely a matrix for the long brown shells.

On the distribution of Birds

IT LOOKS as if the 1200 copies of Dr. Robert Cushman Murphy's monumental *Oceanic Birds of South America* were going to be pretty well distributed over the known world.

President Franklin D. Roosevelt, who bought two copies, was one of the first subscribers. Other early purchasers were Prince Taka-Tsukasa, the Marquis Hachisuka, and the Marquis Yoshemaro Yamashina, all of Tokio, Sir Charles F. Belcher, governor of Trinidad, and the head of the Tribal Council of the Navajo Nation, Thomas E. Dodge by name, who maintains his headquarters at Fort Defiance, Arizona, over 400 miles from the nearest salt water and presumably that far from the probable line of flight of any salt water birds.

Among the very first and most appropriate subscriptions for a treatise on South American sea birds was that of the Peruvian Guano Administration. Orders for five sets have already been received from Peru and eight from Russia, including subscriptions from the Siberian Section of the Russian Geographical Society in Irkutsk (which is three times as far from salt water as Fort Defiance is).

The farthest north for *Oceanic Birds* so far

is the Landsbokasfnid of Reyjavik, Iceland, which is likely to retain this distinction unless some polar explorer takes along a set to while away the long Arctic night. So far no copies have been ordered for Antarctica, but among the famous institutions and people already purchasing the book are the Musee Oceanographique at Monaco, where Doctor Murphy once worked (and, of course, many of the more important museums and universities of the world), Boris A. Bakmeteff, last Imperial Russian ambassador to this country; John Bassett Moore; George Blumenthal, president of the Metropolitan Museum of Art; Mrs. W. L. Harkness, Duncan H. Read, Frank W. Benson, the etcher of shore birds and ducks; Childs Frick, Daniel E. Pomeroy, Leonard C. Sanford, Lord William Percy, George W. Perkins, Herbert L. Satterlee, Mrs. Harry Payne Whitney, who bought five sets; former Senator Walcott of Connecticut, John Hays Hammond, Jr., and the former King Ferdinand of Bulgaria.

Back in the dim days when Dom Pedro ruled in Brazil it seems that Ferdinand collected many a bird in that country. Later, when reigning in Bulgaria, he maintained a court ornithologist. His son and successor, the studious Boris, is also a naturalist by avocation.

A letter from Stefansson

THIS MONTH NATURAL HISTORY publishes one of the first articles to appear in the United States on an important subject that is very little known, the exploration and the beginnings of the development of the Arctic by Soviet Russia.

There are no political inferences to be drawn from this article, of course, but there is abundant reason why Russia, of all nations, should be profoundly interested in the development of the Arctic. In the first place, something like four-ninths of the great circle of northernmost lands and waters is possessed by Russia, a much larger share than that of any other nation. And then there is that problem that has always bedeviled the rulers of Russia, whether Tsars or Communists—the fact that she alone, among the great nations, is practically ice-bound so far as ocean transport is concerned every winter, with only that one northerly ice-free port of Murmansk.

The editors of NATURAL HISTORY have received the following letter from the distinguished explorer, Vilhjalmur Stefansson, which serves as an interesting introduction to Mr. Shipman's article:

"NATURAL HISTORY is to be congratulated on the news which I get from you that you are intending to publish a contribution on exploration and pioneering in the Soviet Arctic. For several years I have been following these activities as best I could, hampered by inability to read the original Russian in which many of the reports have been published. However, various serial publications of the Arctic Institute have been increasingly considerate of western scholars in printing summaries in English, French, or German. Indeed, a good many of the contributions, some of them of major importance, have been published in a western language. There are, too, western publications which follow and summarize the activity of Soviet explorers. Notable in this field, and increasingly complete, is the semi-annual *Polar Record*, published by the Scott Polar Research Institute of Cambridge, England.

"The summaries of the *Polar Record* demonstrate that for some years the explorers of the Soviet Union have been doing more in the Arctic than was being done in Arctic and Antarctic combined by the explorers of all the other nations of the world. By 1935 they had far outdistanced the combined achievements of the rest of the world.

"The broad credit for northern scientific research and development goes, of course, to the general policy of the Soviet Government. Thereafter comes the leadership of Professor Otto Schmidt, whose office as director of northern development approaches what we would think of in the United States as cabinet rank. No nation in recent times, if any nation ever, has given such importance to geographic exploration.

"The author whom you have chosen to present the subject. Mr. S. S. Shipman, is peculiarly well placed for securing complete and authentic information.

"Again congratulations, then, to NATURAL HISTORY for taking up in semi-popular form, through Mr. Shipman's contribution, the enlightenment of English-language readers with regard to those northern activities of the U.S.S.R. which, in comparison with our own, are so colossal; and which hitherto have been little noticed except by technical students and those few others who consult the *Polar Record*."—VILHJALMUR STEFANSSON.

Is Redfern alive?

NINE YEARS ago the young aviator, Paul Redfern, attempting a non-stop flight from Brunswick, Ga., to Rio de Janeiro, crashed down into the unmapped forest of Guiana. Since that summer of 1927 there have been strange stories, and even individuals who claimed to have met Redfern face to face in

some unheard-of Indian village. But even the traveler who claimed that Redfern had taken himself an Indian wife was unable to substantiate his story.

When Doctor Kahn (whose article appears in this issue of NATURAL HISTORY) showed the moving pictures of his expedition at the Explorers' Club a lean and energetic listener displayed so much interest that Doctor Kahn took the pictures to the listener's office for a private showing. The interested gentleman was Captain Lewis A. Yancey, who himself flew in 1930 over the country where Redfern probably cracked up.

The finding of a white man

As Doctor Kahn reeled off the sequence of the Indian gesticulating to convey his story of the finding of a white man, Captain Yancey stared eagerly at the Alukuyana's pantomime.

"It can't represent anything but the intentional crack-up of a plane," he decided.

It seems that when your plane stalls twenty or thirty feet in the air the bounce you make on landing is likely to be a disastrous one. Captain Yancey himself has had the experience of deliberately smashing a wing, once, for example, when his plane dropped a valve near Nassau in the Bahamas. With no place to land except a small rocky beach, there was no room to do any bouncing. Yancey made a stalled landing, smashing the plane pretty thoroughly, but neither he, the radio operator nor the mechanic received a scratch.

Supposing that Redfern is indeed still alive, one wonders what one's own reactions would be if one were to drop out of a tropic sky down into a green wilderness among a people of a culture ages behind our own—and live there nine years, farther removed from our modern civilization than Mark Twain's Connecticut Yankee was when he cursed the suit of armor they gave him at King Arthur's court.

Two expeditions are now searching for Redfern. If they or anyone else ever find him alive there will be a great story to tell—of nine years or more of existence in the very backwaters of the world while expedition after expedition tried to pick up his trail, and now and then vague rumors came to the world he had left that somewhere in the silent forests of Guiana a fallen flyer was held captive.



BUSH NEGRO BEATING SIGNAL DRUM

The Bush Negroes, the descendants of rebel slaves, survive in a section of northern South America. Two centuries and more ago their ancestors revolted against the Dutch, fled into the jungle,

and after a series of long and bloody wars, established their independence. Their culture shows many striking West African survivals. The apinti or signal drum is used also for dances

Where Black Man Meets Red

Adventures in medical research among two strange tribes of Dutch Guiana. Notes on the possible whereabouts of the aviator Redfern

By MORTON C. KAHN

*Department of Public Health and Preventive Medicine,
Cornell University Medical College, New York City*

THE scientific explorer besides having to travel a certain distance into difficult country, usually faces the problem of securing the friendship of the natives among whom he is to work. This latter procedure, though rarely described in detail, involves some of the most interesting experiences.

My recent expedition to the back country of Dutch Guiana was unique in that it brought me into contact with primitive people of two distinctly different races, the black and the red. The Bush Negroes are that interesting group of blacks who, although they were transported to this hemisphere originally as slaves, won their freedom in armed conflict with the white man and maintain it to the present time. In a foreign setting they have retained to a remarkable degree the culture of their West African forebears. The Alukuyana Indians, of the red race, are the tribe who inhabit the country directly back of the Upper Aucaner Bush Negroes in the little known interior of Dutch Guiana. Many of them have never seen a white person.

One of my purposes was to make tuberculin tests on people of both these groups and to collect samples of their blood for purposes of grouping.

Upstream in 'dug-outs

With my two able assistants, namely Mr. Ralph F. Donaldson in charge of cinematography, and Mr. E. W. Rogalli of the Dutch Guiana Government Service, I proceeded by sea from Paramaribo the port of Dutch Guiana, to Albina just above the mouth of the

Marowyne (Maroni) river, a distance of over a hundred miles. The Marowyne marks the boundary between French and Dutch Guiana, and from Albina one may see the town of St. Laurent which is the main prison port of French Guiana and the centre of the penitentiary system popularly known as the Devil's Island Penal Colony. Here we reloaded our baggage into five 40-foot dug-out canoes, and with the help of twenty-two husky Bush Negro paddlers proceeded on our way.

Today there are six tribes of Bush Negroes all descended from the rebel slaves of 190 and more years ago. On the Copenam River, there is a tribe known as the Quintee; those Bush Negroes who inhabit the upper Saramacca River call themselves the Matawaai; while the large tribe on the Surinam are interestingly enough called the Saramaccaner. Then there are the Boni on the French Guiana side of the Marowyne and Lawa rivers, and a small group, the Paramaccas, who inhabit the shores and islands of the middle Marowyne.

Once fugitives

But to my mind the most interesting of all the Bush Negro tribes are the Aucaners, descended from rebel slaves, who signed a treaty of peace with the Dutch in 1761 at the Ouca plantation. There are about 6000 of these people scattered in a less compact way on the rivers and creeks of the colony toward the French Guiana line. The tribe is divided into two parts known as the "Uppo Nengre" (upper Negroes) and "Belo Nengre" (lower Negroes). All members of the tribe living below the Gran Holo (Big Hole) Falls in the Tapanahoni River belong to the Belo or lower

Aucaner group, while the real aristocrats of the tribe live above this dividing line.

In the villages of the Upper Aucaners are found the clans or "lo" from which the King or "Granman" of the entire tribe is selected. These are the Otter lo and the Missi Jon. The Upper Aucaners live in the wildest and most inaccessible part of Dutch Guiana, and have had the least contact of any Bush Negro tribes with the white men.

After seven days of arduous paddling and poling over innumerable falls and rapids, we reached the end of the Marowynne River and entered the mouth of the Tapanahoni. The seat of the Chief or "Granman" of the Aucaner tribe is the village of Dree Tabiki (The Three Islands), but before one may enter this precinct it is necessary to inform the Granman and Council of one's proposed arrival and to await the necessary permission. This was accomplished by dispatching a small canoe two days ahead of my main party.

Overtures

The messengers returned and informed me that desired permission had been granted, but that my party was to wait at a certain point just out of sight of Dree Tabiki and to fire a gun three times as a signal. We were not to proceed until three gun shots were heard in answer from the village which would signify that Kanapé, the head Captain of the Aucaner tribe was ready to receive me.

Kanapé is not the Granman of the tribe. Since the death of old Amekti, some four years ago, however, Kanapé has been the official ruler. A young Bush Negro by the name of Matoja, is the rightful heir to the title but the Bush Negroes consider him too young and inexperienced for such a position, and will not inaugurate him until he is considerably older. When I saw him this winter, he appeared to be about twenty-five years of age.

After a wait of about two hours, I heard the gunshot signal from the village and motioned my canoes to fall in line one behind the other, which is the accepted etiquette of approach. As we paddled slowly to the shore most of the villagers were assembled there in colorful array to greet us, including the most powerful Captains of the tribe, who had been summoned by Kanapé for the ensuing *Krutu* or Council. As we approached the landing

place the Bush Negroes fired several salutes from their old muzzle loaders and percussion cap shot guns while we answered with all available fire arms—rifles, shot guns and revolvers. After several such salutary exchanges my canoe finally touched the shore from which I was assisted in a most dignified way by the Reception Committee, composed of Captains Gagoo, Abompé, Sekendo, Sava, Tonka, Mosi, Batu and Dabooto.

It was not until I had gone some distance up the trail leading to the village, however, and had passed under the Azang Pau, the phantom barrier of palm fronds, under which all must pass to cleanse them from any evil intentions, that I was finally greeted by Kanapé. This handsome specimen of dignified manhood was resplendent in his ceremonial regalia, which included a silk top hat, a drum major's baton and a silver plaque hanging from his neck, upon which was embossed the arms of Dutch Guiana, the official badge of his office, given him by the Government. Some of these insignia still in possession of the tribesmen date from shortly after the signing of the peace in 1761.

Primitive formality

The greeting, which never varies, is somewhat as follows:

"*Odio Bahkra fy you deh, b'a*" (Howdy, white man. How are you, brother?)

"*Havu so, Granman, fy you deh, B'a*" (So, so, Granman—How are you, brother?)

To which he replies: "*Havu so.*" (It does not do to claim that one is feeling too well, otherwise the enmity of the spirits might be incurred.)

"*We meetee baka*" (We meet again).

"*E-yah we meetee baka*" (Yes we meet again).

I then proceeded as follows: "*Granman—Dissee wan muy condree*" (This is a fine village).

"*Ala you suma deh muy tumussi*" (All of your people are very nice indeed).

To which he replied: "*E-yah Bahkra datti Bon*" (Yes, white man, that is good).

He then motioned me to follow him to the *Krutu Oso* or Council House and we were soon comfortably seated on the carved ceremonial benches surrounded by the Captains and other dignitaries of the tribe while the

outside walls of the large hut were almost completely surrounded by villagers. I then proceeded somewhat as follows:

"Granman I have come a long way to your country, many days and nights on the white man's big boat I have travelled—many days of travel on your rivers. I do not come for gold, I do not come for lumber, I do not come for the sap of the wild rubber tree, nor yet do I come to tell you stories of religion or to try to change the God of your people. I come only to make an inspection of your people for a certain illness and to help them in any way I can. I would also like to take a few photographs and collect the beautiful wood carvings made by the Bush Negroes, so that the people of my country can see how the people of your country live, and what beautiful things they make."

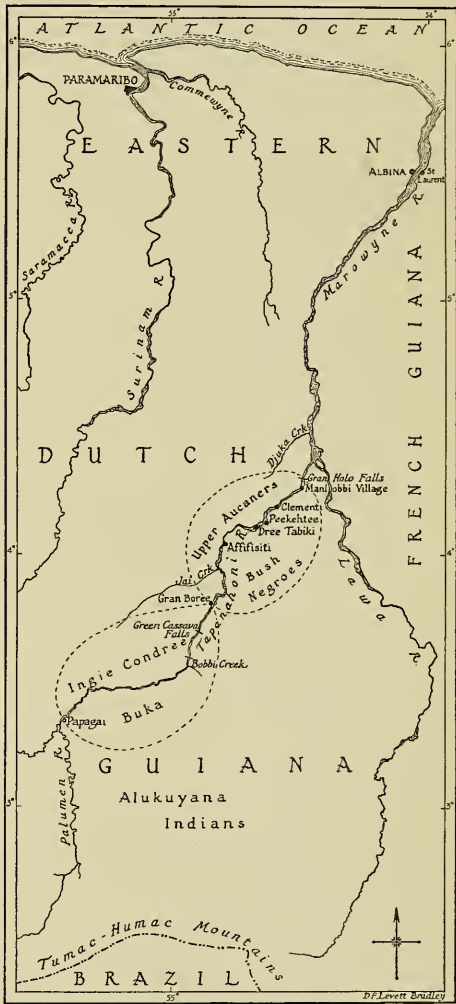
At this point, I passed around several photographs taken on previous expeditions. These were received with many exclamations of amazement, especially since some of the persons in the pictures had since died.

Kanapé then turned and looked me full in the face, saying, "White man I can see by your eye that you tell the truth." He then turned to the assembled Captains, and said: "You see the white man and you have heard him talk. He is not a stranger among us but has come to our people before. He has also travelled in the land of other tribes of Bush Negroes. He knows the Paramacca, the Boni and the Saramaccaner. You hear what he says, he wants nothing from us, but works to do us good. He wishes to go among the villages of our people, even to Gran Boree, the very farthest village of our nation. What is your pleasure?" etc.

"This white man is all right"

After each few words, Kanapé would pause and listen to the exclamation of his council. Such phrases were forthcoming as "*E-yah Granman*"—"Datti Bon"—that is good; "*you tahki true*"—you speak the truth; "*Kwet-Kwetti*"—not at all; "*Dissee Bahkra Dehbon*"—this white man is all right, as well as other nasal and guttural exclamations of an affirmative nature. The *Krutu* was finally ended by permission being granted to me as signified by all of the Captains clapping their hands in unison and nodding their heads.

Anticipating favorable judgment I had already begun to unpack my medical kit and had the necessary material ready for the purpose of making tuberculin tests, and also for extracting blood. I then said: "Granman since you are the head man of this tribe, it is only fitting that you should be the first to receive these tests." He demurred for a few seconds



REGION VISITED BY DR. KAHN

but being surrounded by the chief Captains, it, of course, would not do for him to show any signs of cowardice. And more or less to simplify matters, I gently seized his arm, rubbed it with alcohol, and applied the tuberculin test. A necessary sample of blood was obtained in a similar manner. As I was performing the

test on Kanapé the entire council laughed in high amusement and after that it was a simple matter to make similar injections on practically the entire tribe.

Without going into the theories involved, it can be said that the tuberculin test shows the Bush Negroes to be remarkably free from infection with the tubercle bacillus. They stand a marked contrast in this respect to the North American Negroes, their blood brothers, who show relatively high infection. This is especially interesting in view of the fact that the ancestors of the Bush Negroes came into contact with tuberculosis in the days of slavery, for it may indicate that life in the natural state, coupled with their isolation has enabled these people to throw off any manifestations of the disease which their forebears might have picked up.

Mr. Donaldson set about his task and obtained a number of most interesting motion and still pictures. Mr. E. W. Rogalli was of inestimable aid to both Mr. Donaldson and myself. After completing our work in one village, we went higher up the river to the next one and then on to the next. Opportunity was also taken to enhance the collection of Bush Negro art work now at The American Museum of Natural History, and also to gather further information concerning the life and customs of these people.

In this way, all of the villages of the upper Aucaners were visited. At a few places where the settlements were adjacent, the people from one village would come into the field headquarters which had already been set up in another. And at last we came to the most remote of all the Bush Negro settlements in Dutch Guiana, the village of Gran Boree, high up the Tapanahoni River, past the mouth of the far Jai Creek.

Unknown Indians

Late one afternoon while attempting to do some fly-casting from the shore, I happened to glance up the river and to my surprise saw three canoes coming down. I knew immediately that these were not Bush Negro dug-outs as the construction was entirely different. As the crafts came a little nearer it at once became apparent that the occupants were Indians, and from their appearance quite the wildest looking specimens that I have ever

seen. The red men saw me at about the same time. One of them gave a loud guttural command upon which the entire flotilla headed about and paddled full speed up the river from whence they had come.

In friendly pursuit

I dropped my fishing rod upon the rock and ran as fast as I could up the jungle trail to the village. Although I had seen the Caribs and Arawak Indians, who dwell closer to the coast, also the Akawoi and Wapisianas of British Guiana, it had never been my good fortune to encounter these wild tribesmen of the all but unknown interior, and I did not wish to miss such an opportunity. Fortunately, some of the members of my Bush Negro crew were about, and the story which I told as rapidly as possible was greeted with loud laughter. "Of course they ran away, they are very much frightened of white men. They call white men 'Panacheeree'—or those who kill their friends. They call us 'Micolo,' their name for Bush Negroes. Most of them have never seen a white man before but have heard some very bad stories about them. They are members of the Alukuyana tribe. Their country begins four days paddle from here at the mouth of the Palumen River (which drains into the Tapanahoni) and extends up the Palumen for many miles. The region between this village and the mouth of the Palumen is known as 'Ingie Condree Buka,' the mouth to the Indian country—no one lives there, so it was agreed upon many years ago by our chiefs and theirs. We will paddle after them with presents and try to induce them to visit you here. If they come be very gentle and do not make quick movements. Go to your hut and wait. If they come, give them rum and cigarettes, which they will like."

With these proud instructions in mind, I sat patiently at the door of my hut, but it was not until about 9 p.m. that I was able to make out a few dim figures crossing the village clearing. These proved to be Moiman and N'angoto, two members of my Bush Negro crew, each leading a stalwart red man by the hand, much as one would lead a child. I arose slowly from my camp chair and extended my hand to each of the Bush Negroes, and then to the Indians, who seeing what was expected of them shook it limply but gravely.

These men were entirely nude excepting for a loin cloth and necklaces and bandoliers of animal teeth and shells. Each carried a bow some 5½ feet in length with arrows of nearly equal length. The heads of the arrows were made of hard wood and, as afterward proved to be the case, were poisoned with curare. They had long black hair, extending well over their shoulders, while their bodies and faces were painted with red, green and yellow pigment. One must admit that such specimens would satisfy any small boy's idea as to what a real wild Indian should look like no matter how hard to please such a boy might be.

After the refreshments had been passed about, the tension seemed to ease considerably and the Indians seemed much interested in examining my clothes, skin, and the various pieces of camp equipment which were about. The next morning about 11 o'clock, seven more Indians came into our camp and from that time on we had little difficulty in making them feel at home. Larger bands were encountered by us when we proceeded up river some distance beyond Gran Boree to hunt fresh meat. This journey took us considerably beyond the Green Cassava falls, and to the mouth of the Bobbi Creek.

A no-man's land

The Indians come down to the remote Bush Negro villages to trade hunting dogs, bows, arrow shafts and feather work, for knives, machetes, cloth and sugar, which filter back into the Bush Negro country from the trading post of Albina, near the foot of the Marowynne River. Curiously, while the Bush Negroes are expert wood carvers they have not been able to make a bow which they consider comparable to those made by the Indians. The hunting dogs which look like a combination of hound and smooth haired fox terrier, are very highly prized and command a large price.

There is considerable traffic on this remote border, where red and black men meet. While the Indians cannot speak the "talkee-talkee" language of the Bush Negroes, nor do the Bush Negroes speak the Alukuyana dialect, they have developed a language known as "Mocks-Mocksie," in which a sign language is aided by a few words from both tongues.

One day while sitting outside of my hut, old Kanapé came to me with a spear having a

blade of hardwood 14 inches long and two inches wide at its widest part. The shaft of the spear was broken.

"You see this, Abentee (my Bush Negro name)," said he. "Just last year three Alukuyana Indians brought this down to me, the blade was covered with blood. The shaft of the spear was broken as you see it. This was a message from their chief to help them in their war against the Trio Indians. Those Indians! Their temper is quick and their head is hot. They fight each other for the least little thing. The Alukuyana and the Trio have war one against the other, and then sometimes after peace has been made both combine to fight the Saluma or Diau tribe, who live even beyond the Trio country. It is seldom that all tribes are at peace, but sometimes that is so. All the tribes are friendly with my people, and even in time of war a Bush Negro can go among them without fear of harm. Often I send my most able statesmen to make peace among them but many moons do not pass until some stupid minor incident causes hostilities to break out anew. This has been going on as long as my people have been on this river. In the early days, we also had our trouble with the Indians, but they soon found out that they were no match for us."

In these words you have a summary of the attitude of this group of Bush Negroes to the tribes of redmen who are their neighbors. The white man plays no part in this unusual borderland between two races.

The lost Redfern

It was in this part of South America that the gallant young aviator Paul Redfern has been supposed to be living. It may be of interest to recount some of the information I gathered concerning his possible whereabouts. As will be remembered, Redfern took off from Brunswick, Ga., in the summer of 1927, in an attempt to make a non-stop flight to Rio de Janeiro. There is no question but that he took fresh bearings from a ship off the coast of Venezuela, and there is good reason to believe that the aeroplane which was heard going over mission stations in British Guiana shortly afterward was Redfern's. After that nothing more was heard. Many reports have since filtered out from the interior of a white

man living with the Indians and Redfern's brave father has never lost hope of his son being alive and some day being restored to him. Some claimed to have actually seen Redfern in this or that Indian village, while others claim to have found pieces of aeroplane wreckage, wing fabric, the hat of the aviator, etc. As far as I am aware, none of these reports have been substantiated.

In view of the fact that my expedition was within a very short distance of the Palumen River in the upper country of which Redfern was last reported to be located, I took particular pains to ask the Indians who inhabit this region, also certain Bush Negroes who visit the Indian country, of the possible whereabouts of a lost white man. Their response convinced me that the possibility of a white man being in the very far interior is not entirely remote but whether such a person will prove to be the missing aviator is quite another matter.

Various reports

In the village of Dree Tabiki, I saw and spoke at great length with the Bush Negro Kau-flay, whose name has appeared in the news in connection with Redfern. Kau-flay went to the end of the Palumen River and walked twenty days further into the Indian country. He saw and spoke with the Indian Chief Sapuconu, in whose village Redfern had been reported to be. Sapuconu told Kau-flay that he had heard of a white man falling out of the sky and that such a white man was reported living with Indians even further in the interior. Sapuconu himself had never seen this man as has been reported. I also spoke at length to Negro dog traders, namely Payé (Paje), a most intelligent chap, and Captain Tattoo, who had accompanied me on a previous expedition. They had penetrated far into the Indian country from different directions. They encountered numerous Indians of the Alukuyana and Trio tribes, all of whom had heard the story of the white man but none of whom had actually seen him. It was my good fortune also to speak with Mr. M. A. Melchert who is in charge of the most remote mission station in Dutch Guiana. It was to Mr. Melchert that the Indian Kopan first told the story of a white man living in the village of Sapuconu. As has been indi-

cated, this rumor later proved unfounded.

It was from an Alukuyana Indian by the name of Awaimat, whose home is on the high Palumen River in the village of Tulu that I received the information about this white man who may be Redfern, that I considered the most authentic. Awaimat told me that his brother had actually seen this white man living in the village of Asunanga in the country inhabited by the Saluma (Saloma) tribe of Indians. This territory is on the western side of the Tumac-Humac Mountains across the Dutch Guiana border in Brazil. It is on the Hona-Wau Creek near the source of the Trombetas River, which finally drains into the Amazon. Awaimat appeared to be a man of about 45 years of age. He seemed to be in command of his band of men and impressed me as a reliable person and of good judgment. He stated further that this white man had fallen from the sky, and as he made the appropriate gesticulations he also made a noise like the humming of an aeroplane motor. Awaimat said that this white man's legs had been injured, but are now healed. Awaimat also stated that if the Saluma Indians saw white men coming they would be very liable to move even deeper in the interior. It is my impression that an attempt to reach this wild region, most of which no white man has ever seen, would be highly impractical if penetration were attempted from the Dutch Guiana side. It would seem more reasonable to reach the Hona-Wau Creek by going up the Trombetas River from the Amazon.

Two search parties

The stories I heard made it clear that if Redfern is among the Indians they are not treating him as a god, but do recognize that he is a white man. There are two expeditions now in the field to determine his possible whereabouts.

My expedition, which was conducted under the auspices of Cornell University Medical College, the American Museum of Natural History and the National Tuberculosis Association, penetrated this shadowy region primarily for scientific purposes. And the problems for investigation here are manifold, for in the entire world there is no other border where wild men of the black and red races meet on terms of aboriginal equality.



Where Black Man Meets Red

Dr. Kahn at the village of Loca Loca making plans for his expedition into the interior of Dutch Guiana: a journey for purposes of medical and anthropological research. The program included tuberculin tests and blood grouping of the little-known Alukuyana Indians and on the Bush Negroes, who dwell

far from their original West African home (Below) The two white men who assisted Dr. Kahn on the expedition: Mr. E. W. Rogalli of the Dutch Guiana Government Service, with thirty years of South American experience back of him, and Mr. Ralph Donaldson, in charge of motion pictures





(Above) Native paddlers: some of the twenty-two husky Bush Negro rivermen who manned the five 40-foot dug-out canoes

(Right) Poling through the tropical rain against a strong current



(Below) Rapids hinder progress throughout the entire length of the Tapanahoni River, the only avenue to the interior





(Above) The flotilla just after leaving Albina, a short distance above the mouth of the Marowynne River. Each canoe had a capacity of half a ton



It sometimes took the expedition three hours to go one hundred feet. Seventeen days of travel upstream took the explorers to their highest point





Statuesque figures are common among the Bush Negroes



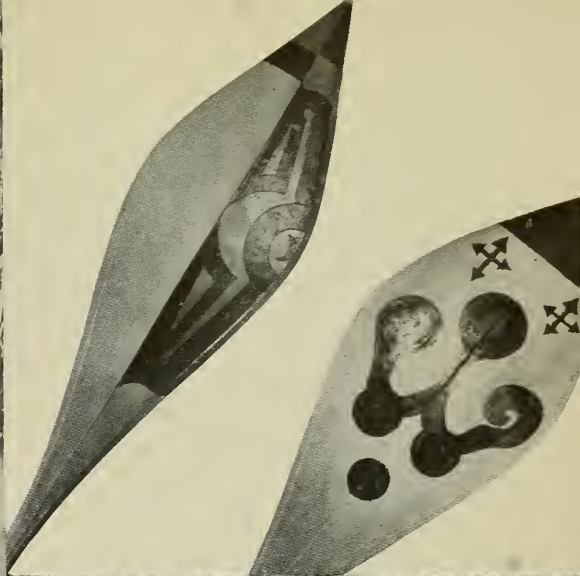
The Bush Negroes bathe often and are cleanly people. The unmarried woman wears only a short length of cloth, whereas the married woman's dress extends to the knees

Bush Negro rivermen with paddles bearing clan designs

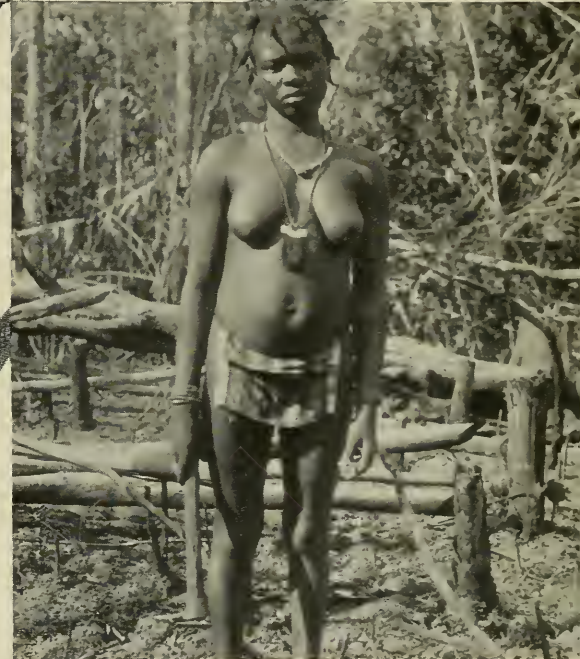




Bush Negro carving a tray out of a section of a tree trunk



Paddles. The Bush Negroes have a distinctive art which makes use of conventionalized, symbolic designs



(Above) A woman of the Aucaner tribe. The women tend the crops after the men have cleared the ground. Upland rice and casaba are the chief crops



Ornamentation of the skin by scarring such as the girl at the left shows is a direct West African survival. Both sexes adorn themselves in this way



A Bush Negro in his home; beside him are a fire fan, a carved tray and a mortar. As the logs burn they are shoved in toward the center. The tripod is used to support cooking vessels. This man, Moiman ("nice fellow"), accompanied Dr. Kahn on several expeditions



Common objects are fashioned by the Bush Negroes into elaborate objects of art

Clan designs on paddles. The Bush Negroes are divided into six tribes and numerous clans. They marry between clans but never outside their own tribe



(Below) A native weaving a thatch of palm fronds for his house





(Above) Enshrined fetiches in the village of Gran Boree. It is here that all the sacred objects of the tribe are kept because it is the most remote village of the tribe

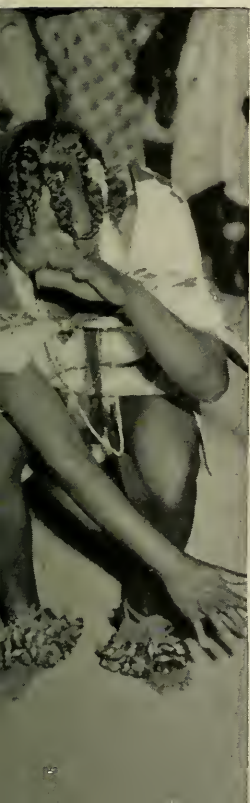
(Above) The shrine to the Voodoo or snake god, the most sacred symbol of the Aucaner tribe. It was only after a long krutu or pow-wow that permission was granted to photograph this object





(Above) Another difficult photograph to secure: a sacred drum, the ageeda, used to summon the spirit of the Voodoo or snake god

(Below) A member of the remote Upper Aucaners smeared with a sacred white clay that is used by these people whenever they feel the influence of religious emotion



(Left) A harvest dance in a wild section of Dutch Guiana. The anklets are made of Kau-e seeds. The orchestra consists of three tom-toms, rattles (saka), and a board of hard wood beaten with two paddles called quaqua





Dr. Kahn performing tuberculin tests. The tests showed the Bush Negroes to be remarkably free from infection with the tubercle bacillus. Life in the natural state, coupled with isolation, has apparently enabled these people to throw off any manifestations of the disease which their forebears may have contracted while enslaved



New information on the possible whereabouts of the aviator Redfern: Payé, the Bush Negro dog trader, relating the story of the white man who fell from the sky as he heard it from the Trio Indians farther inland

Indians who had never before seen a white man: a flashlight photograph of two Alukuyana Indians. The beliefs and customs of these people are unknown. They live almost entirely by fishing and hunting, and in the latter pursuits even the Bush Negroes acknowledge them their superiors



Dr. Kahn with three Bush Negroes and four Alukuyana Indians (with long hair). This remote section of Dutch Guiana is the only place in the world where wild men of the black and red races meet on terms of aboriginal equality. Many years ago there was trouble between these groups, but today they are on good terms



Three Alukuyana Indians and a Bush Negro. The Indians train dogs for hunting and bring them down the river to trade with the Negroes for knives, axes and machetes. Dr. Kahn's tests showed them to be entirely free from infection with the tubercle bacillus



The Indian who gave Dr. Kahn the most authentic information that may relate to the lost aviator Redfern. Awaimat stated that a white man had fallen from the sky and was living in the village of Asunanga beyond the Tumac-Humac Mountains in Brazil, and that his brother had seen him



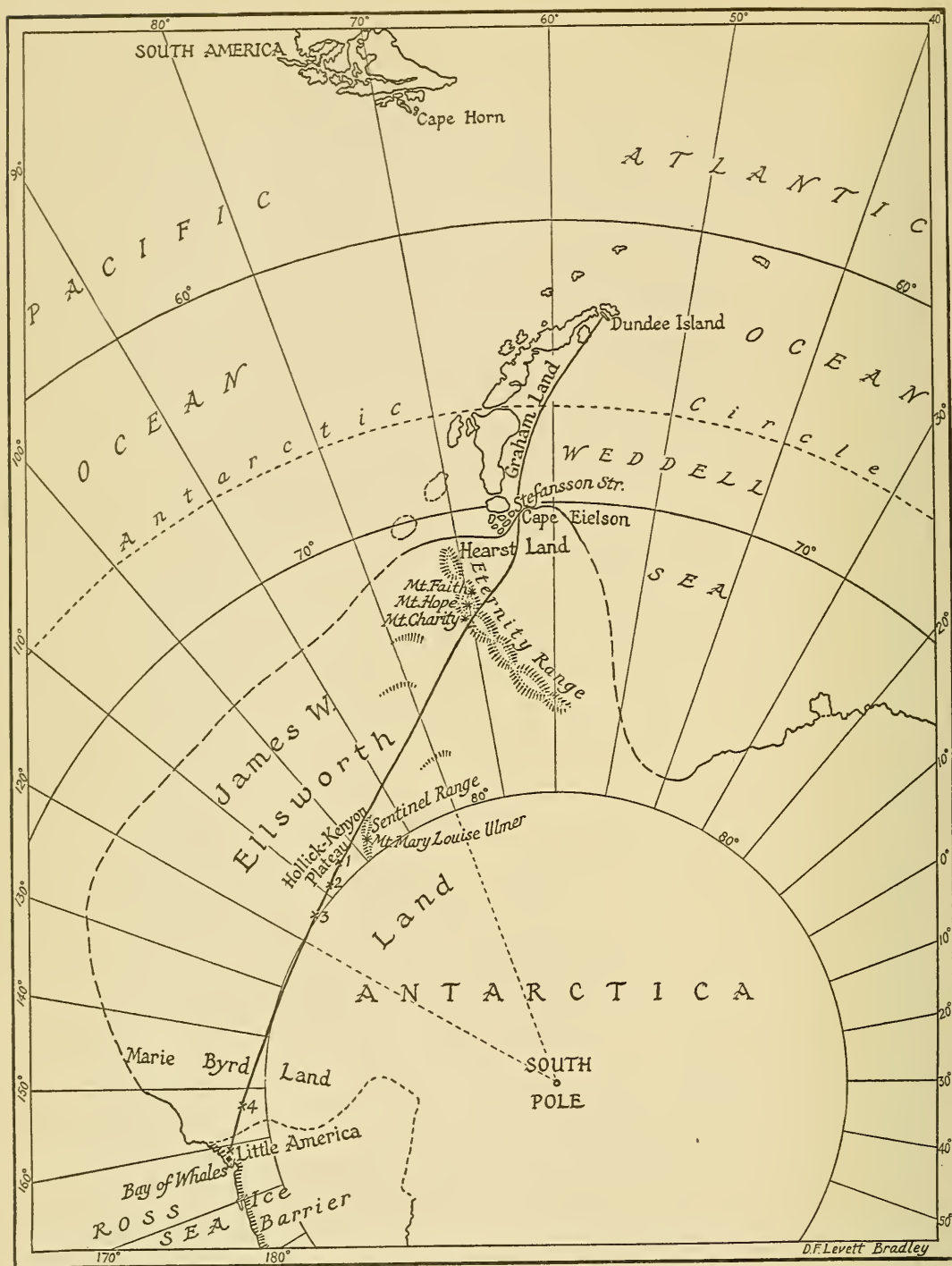
Wide World Photos

LINCOLN ELLSWORTH

Ellsworth's Own Diary

The wonder of discovery revealed in a document that chronicles, minute by minute, the exploration of an unknown world

Date	G.M.T.	Local Mean Time	Remarks
Nov. 23rd	03.00	22nd 11.16 p.m. (Long. 56° W. = -3 ^H 44 ^M)	Left "Wyatt Earp" at ice edge of Dundee Is. for 500 foot climb to where "Polar Star" stood groomed and ready for trans-Antarctic flight.
Nov. 23rd	08.04	4.20 a.m. (56° W. = -3 ^H 44 ^M)	Took off in "Polar Star." Headed south following east coast already explored Graham Land. Weddell Sea observed to be quite open to about Lat. 69 south.
Nov. 23rd	12.22	8.6 a.m. (64° W. = -4 ^H 16 ^M)	Crossed Stefansson Strait. Confirmed Wilkins' discovery of a separation between Graham Land and the Continent of Antarctica, but observed Strait to be not more than one mile wide, which is much less than is shown on maps. Compass bearing of coast S.E. 138° and W. 242°. Low black conical peaks of Cape Eielson on our left. Climbed to elevation of 13,400 feet, temp. minus 22° cent. Heading for the unknown. Bold and rugged mountain peaks across our route lay ahead, some of which seemed to rise almost sheer to 12,000 as far as the eye could see. I named this range "Eternity Range."
Nov. 23rd	14.25	9.45 a.m. (70° W. = -4 ^H 40 ^M)	Passed three prominent peaks of Eternity Range on our right. I named them "Mt. Faith," "Mt. Hope" and "Mt. Charity." Saw no glaciers or crevassed surfaces.
Nov. 23rd	15.30	10.42 a.m. (72° W. = -4 ^H 48 ^M)	Mountains beneath us dwindled out into isolated nunataks and merged into a great snow plateau surface with elevation of between 6000 and 7000 feet. Isolated patches of sastrugi appeared at intervals on our right, but no crevasses.
Nov. 23rd	16.15	11.11 a.m. (76° W. = -5 ^H 4 ^M)	On distant right horizon a mountain range became visible with isolated black peaks which faded out 20 minutes later.
Nov. 23rd	17.00	11.32 a.m. (82° W. = -5 ^H 28 ^M)	A few more peaks showed on same horizon.
Nov. 23rd	17.20 17.45	11.44 a.m. (84° W. = -5 ^H 36 ^M)	Mountains 120 to 140 miles distant appeared on our left horizon, also a few peaks on our right horizon.
Nov. 23rd	18.20	12.16 p.m. (91° W. = -6 ^H 4 ^M)	Very hazy ahead. It was dead flat with a patch of sastrugi on our left. 110 miles further on came a beam of a solitary little range about 75 miles long on our left to which I took bearings. It was symmetrically formed with peaks rising to 13,000 feet. and all clustered into a central mass which dwindled down at either extremity to merge into a plain around. I named it "Sentinel Range" and its central peak "Mt. Mary Louise Ulmer" after my wife.
Nov. 23rd	19.30(?)	12.58 p.m. (98° W. = -6 ^H 32 ^M)	



LINCOLN ELLSWORTH'S FLIGHT, 1935

Between November 23rd and December 15th Lincoln Ellsworth flew from Dundee Island to Ross Sea, traversing an unexplored section of the Antarctic continent. The 2100 mile

flight was broken by four landings as shown. Much territory was explored, and the section between 80 and 120 degrees west longitude was claimed for the United States.

Date	G.M.T.	Local Mean Time	Remarks
Nov. 23rd	19.45 (?)	1.5 p.m. (100°W.= -6 ^H ₄₀ ^M)	Fifteen minutes later on south horizon, 100 miles distant, appeared a long black-tipped range which visibly extended through at least one degree of latitude. This appeared to be the last of the mountains we were to see, for ahead and around swept only a vast plateau meeting the horizon in a vista of white. Our visibility on the journey thus far had been from 120 to 150 miles, for we were flying at an average height of 10,000 feet in clear weather.
Nov. 23rd	21.55 (First Landing)	2.59 p.m. (104°W.= -6 ^H ₅₆ ^M)	Visibility getting low. Landed after 13 ^H ₅₀ ^M flying and fixed our position as Lat. 79°12'S. Long. 104°10'W. Altmetre showed surface elevation as 6400 feet, and the plateau extended, with slight undulations, in every direction. We stood on the only unclaimed land in Antarctica; in the whole world in fact. With permission of the Department of State I raised the American flag and named this area between Hearst Land on the one side and Marie Byrd Land on the other, or between the meridians of 80° and 120° West longitude, "James W. Ellsworth Land," after my father who made the flight possible. The plateau, above 6000 feet, upon which we were, I named "Hollick-Kenyon Plateau," after my pilot. Remained in this camp till November 24th.
Nov. 24th	5.03 (Second Landing)	—	Took the air again, but landed 30 minutes later in Lat. 79°30'S., Long. 107°55'W., due to low visibility. Elevation about 6400 feet.
Nov. 27th	— (Third Landing) 23.55	11.10 p.m.	Took off and landed 50 minutes later (midnight) in Lat. 79°58'S., Long. 114°15'W., just as such thick weather enveloped us that we could barely see to land. No sooner had we pitched our tent than a blizzard broke upon us. For three days we lay in our sleeping bags trying to keep warm and save fuel. Temp. -5° Fah. This point seemed to be about the end of the level plateau which had extended from the last seen mountains.
Dec. 4th	19.15	11.38 a.m. (114°15'W.= -7 ^H ₃₇ ^M)	Took off.
Dec. 4th	20.30	11.58 a.m. (128°O'W.= -8 ^H ₃₂ ^M)	One hour and a quarter later, and about 140 miles after taking off, at an elevation of 4500 feet the plateau, with undulations, seemed to drop towards the Ross Sea Barrier.
Dec. 4th	22.04	12.24 a.m. (145°O'W.= -9 ^H ₄ ^M)	In longitude 145°W. we were over crevasses and 36 minutes later we estimated the surface to be at an elevation of about 1000 feet.
Dec. 4th	23.10 (Fourth Landing)	12.57 p.m. (153°16'W.= -10 ^H ₁₃ ^M)	Landed. Elevation 980 feet, Lat. 79°15'S., Long. 153°16'W. Camped for night. 125 miles from Bay of Whales.
Dec. 5th	—	Early a.m.	Took off.
Dec. 5th	—	10.3 a.m.	"Polar Star" slackened in her speed, and like a weary bird gently came to earth, completely out of gas. We dug trenches for the ski, weighted them down with some of our equipment and then pitched one tent. We knew that we were not far from Little America. One day Kenyon, standing on the wing of the

Date	G.M.T.	Local Mean Time	Remarks
			plane and looking ahead, saw what he thought to be Little America. Yes! There it was, the wind generator coated in ice and a long line of snow-covered objects which must be the houses—and only 4 miles away.
Dec. 9th	—	—	<p>Packed hand sledge with three weeks' rations. We started out wearing 3-foot snowshoes, and well we did, for drawing a sledge over the ice-coated sastrugi surface we never should have gotten any place with ski.</p> <p>The four miles proved to be fifteen, and instead of Little America we came to only a pinnacle of ice in the midst of a huge pressure ridge. We had left the plane without tent or sextant, hoping to find shelter in Little America. Leaving our sledge, we started back for those two necessary items, rested an hour at the plane and then started back for the sledge. The snow was soft and wet and the sun beat down out of a cloudless sky and made us sweat for the first time during the 22-day journey. Because of heavy hauling we decided to sledge by night and sleep by day, but good weather only lasted two days, then turned foggy. For the first two days we travelled west, then north. Kenyon took bearings with his pocket compass and we estimated our speed to be two miles per hour. We would pull for fifteen minutes, then rest for four, and so on we went, calling 6 hours a day's work.</p>
Dec. 12th	—	—	Overcast and misty. We had made 12 miles and I pointed ahead to where a dark streak broke the dull vista of endless white. It could only be one thing—open water—we both agreed. We pitched our tent, intending to reach it next day.
Dec. 13th	—	—	We looked out of the tent to see everything enshrouded in mist. We travelled all day in the direction we thought the open water lay, but it seemed we were never again to get a glimpse of it. At noon we rested. In the late afternoon through the mist we could discern the crest of a ridge, and thought it odd on the flat barrier surface. We hastened our march. We heard what we imagined to be the lapping of waves. We mounted the ridge and looked straight down into the Ross Sea and were standing on the very edge of the Great Barrier. We retraced our steps and camped for the night about a mile back, for the barrier face is always breaking away. We didn't want to be dumped into the sea just as our goal had been reached.
Dec. 14th	—	—	Morning observations put us about 15 miles north of Little America. We had evidently passed it in the thick fog, so back we must trudge. We found later that we had been three miles east of the eastern end of the mouth of the Bay of Whales. The Bay itself had not begun to open as yet, and a wintry scene indeed it looked. We remained in camp all this day.
Dec. 15th	—	—	Followed the edge of the Bay of Whales and reached Little America just 22 days after leaving Dundee Island.
Jan. 16th	—	8 p.m.	"Discovery II" arrived Bay of Whales from Melbourne with relief.
Jan. 22nd	—	5 p.m.	"Discovery II" left Bay of Whales, departed for Melbourne.

The U.S.S.R. in the Arctic

A new page in the history of the North, showing how supposedly worthless lands can be made habitable and productive

By S. S. SHIPMAN

IN September, 1935, brief press dispatches from Moscow reported to the world that four freight steamers had succeeded in linking the Atlantic and Pacific Oceans by voyages across the frozen Arctic.

Two of the vessels, the "Vanzetti" and the "Iskra," made the West to East journey from Murmansk to Petropavlovsk, on the Amur River, while the "Anadyr" and the "Stalingrad" sailed from Vladivostok to Murmansk. All four ships, built in the U.S.S.R. of Soviet materials, carried large cargoes of foodstuffs, clothing, fuel, and supplies for the population of the extreme North. The "Stalingrad," after completing her record-breaking journey to Murmansk, went on to London to establish a new trade route from Asia by way of the Arctic.

A new era

Behind the prosaic words of these reports is a drama of the North—the culmination of years of struggle to open up the Northeast Passage for commercial navigation and to develop the great natural resources of the white Arctic continent of the Soviets. For a veritable continent it is—constituting about 40 per cent of the huge expanse of Russia and an area at least fifteen times as large as France.

It is a drama punctuated by heroic exploits of ice-breaker expeditions, by daring airplane rescues, by tales of little groups of explorers and scientists pursuing lonely vigils, sometimes lasting for years, in remote Arctic outposts. It is a drama in which human courage and persistence, armed with the tools of modern science, have conquered the snow and ice of the Arctic. Exploration and development in the

Arctic today, backed by the resources of the State, bear the same relation to the largely individualistic efforts formerly traditional in Arctic exploration that the "Normandie" bears to the sailing vessels of the nineteenth century. It is possible that more has been accomplished by the U.S.S.R. in the Arctic in the past ten years than by all other countries together since the beginning of the past century.

Planes aid ships

The manner in which the journey of the four freight steamers across the Arctic was accomplished last summer was a practical demonstration of how, by mobilizing the various technical means now available, it has been possible to master the unknown North. Four powerful ice-breakers were stationed in the most difficult sections to convoy the freighters through the heavy ice. Scouting airplanes went ahead to survey the route and relay back to the vessels and to polar stations radio reports on weather and ice conditions. With this assistance the steamers were enabled to navigate thousands of miles of pack, frequently enveloped in dense fog. The voyages, scheduled for five months, were completed in little over half that time.

As a result of numerous such episodes, a new life has come to the Arctic. Where formerly polar bears roamed about and seals crawled over drifting floes, Soviet geologists, explorers, and workers are living, building and making studies. At present about thirty thousand persons of various occupations and callings live and work in the Arctic regions, and the number is steadily growing. Scores of radio stations in the far North transmit to Moscow regular reports of meteorological con-

ditions. Surveying parties have uncovered valuable deposits of coal, oil and metals. Sea and river ports have been built, and new industrial centers created. Dozens of vessels now sail the Arctic waters and airplanes wing their way freely over the uncharted wastes. New islands have been discovered and "blank spaces" on the map filled in. In the words of Rudolph Samoilovich, famous Arctic scientist, "life is everywhere. Like a spring it bubbles in the lands of the Soviet Arctic, and the day is not far distant when the Arctic will cease to be a land of adventure and will become an integral part of the country."

As early as 1919, when the northern regions were still occupied by foreign armies, Soviet leaders were laying their plans for harnessing the Arctic wastes. A first expedition to Novaya Zemlya (New Land) in 1921 was followed by a series of explorations around that island and in other parts of the Western Arctic, especially Franz Josef Land. Another early expedition set out from Belushia Bay, on the west coast of Novaya Zemlya, in July, 1923. The party of four men sailed in a 25-foot boat equipped only with a mainsail and a five horsepower engine. The chief combined the functions of captain, sailor, geologist and topographer. It is interesting to compare this expedition with those of recent years, with as many as 150 scientists and workers in one expedition, commanding all the resources of modern Arctic science and navigation—ice-breakers, planes, radio, etc.

The "Krassin" to the rescue

The first big test for the Arctic forces of the U.S.S.R. was the rescue in 1928 of the hapless members of the Nobile polar expedition from the dirigible "Italia" by the ice-breaker "Krassin."

On May 29, 1928, radio stations in North Russia picked up the S.O.S. of the "Italia." The ice-breaker "Krassin," the largest in the world, sailed June 15 from Leningrad toward the west side of Spitsbergen, from the vicinity of which the radio signals had come. At the same time the icebreaker "Malygin" was dispatched from Archangel toward the eastern shores of the group. By July 10, the "Krassin," after slowly ploughing through the crushing ice, was within sixty miles of the marooned flyers. Her aviator, Chukhnovsky,

in a daring flight over the Arctic wastes, spotted two of the survivors. In his return flight, he was forced down by heavy fog, damaging his plane in landing. Two days later, the "Krassin" picked up from the ice Zappi and Mariano (whose companion, the Swedish scientist Malmgren, had died) and the same day took aboard five more of the Italian survivors. Then the party searched vainly for a third group of seven Italians who had been blown eastward when the gondola broke loose from the ship; effected the rescue of Chukhnovsky and his companions; relieved the Italian group who had made their way overland by dog-team to seek aid, and, finally, carried on a search for the famous Norwegian explorer, Amundsen, who had disappeared in the sea without leaving a trace, somewhere between the coast of Norway and Bear Island.

Northeast Passage in one summer

These and several later expeditions were preludes to the memorable voyage in 1932 of the ice-breaker "Sibiryakov," the first ship to complete the Northeast Passage in a single navigation season. For 400 years scientists and navigators had been trying unsuccessfully to find a short route to India and China through the northern seas. It was not until 1868, that the Swedish explorer, Nordenskiöld, was able to get through this passage at all, after first being compelled, however, to spend a winter near Bering Straits. The only expeditions to make the journey since were those of the Russian Vilkitsky, in 1914-15, who spent one winter in the ice, and of Roald Amundsen (1918-20), who was forced to winter for two years before finally breaking through. The "Sibiryakov" made the passage in two months.

The expedition, under Commander Schmidt, left Archangel July 28. After sailing around the northern shore of Northern Land—the first time that this had ever been accomplished—they encountered heavy ice, sometimes over thirty feet thick. Battling the pack ice, several propeller blades were broken, the engine was put out of commission, and, finally, the propeller shaft broke off, taking with it the propeller. The vessel drifted eastward with the heavy ice floes. When the ice began to thin out, home-made canvas sails were put up, and taking advantage of the favorable winds and the

current which she had now succeeded in reaching, the ice-breaker slowly made her way toward Bering Sea. Sometimes in order to make headway it was found useful to cast anchor in the ice and kedge the vessel forward by means of a winch. At times explosives were used to blow up the largest and most unyielding ice masses. Thus, in one way or another, but through her own efforts, the "Sibiryakov" reached open water in the Bering Sea on October 1. This unprecedented journey demonstrated that with proper technical equipment it would be possible to establish regular commercial navigation through the northern sea passage.

As the efforts of Soviet explorers were now directed toward the opening up of the Northern Sea Route for practical commercial purposes, it was decided to repeat the voyage of the "Sibiryakov" with a commercial vessel. Accordingly, the "Cheliuskin," a specially built 4,000-ton freight steamer, constructed with some ice-breaker features, was dispatched from Leningrad on July 18, 1933. This journey, although ending in the sinking of the vessel, proved to be one of the most noteworthy in the annals of Arctic navigation. The expedition was led by Professor Schmidt, head of the Northern Sea Route Administration. Its 105 members included many of the members of the "Sibiryakov" expedition. There were also on board ten women and two children (one of whom was born as the steamer battled its way through the ice of the Kara Sea), making up the families of a party of scientists who were to replace the group wintering on Wrangel Island. By September they had reached Cape Cheliuskin—about midway along the bleak Arctic coast line and the northernmost point of the continent. Twelve vessels were gathered at the mouth of the Lena River, whereas in the entire previous history of Arctic navigation only nine ships had ever reached that remote port.

A miss as good as a mile

At about 250 miles from Bering Straits heavy pack ice was encountered and progress became painfully slow. After 18 days of alternately buffeting and drifting with the ice the vessel was actually in sight of Bering Straits and open water on November 3. But before the last 15 miles of heavy ice could be

negotiated a fierce gale blew up and swept the ice masses in which the "Cheliuskin" was caught fast far to the northwest. For three months the vessel struggled against the heavy ice fields and on February 13 a wall of ice thirty feet high crashed against her and split her side from bow to stern. In the two hours that it took the ship to sink, provisions, building materials and supplies and the entire party on board—with the exception of one man crushed by a beam—were safely landed.

Then followed the amazing series of rescue expeditions organized by the Soviet government, by air, land and sea. Airplanes were dispatched from all parts of the Arctic; dirigibles were sent by rail and boat as a reserve; dog-team bases were established at the nearest points along the shore with supplies of food. As a final measure the ice-breaker "Krasin" was overhauled at Leningrad and sent on a 12,000-mile voyage through the North Sea, across the Atlantic Ocean, through the Panama Canal and up the west coast of North America to the Bering Sea. By the time the vessel reached the Canal Zone all of the 104 persons on the ice floe had been rescued by seven airplanes, after a series of spectacular flights in which fogs, blizzards and masses of moving ice on the improvised landing-fields and other hazards were successfully overcome. The women and children were taken off the floe on March 5 but it was a month before other planes could arrive at the scene and make their way to the marooned group. The last six persons were carried to the mainland on April 13, exactly two months after the sinking of the vessel.

Victory out of defeat

The "Krasin" arrived in time to transport the rescued members of the expedition from the Chukotsk Peninsula to the steamers which carried them to Vladivostok on their triumphant homeward journey. Then the ice-breaker headed for Wrangel Island to relieve a party which had been operating the least accessible polar station in the world. This group, including a woman explorer, had been on the island for five years, since for that entire period the ice had been too heavy for any vessel to plow through. While waiting to be carried back to civilization the party put their spare time to good advantage, collecting 2,000 fox skins, 600

bear skins and tons of ivory mammoth tusks.

That summer the ice-breaker "Litke" for the first time in history completed the west-bound voyage from Vladivostok to Murmansk in a single navigation season.

The year 1935 marked the turning point from the stage of experimental journeys to that of regular navigation on definite schedules. During that season eighty-five vessels sailed in different parts of the Arctic, carrying cargoes totaling 500,000 tons.

Commerce in the Arctic

The most important commercial voyages are those on the Kara Sea, through which vessels carry freight, principally lumber, from the mouths of the Ob and Yenisei Rivers in north-western Siberia to western Europe. The Kara Sea expeditions started in 1921 and the volume of shipping has grown steadily from five vessels carrying thirteen tons that year to twenty-eight ships carrying 116,000 tons in 1934. In 1935, forty-five vessels participated in the voyage. These expeditions link up the vast expanses of northern Siberia and their great natural resources with the markets of the European part of the U.S.S.R. and of western Europe. The Ob and the Yenisei each extend for a distance of over 2,000 miles from north to south and with their tributaries tap a basin of about 2,000,000 square miles. Until very recently, with the establishment of regular all-year-round air schedules in the northern regions, these great waterways were the only links between the remote Arctic districts and the industrial and trading centers of the U.S.S.R.

The Kara Sea passage has a famous history, dating from the eleventh century, when daring river pirates occasionally ventured on errands of plunder to the mouths of the Ob and Yenisei Rivers. However, as late as the middle of the nineteenth century, the Kara Sea was looked on as an ice-bound prison from which escape was well-nigh impossible. In the thirty years from 1875 to 1905, only seventy-eight freight vessels penetrated into its icy waters. Regular navigation began in 1920 but it was not until ten years later that sufficient knowledge had been accumulated to permit of the publication of the first charts and sailing instructions. The voyages are no longer called

"expeditions" but "operations" which, although of short duration—the Kara Sea is open for navigation not more than 100 days a year—have attained the regularity of normal trading schedules. Besides Soviet steamers, ships from many other European countries now visit the new Siberian ports at the mouths of the Ob and Yenisei Rivers. British vessels accounted for two-thirds of the total tonnage in 1934.

Complete mastery of the Arctic route, from Archangel and Murmansk to Vladivostok, will relieve considerably the burden on the Trans-Siberian Railway and give a great impetus to the fur and fishing industries as well as to agriculture and cattle-breeding in the polar regions.

A leading role in the opening up of the Arctic to navigation has been played by the sturdy ice-breakers, which eat through almost the heaviest ice packs. The Soviet ice-breaker fleet, already the largest in the world, is being augmented by six powerful vessels recently put under construction. Four of these will have steam engines totaling 10,000 H.P. each, the same capacity as the "Krassin." Each will have emplacements for three airplanes and catapults to propel them into the air. Two Diesel-electric ice-breakers will have a capacity of 12,000 h. p. each.

Minerals

The army of scientists operating in the polar regions have proved that the Arctic territory, far from being merely a bleak waste of snow and ice, actually abounds in mineral wealth. A recent map shows the location of 273 deposits of useful minerals already discovered in the polar regions, including coal, peat, asphalt, oil, graphite, asbestos, gold, platinum, copper, lead, tin, nickel, iron and amber.

The expanse of dense taiga (forests) and tundras (marshy plains) along the Pechora River in the extreme northern Urals is becoming an industrialized territory. Several coal mines now supply fuel for vessels sailing on the Northern Sea Route and for Archangel and Murmansk. Oil derricks have been built and a new refinery is producing kerosene and gasoline at this most northerly oil center in the world.

At Igarka, on the Yenisei River, a bustling lumber port and industrial center of 20,000 inhabitants has been created amid forest and

frozen tundra. To build city and port, work was carried on in winter with the temperature sometimes down to 60 below zero. Now there are sawmills producing lumber for the Kara Sea operations, a fish cannery, a graphite plant, radio and meteorological stations, as well as schools and hospitals. The dreaded scurvy, which created havoc among the population several years ago, largely because the vegetables sent from Krasnoyarsk froze on the way and lost their vitamin content, has now been entirely overcome. Vegetables are now grown in hothouses artificially lighted and heated during the long Arctic winter.

A mushroom city

To exploit the famous apatite (phosphate) deposits of the Kola Peninsula, where a few years ago the entire population consisted of a few nomadic Laplanders roaming the snowy wastes with their reindeer, there has grown up the important industrial center of Kirovsk, with 40,000 inhabitants. For a month and a half there is virtually uninterrupted night, for a month and a half unbroken sunshine. The development of the apatite deposits has not only freed the U.S.S.R from dependence on imports but has converted her into an important supplier of phosphate fertilizer for world markets. In connection with the apatite mines and concentration plants, there has been constructed a 60,000-kilowatt hydro-electric station on the Niva River, the most northerly in the world. Thus the Arctic wastes are beginning to be dotted with towns, factories and ports.

The fish catch in the Arctic has increased from less than 1,000 tons in 1932 to over 5,000 tons last year. Canneries operating in the North now turn out about 2,500,000 cans a year. The seal catch is also steadily rising.

To increase and improve the breeds of fur-bearing animals special nurseries have been established. The most important are on the Commander Islands in the Bering Sea and the scores of islands lying in the vast expanse between them and the mainland. On these islands blue and red foxes, beavers, sables, spotted reindeer, are being bred by the scores of thousands.

For the first time in history large-scale farming is being developed in the polar regions. It has been found that the lack of heat

is compensated by the abundance of light. State farms in the Arctic last year cultivated over 6,000 acres of vegetables, including potatoes, carrots, beets, cabbages, onions, kohlrabi, peas, cucumbers and turnips. The anti-scorbutic vitamin "C" is now produced in abundance in the Arctic. Aside from Igarka, hothouse farms have been set up on Dickson Island and at Capes Schmidt and Wellen. Many Soviet scientists are working on the problem of developing northern varieties of plants. Seeds brought from all parts of the globe—from Canada, Alaska and South America—are crossed with the native varieties.

The Kirovsk Polar and Alpine Botanical Gardens, organized in 1932, studies the flora of northern regions. The gardens occupy an area of 3,000 acres, with extensive nurseries and flower beds. So far about 25 types of plants have been found which grow well in the far North, particularly the hardy fruits and berries developed by the famous Michurin.

Farming in the Arctic

The nomad natives of the Arctic—constituting in all twenty-six nationalities—were formerly entirely ignorant of plant culture. For the first time they are now planting fodder grasses and vegetables. This activity supplements deer-breeding, hunting and fishing, tends to adapt them to a more settled existence, and raises their standard of living.

Successful experiments have also been made in the breeding of livestock. Pigs stand the northern climate well, and when they were introduced at Igarka and Anadyr proved quite prolific. At Anadyr the native Eskimos, Chukchi and Kamchadals are beginning to go in for pig-raising and the local cooperative dairy is raising milch cows.

Experiments in cross-breeding the native reindeer have produced a domesticated animal that is in every way superior to the ordinary northern deer. The laboratories of the Lenin-grad Deer Breeding Institute have produced foods to supplement the moss and lichen ordinarily considered adequate for deer, as these have been found to lack certain nutritive elements. Serums to ward off diseases to which these animals are susceptible have also been prepared.

Almost the year round Russian fliers thread

their way to and from all parts of the polar regions. They accompany the Kara Sea expeditions and guide freight vessels on their journeys to the mouth of the Lena River. They participate in trapping and fishing expeditions, locating seal herds and fish schools and guiding the boats through the ice. They assist in geological surveys and mapping operations. They carry mail, freight and passengers on the several air lines that have been organized in the far North in the past few years. About two-score Soviet planes flew a total distance of 875,000 miles in the Arctic regions during 1935—over a dozen times as much as three years before.

New air routes

At present regular airways are already in operation along the valleys of the Ob, Yenisei and Lena Rivers. The 1,250-mile Krasnoyarsk-Dudinka line will shortly operate on a daily schedule throughout the year. Another service will extend from Khabarovsk through Anadyr, Cape Schmidt and across the Chukotsk Sea to Wrangel Island. Planes will make this journey of 2200 miles every ten days and for the first time Wrangel Island will have direct communication with the mainland all year round.

Within the next two or three years it is planned to have a network of mail and passenger airlines tapping the entire Arctic territory. Airplanes will be expected to cover the route from Murmansk and Archangel to Vladivostok, via the Arctic Ocean and the Bering Straits, in sixty hours' flying time.

The opening up of the new air routes in the polar regions was preceded by a series of daring experimental flights over almost unknown territories. The pilot Vodopianov flew from Moscow to Cape Schmidt, at the extreme northeast tip of Siberia, and back—a distance of about 12,500 miles—in 104 hours' flying time. In the last 3000 miles of the flight to Cape Schmidt, the stretch from Khabarovsk, the aviator had to wing his way "blind" through thick fog and mist over the open sea to Okhotsk and over the Anadyr Mountains.

An outstanding flight was made last summer by the pilot Molokov, a hero of the "Cheliuskin" rescues, over northern Siberia and the eastern section of the Arctic. Starting

from Krasnoyarsk, Molokov, using a specially equipped giant plane "U.S.S.R.N-2," flew east to Yakutsk. From there the route lay over the towering Kilima Peaks, never before conquered by plane, then north to the Arctic Ocean. For a month and a half the party of six made studies of the ice and meteorological conditions in the East Siberian and Chukotsk Seas. They then flew north of Wrangel Island to a latitude of 73°, the furthest north ever attained by a plane in that territory. It was here that the mythical Andreyev Land was supposed to lie, but Molokov reported that all that could be seen was a vast smooth expanse of ice. The plane covered a distance of 25,000 miles in 250 flying hours during an expedition lasting eighty-nine days, without a single mishap.

Radio plays a no less important part in the conquest of the Arctic regions, assuring every ship sailing the Northern Sea Route of continuous contact with the mainland. When the "Cheliuskin" sank the radio station was dismantled five minutes before the vessel disappeared in the icy sea. Within twenty-four hours the operator, Krenkel, had brought the Schmidt Camp in touch with the mainland, and the constant communication maintained made possible the subsequent rescues.

The aggregate capacity of radio stations in the Arctic was 20,000 watts in 1934, compared with 3050 in 1932. The schedule calls for putting into operation by the end of 1936 additional wireless stations with a capacity of 35,000 watts. There are now over 100 wireless stations in the Arctic and sub-Arctic territories, whereas in 1917 there were in all four radio stations in the Arctic.

Scientific work

Last year about two-score scientific expeditions were sent to the Arctic. Among the forty-nine special expeditions planned for 1936 will be one to study the White Sea herds of Greenland seals; another will study the sturgeon fisheries at Novaya Zemlya, and another will go to the Yenisei region to help develop the raising of muskrats. Over 400 scientific workers, including 150 geologists, will participate in the various expeditions.

An important and fruitful expedition was that aboard the ice-breaker "Sadko" last sum-

mer. Its fundamental tasks were to explore the course of the warm currents of the Gulf Stream and to make a hydrological study of the lower depths—two miles down—of the polar basin.

The "Sadko" had been raised from the bottom of the sea, where she had rested for seventeen years, in October, 1933. The expedition spent eighty-five days cruising in polar waters and covered a distance of 7500 miles. Half of this lay north of the 80th parallel. The highest point reached was $82^{\circ} 41'$, setting a world record for navigation in northern latitudes. The scientific observations embraced the territory from the shores of Norway across the Barents Sea, the Greenland and Kara Seas and the entire western part of the Arctic Ocean. The "white spot" on the map of the Soviet Arctic between Franz Josef Land and Northern Land—an area of 14,000 square miles, was filled in. Shallow water was found in the center of this area and one large and three small islands discovered near the shores of Northern Land. The expedition collected many thousands of species of flora and fauna, a great number hitherto unknown; made over 5000 chemical analyses of sea water; took 2500 soundings of the sea bottom; drew up ninety weather charts based on its own observations and on meteorological reports received two or three times a day from other stations; studied the ice-drifts, and mapped more precisely the outline of the coast of North Spitsbergen and other little known islands.

Radio-probes

The stratosphere was studied by means of radio-probes, which are automatically recording instruments sent up in little balloons. The readings of the instruments are automatically transmitted by radio. Thirty-three radio-probes were sent aloft, of which twenty-one reached the stratosphere. This instrument, invented by Professor Molchanov, is one of the most valuable devices for investigating the properties of the atmosphere. On occasions they have reached a height of fifteen miles in the Arctic regions and recorded the temperature and air current conditions prevailing. This radio balloon, which as originally designed weighed about three pounds, now weighs less than a pound.

Ushakov discovered a warm water lane 650 feet wide cutting through previously unexplored territory between Franz Josef and Nicholas II Land. The temperature of the water was 30° F. and Ushakov expressed the belief that it was a part of the Gulf Stream. Should this prove true the discovery may lead to findings of incalculable value to navigation in the northern seas.

The recent discovery by the "Malygin" expedition of six hitherto unknown islands in the center of the Kara Sea was received with great interest in view of a theory held by Soviet experts that at one time the entire territory from the Kara Sea north to Franz Josef Land and Northern Land was part of a continent which sank into the sea, leaving only the tops of mountains above water. The four islands discovered by the "Sadko" expedition are believed to be peaks of these submerged mountains.

Arctic museum

To popularize the scientific and economic achievements in the Arctic, there is to be opened this year in Leningrad the first Arctic Museum. Exhibits will show the natural resources of the polar regions, and display interesting relics, including some objects left by the explorer Barents, who spent a winter beyond the Arctic Circle in the year 1596. These were buried under the snow for over three hundred years. Notes written by Roald Amundsen on his expeditions of 1918-19 also constitute a part of the collection. They were found by Soviet explorers wintering near Cape Cheliuskin last year.

Existence in the Arctic settlements is becoming more livable as the amenities of civilization make their appearance. Each winterer is given a monthly medical examination and special diets are prescribed. As a result, only one serious case of scurvy has developed in the past three years. Hospitals give regular ultra-violet ray treatments as a prophylactic during the long winter night.

A few months ago medical science and radio combined in dramatic fashion to handle successfully a most difficult case of childbirth. The physician on Dickson Island received an urgent message one night from the doctor at far-off Cape Desire, on Novaya Zemlya, requesting advice on a confinement case of a

type on which he had had no previous experience. The former, standing at the microphone, gave detailed instructions. Within three hours a radio message of gratitude was received from the happy father. The news spread throughout the Arctic stations and the doctors, radio operators and the mother were showered with messages of congratulations.

Last summer, the Polar Theatre, a troupe of fourteen entertainers, in a tour lasting four and a half months, gave sixty-nine performances. Their itinerary included the decks of vessels in the Kara Sea and at the mouth of the Lena River. Programs ranged from vaudeville to Molière's *Tartuffe*. Costumes and sets were carried in large cases which could be converted into a stage. Some of the performances were given for lumberjacks, hunters and other workers at midnight, without the use of artificial light.

Morale

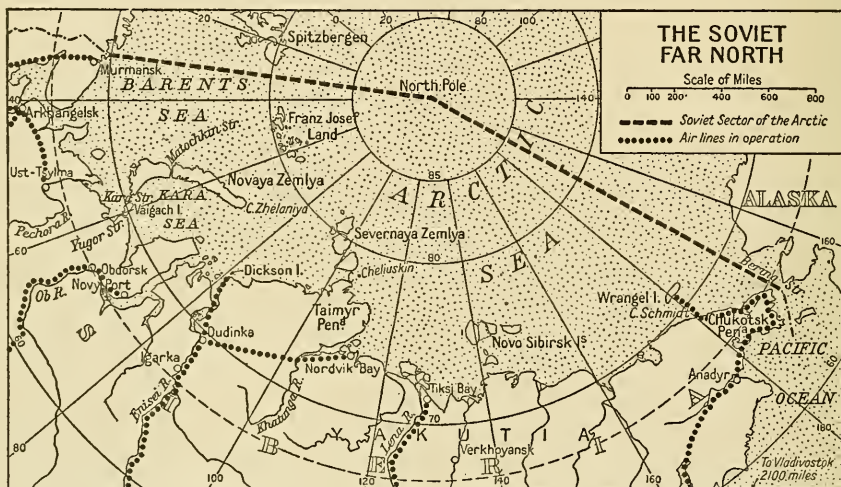
The varied diversions, the spirit of comradeship, and the never-ceasing activity have done away with the dreaded melancholy, once considered an inevitable concomitant of life during the Arctic night. Svetakov, chief of the winter settlement on Dickson Island in 1934-35, in describing how the gloom and terror invariably suggested by the long polar night were dispelled, said: "Our men experienced no emotional pangs. Scientific and social activity absorbed all our energy. If one commenced to brood or pine, the entire group

would endeavor to surround him with attention and care until the mood dissolved. There was little time for loneliness."

Maxim Gorky, in a recent broadcast to 2000 young people who had sent him a collective letter from the Arctic city of Igarka, said: "In the darkness of the polar night the sun of human intellect shines brilliantly." And its light has brought new life to the indigenous peoples of the far North. Doomed to slow extinction from exploitation, vodka and disease, the principal contributions once brought to them by civilization, they have now taken on a new lease of life. Where the population was formerly 100 per cent illiterate, there are now scores of schools, attended by thousands of children. Where the art of healing was the exclusive prerogative of native shamans, there have been established hospitals and medical stations. A few years ago tribes were discovered in the taiga so primitive that they did not know the principle of the wheel. Now the various northern nationalities send their promising young people to study at the Institute of Peoples of the North in Leningrad.

The Arctic yields

In ten years a wilderness inhabited by primitive tribes has been explored and made useful. Where only a few explorers previously ventured, a wave of civilizing influences has created the habitable and productive white continent of the Soviets.



Courtesy of "Foreign Affairs"

The U.S.S.R. in the Arctic

(Below) A pioneer in Arctic commerce: the steamer "Anadyr," one of the four freight ships which in 1935 linked the Atlantic and Pacific Oceans by voyages across the Arctic. All four

ships carried large cargoes of supplies for the extreme North. The voyages culminated years of struggle to open up the Northeast Passage for commercial navigation



All Photos by Sovfoto

Four powerful ice-breakers were stationed in the most difficult sections to convoy the freighters through heavy ice. The vessel at the extreme right is the famous ice-breaker "Krassin"; next to her is the steamer "Tovarish Stalin," on board which is the Lena-Khatang expedition, whose mission was to found a settlement at the mouth of the Lena





Provisioning the "Sibiryakov" for her memorable voyage in 1932: taking on bullocks which provided meat during the first Northeast Passage to be made in a single navigation season

On board the "Sibiryakov." Professor Schmidt, commander of the expedition, Captain Voronin, Professor Wiese, and T. Azaev discussing plans. After numerous difficulties the "Sibiryakov" reached open water in Bering Sea on October 1





Radio plays a big part in the Soviet program in the Arctic. The above is a picture of the station at the mouth of the Lena River, at 72 degrees north latitude. The operators maintain contact with the nearest cities and with other parties and expeditions wintering in the Arctic, greatly increasing the safety of their exploratory activities



A scene along the route of the "Sibiryakov's" 1932 voyage: crews going ahead to dynamite unyielding masses of ice



Tapping the resources of the Arctic: a Soviet trawler hauling his net on board. The fish catch in the Arctic has increased from less than 1000 tons in 1932 to over 5000 tons last year. Canneries operating in the north turn out about 2,500,000 cans a year

A catch of seals on the ice-breaker "Sibiryakov." These are the skins, the fat having been removed and placed in special containers. One of the forty-nine special expeditions planned for 1936 will study the White Sea herds of Greenland seals



(Right) Exploiting the rich apatite deposits on the Kola Peninsula, which have made the U.S.S.R. an important supplier of phosphate fertilizer. Where a few years ago only a few nomadic Laplanders roamed the snowy wastes, there has grown up the important industrial center of Kirovsk, with 40,000 inhabitants.



(Above) An unusual application of serotherapy: a veterinary inoculating an ill reindeer



The first wooden house built at the strategic settlement of Ust-Lena ("Mouth of the Lena"): a bakeshop constructed of driftwood



Meteorological work being carried on aboard the ice-breaker "Krassin" in the Kara Sea. A so-called radio-probe recently invented by Professor Molchanov facilitates study of the stratosphere by automatically transmitting the readings from instruments that are sent up in small balloons





(Above) A scene in a dwelling house in the new settlement at the mouth of the Lena

(Below) A hasty unloading at Tixie Bay, at the mouth of the Lena River. As soon as the Lena-Khatang expedition disembarked, the steamers hurried back to Archangel





(Above) A result of recent scientific exploration: a four-year-old city of 40,000 inhabitants, Kirovsk, north of the Arctic Circle on the Kola Peninsula. The discovery of rich apatite deposits gave rise to this city. New apartment houses are replacing the wooden houses shown in this picture. The 60,000-kilowatt hydro-electric station on the

Niva River is the most northerly in the world

(Below) The talking cinema theater at Kirovsk: a reinforced concrete building accommodating an audience of 1200. The city also has hospitals, modern schools and clubs, and is becoming a popular tourist resort for Russians



8000 Miles of Northern Wilderness

An exciting expedition to the Barren Lands, the Arctic coast, and up the swift Nahanni River, which brought back new knowledge of the great animals of the Northwest

By GEORGE G. GOODWIN

Assistant Curator of Mammals

From the diary of

HARRY SNYDER

THE Harry Snyder 1935 Barren Lands Expedition covered considerably more territory and took us much farther north than the Snyder-Canadian Expedition of the previous year. Like the latter trip it was made possible through the generosity of Mr. Harry Snyder; and much of this narrative is derived from his diary. He not only carefully planned but also led the expedition over 8000 miles of northern wilderness.

Although the first objective of this expedition lay in a region which Mr. Snyder and I have already described in a recent issue of *NATURAL HISTORY*¹, namely wood buffalo country, an experience which occurred there deserves to be mentioned in brief.

Mr. Snyder was to meet me later at the Slave River when I left Cooking Lake, Edmonton, on July 17, 1935, in a Fokker monoplane. Dense threatening clouds, pelting rain, and flashes of lightning with deafening peals of thunder marked our exit from the civilized world.

Flying in a storm has its own thrills. The wind whistled as the plane, straining at the struts, labored northward over the billowing clouds. I was later to learn that the storm beneath us washed out many miles of railroad, flooded considerable territory, and demolished many villages.

First stop

At 4:00 p.m. we landed at Pine Lake. The following day, accompanied by Mike Dempsey, the head forest ranger, I trailed through the forest north of Pine Lake with the purpose of getting motion pictures of the wood buffalo.

Rain fell steadily all day, until about 7:00 p.m., when I located a herd of buffalo in a grove of jack pine and spruce trees. The next morning I left camp at 2:00 a.m., intent on stealing among the buffalo under cover of darkness. Before daybreak I was safely settled in a blind. Occasional grunts from several directions indicated that luck was with me; the animals had not moved away. The long wait until sun-up was a trying period, for mosquitoes swarmed in countless numbers.

I got the first pictures about 7 o'clock. The herd of about thirty animals, mostly bulls, milled restlessly around my hiding place. The hum of the movie camera did not seem to disturb them and through the branches I got some excellent shots; but the first click of my Graflex caused a general drifting away. As the morning advanced their distrust increased, and by 10 o'clock the last of them had disappeared.

Action

I waited until the third day before they returned. This time I was in for some excitement. The herd milled around, rolling in the wallow and rubbing on the trees to rid themselves of insect pests. I patiently waited to photograph a certain big bull. Slipping from tree to tree I approached him cautiously. At the first whirl of my camera at close range he wheeled about, faced me and stood motionless. Placing myself against a tree to steady my palpitating heart and shaking knees I continued to run off film. Then suddenly, from directly behind me, came a burst of compressed air, like the escaping steam of a locomotive, warning me of unsuspected danger. I turned my head very slowly and saw, to my amazement, a curly head and massive horns smeared with blood. A gigantic bull was not more than twenty-five feet away.

The silence that followed was intense. The

¹ "Buffalo Hunt—1935," by Harry Snyder and George G. Goodwin, *NATURAL HISTORY*, September, 1935.

bull was holding his breath and I remember distinctly that his big dark eyes appeared to be of a deep royal purple. No white showed at the corners, marking him for a genuine wood buffalo. His shoulders scraped the branch of a tree, which later proved to be seven feet from the ground. After a seemingly endless wait he emptied his lungs with a sudden spurt and charged. His huge form lunged forward at an amazing speed. I actually felt a rush of hot air as he hurled himself past me at the other bull. Then, to my relief, both animals passed into the timber and out of sight. Apparently he disdained to bother with anything so insignificant as a mere man when an opponent more worthy of his stupendous strength was at hand.

I had secured a thousand feet of buffalo pictures in the timber and many still photographs. On the salt plains and on the way back to camp I photographed some other animals, including a solitary old bull at twenty feet and a splendid specimen swimming across Pine Lake, with his tail arched clear of the water and his snout, horns, and shoulders just above the surface.

We had to hurry to meet Mr. Snyder at the Slave River. We had thirty-six hours in which to cover a distance of forty miles of forest and swampy muskeg. Breaking camp at six in the morning we found the black flies, bull-dog flies and mosquitoes more annoying as we approached the lower country. We arrived at the Slave River as the sun came up the following day, having halted only once to water and feed the horses. Then we learned that our forced march had been unnecessary. Mr. Snyder did not arrive until evening. He and his pilot, Stan Mac-Millan, had been forced down twice by storms in their giant Bellanca, and had passed the night at Lac la Biche. Accompanying Mr. Snyder were Col. Steel, government representative, and Jim Ross, outfitter, from Hudson Hope.

To study musk oxen

Our main objective in the Barren Grounds was to secure pictures and make a survey of the musk oxen in the Sanctuary, together with proper recommendations as to the present and future boundaries of the Sanctuary. Leaving a storm behind us we flew eastward over the many islands and intricate bays of Great Slave Lake and landed at Snowdrift where our

guide, a Chippeweyan Indian, was to meet us. He was not there. We learned that he and his family were encamped at Lost Channel some seventy miles away. So we flew over there and anchored in the bay. The guide made a spectacular picture standing in the bow of his galley while his eight braves, with long swinging strokes of their paddles, brought him out. After an extensive argument we persuaded him to come with us.

Into the barren grounds

From Fort Reliance, where an ample supply of gas had been shipped in by boat the year before, we followed the Lockhart River and the north shore of Artillery Lake, Ptarmigan Lake, and Caribou Narrows to the great waters of Clinton Colden. As our plane landed in a sheltered cove, two bull caribou left the rocky beach for the mossy hillside and stood silhouetted against the sky. Here we had the most comfortable and pleasant camp of the entire trip. The air was clear and crisp, and no insect pests bothered us.

Our guide, big chief of his clan, proved to be an interesting character. His name, Catholique, has no religious significance but means "rabbit blood." He showed unusual ability in recognizing land marks from the air. When Stan delivered him back to his own village he stated, "I go into flying canoe; I help load with gas, grub, and tents. We fly over the mountains; we fly over lakes; I help carry gas, grub, and tents out of flying canoe—still I don't believe it."

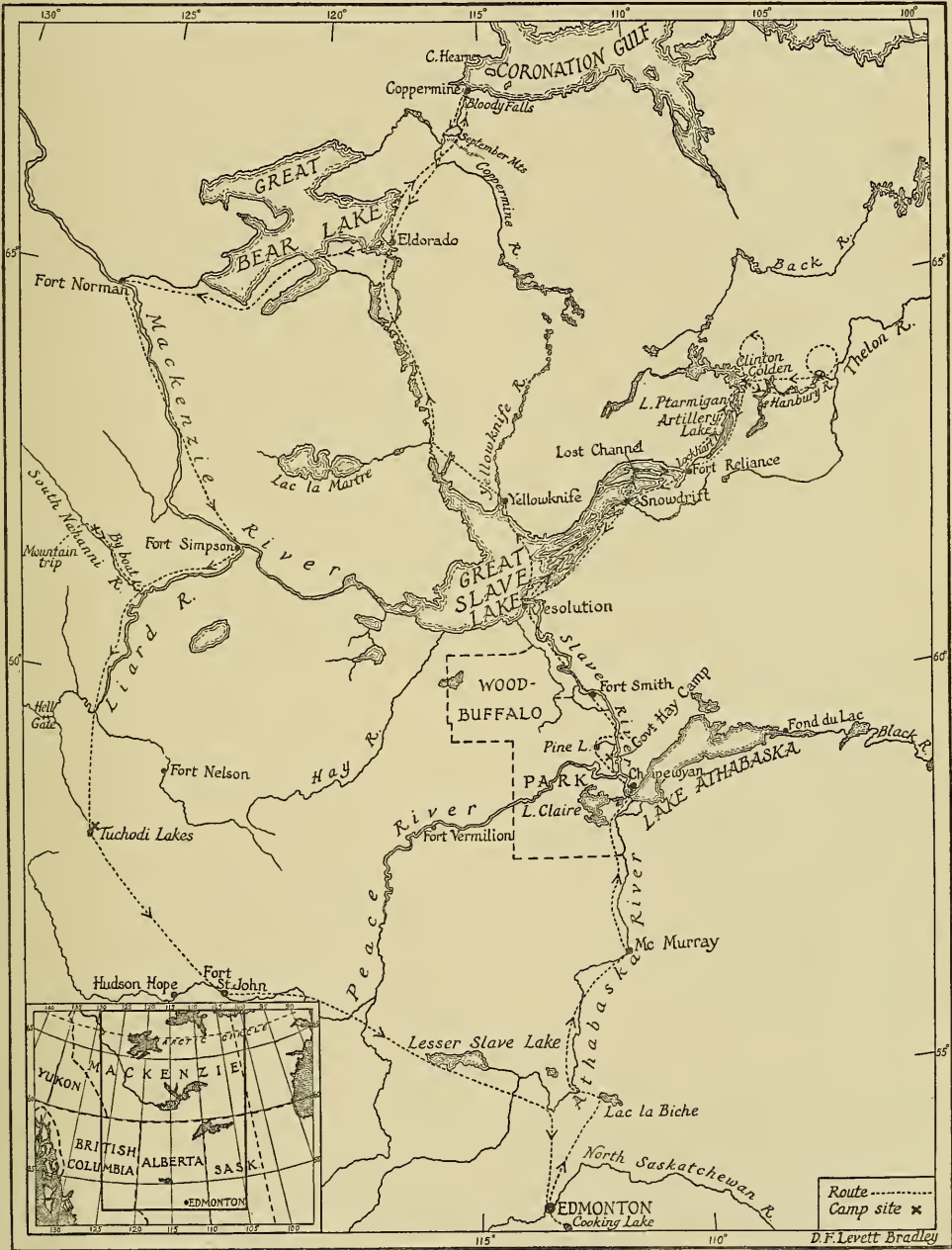
We scouted from the air for signs of musk oxen. Flying over the area north and east of Clinton Colden towards the Black River we were amazed at the extent of bare granite landscape. A few miles south of this area, along the northern boundary of the Thelon Game Sanctuary, the ground was covered with lichens and the edges of some of the lakes with small willows. Not sighting any musk oxen here we continued eastward past Sifton Lake.

It was on the banks of the Hanbury River, near its confluence with the Thelon, that we saw the first musk oxen, a band of about twenty. We could not land in this vicinity, but a small lake farther on proved suitable and we descended to an excellent shelter in a cove surrounded by steep banks.

After the failure of a laborious attempt to

approach a second group of animals that we had also sighted from the air, and traveling on foot distances which seemed many times longer than they had from the sky, we spied, later in the day, a lone bull musk ox on a narrow neck of land between two lakes. By crossing two swamps infested with black flies

and fording a river which we never suspected was there, we approached under cover to within 150 feet of the animal. He was lying with his back towards us. Our guide skirted the lake and came out twenty-five feet from him. The creature jumped up, raked the sand with its horns and charged. The Indian, a few



The Route of the Harry Snyder 1935 Barren Lands Expedition

feet ahead of him, leaped over the bank and went headlong down to the lake.

The bull, now fully roused, frequently rubbed his nose on the glands inside his fore legs. I approached cautiously to get some close-up pictures, followed by Colonel Steel with a rifle at his shoulder. The bull made several short rushes toward us but could not quite make up his mind to come all the way. When we were getting so near that retreat would not be possible I asked if he was quite ready with the rifle. He replied, "How the blazes do you take the safety catch off?" It did not take me long to get away to a safe distance.

Back at camp the mosquitoes and black flies were very thick. Realizing the hopelessness of trying to locate animals on foot, we piled into the plane and scouted along the Thelon River and surrounding lakes. Just east of Grassy Island we located a large herd of musk oxen, bulls, cows, and calves. And on the way to the nearest lake we saw another fair-sized herd in a grove. But when we taxied across and landed, the latter herd had completely disappeared. There were no flies, so we did not mind the long trek back to the first band. The musk oxen were still feeding by the lake, and we were able to approach reasonably close. But the dense growth of willows and the necessity of sighting into the sun made photographing difficult.

One old bull musk ox waded out into the lake and swam across. As his heavy coat of long hair gradually became saturated with water, he sank lower and lower. When he approached the opposite shore only his nose and the crown of his head remained exposed. The rest of the herd, sighting us, gathered in a defensive ring formation—this is called "defense carrière"—and then stampeded past us and over the top of the hill. Another herd about three miles away caught our scent and dashed off after the first one.

Plane endangered

Trailing over the last ridge on our return trip, we were amazed to see that both herds had congregated on the beach by the plane. What disturbed us was that the plane, our only communication with the outside world, seemed to be in danger from their rampages, and they could get away without retreating some dis-

tance towards us. We hurriedly closed in on them. They galloped back and forth and, finding themselves cornered, plunged into the lake and swam across. One old bull got so waterlogged that he barely made the opposite shore. Two others preferred to take the long trek around the lake.

From our observations, I am inclined to believe that the musk ox is as strong and rapid a swimmer as the buffalo. We counted a total of 171 animals in one tenth of the musk oxen range and concluded that there are approximately eight hundred musk oxen in the entire Sanctuary. Well satisfied with the day's pictures we circled wide towards the north on our flight back to camp. Smoke seen in the distance was explained by Catholique as a signal sent by the Eskimos, but flying directly over it we could see no one. The fire had burned over quite an area but was dying out. Smoke that was seen the previous day had been answered by Catholique, when he and Jim were on the ridge back of our camp. They were definitely answered in smoke signal language, which conclusively proved at that time the presence of the Eskimos.

Back at Clinton Colden the next day our base camp was a welcome sight. Plenty of supplies; and the greatest boon of all, we were free from the host of insect pests.

Treacherous weather

The following day I was to get photographs of the caribou on the shore of Clinton Colden, while Mr. Snyder was to take the plane and scout along the north shore. The morning broke clear and the lake was like a big sheet of glass. We saw three large lake trout tearing chunks from the meat we had put in the lake to keep fresh. Everything looked favorable for a good day. Mr. Snyder called attention to the falling barometer, the pilot climbed a nearby hill for a lookout, and came down in a hurry saying that we had to leave within twenty minutes. In ten minutes the barometer dropped ten points. Suddenly the wind sprang up and before we had half loaded the plane the sun was blotted out by threatening banks of clouds bearing down from the east. A considerable swell rose on the lake, and when we took off we bumped along the tops of the waves before finally rising.

Visibility became poor as the storm closed in on all sides. Tracing the outline of Artillery Lake we raced at less than a thousand feet expecting every minute to make a forced landing. But beyond Lockhart River the weather cleared and we alighted at Fort Reliance beneath a cloudless sky. The following day, however, bad weather again beset us, and the necessity of landing at Resolution on the breakers of Great Slave Lake made a serious problem. After bounding from wave to wave, however, our pilot skillfully eased us into calmer water behind the breakwater. That night the storm increased. Part of the dock was washed away, boats broke their cables, and, to our dismay, the next morning the plane was gone. Both anchor cables had parted. We saw its green and gold outline upon the beach across the bay. Fortunately, the French Padre at the Mission woke us up at daylight and Harry, Stan, and Jim got over to the bay before the plane drifted in and were able to anchor it before any serious damage was done. That storm delayed us three days. It was here at Resolution that Dorothy Snyder and Sam Sackett joined us.

To the Arctic coast

On our trip to Coronation Gulf on the Arctic shore for pictures we followed the course of the Yellowknife River to Great Bear Lake where we spent a week as the guests of Mr. Gilbert LaBine of the great radium mine known as Eldorado. From there we flew across the eastern end of Great Bear Lake, over the September Mountains to the Coppermine River and on to Coronation Gulf. On the road we dodged five snow squalls. A most interesting day was passed at Fort Hearne where Mr. Snyder secured a specimen of Barren Land grizzly killed by the Eskimos last spring at Bloody Falls on the Coppermine. Our next objective was the Nahanni River country, where we hoped to secure specimens of white sheep with black tails.

The Nahanni River flows southeastward through wild country into the Liard which joins the MacKenzie. It is a most beautiful, but extremely turbulent mountain river, with an average fall of eight feet to the mile. In places its current reaches fifteen miles an hour. The average width of the river is about two hundred yards, and its valley is for the most

part narrow and passes through a tremendously rugged chain of mountains. In places the valley widens out and shows considerable forested alluvial land. The landscape is a jumble of rough mountains, irregular steep ridges, hills, valleys and ravines.

On arriving at the mouth of the Nahanni we learned that the boat, which had been constructed last year for the express purpose of making this trip, had been wrecked on a trial run. It was a 40-foot craft, carrying two 50-horsepower engines. A snag had been driven clear through the bottom and deck of the boat. Thus the swift Nahanni retains its evil reputation. We had to rent two 28-foot pointer scows from local trappers and prospectors and search for outboard motors downstream as far as Fort Simpson and up and down the Liard. Finally we secured them and started up the Nahanni.

The 140-mile river trip was most interesting. The first fourteen miles above the junction with the Liard was pleasant, the river being wide and deep with only a four-mile current. At dusk we encountered a bad riffle. Mr. Snyder's boat got over all right; but when mine was nearly through it broke a drive pin and we shot back half a mile before we could regain control.

Snags

We had not gone far the second day when we had to line the boats along the shore. Then we arrived at the first "splits." These places, where the river divides into many channels, are characterized by extremely rapid and shallow water. Hundreds of snags and sweepers always harass the traveler just above and below the steepest parts of these rapids. In some places the snags pointed upstream, an entirely new experience to us. Travel was dangerous and most arduous. In some places the water was so swift that lining again had to be resorted to. The "splits" continued for forty miles.

The river wound back and forth across a wide valley, between rugged mountains, and finally carried us toward an isolated group known locally as the Buffalo Mountains. These mountains derive their name from the fact that a small vagrant band of from twenty to thirty buffaloes dwell there, probably having strayed from the Sanctuary.

Just above the Buffalo Mountains we reached the first canyon and the so-called "tropical valley," which in reality is a series of five hot sulphur springs just under the escarpment of the first canyon. This first canyon is a spectacle of indescribable beauty and grandeur.

There were many signs of game, but we were after a particular animal; and from two local prospectors whom we met just below the first canyon, we gleaned an encouraging piece of evidence. The prospectors, George Buda and Joe Clark, from Muncho Lake, B. C., had been up the Flat River and were bringing out some coarse gold. What caught our eye was the pelt of a sheep which they had secured in the canyon. Its well defined black-tipped tail aroused our hopes to a high degree.

Fire

Our navigation problems continued. The gas tank on Harry's boat leaked continually and eventually caught fire. He had thirty gallons of gasoline in his boat, certainly not a comfortable situation in a very rapid river. Near the top of one especially swift riffle between high cliffs, our boat broke a drive pin and we headed straight for a smash against the cliff. Our paddles were shattered when we tried to break the impact against the cliff and the guide's pole shot out of his hands and drifted away. Then with a thud we hit a partially submerged rock and were wedged in with the water pouring over the side. It seemed that at any moment the boat must be sucked under. But she swung around presently and grated along the side of the cliff. Then we headed straight toward a rock in midstream. We hit it, but fortunately broke clear and slipped downstream still afloat. The Indians took the whole incident as a matter of course, but I still believe that we just escaped by the skin of our teeth.

The going continued to be rough right on to Deadman's Valley, which is so named because of the many lives that have been lost there. To us it brought a welcome relief because we could jog along with relative ease. The Gates came as a complete surprise, sheer walls rising 2500 feet on one side and 1500 feet on the other from the water's edge, where the river appears to have cut its channel right through a mountain. Base camp was just beyond the

Gates. Two Indians whom we had sent ahead to establish camp assured us that they had seen quite a number of sheep ten miles beyond.

The following day we proceeded to the mouth of Mary River and then inland some six miles on foot, carrying our equipment on pack dogs. Some 3500 to 5000 feet above the river we found the sheep, in the Alpine meadows and on the shale ridges. With Dorothy Snyder on one side of me and Mr. Snyder on the other we came suddenly into full view of the specimens we so much desired, only two hundred yards away. I was able to get some pictures before the animals started to move. Dorothy brought down a big ram to the left and Harry shot another large one on the right. Dorothy, who had started out with only three shells in her rifle, picked out the next two large rams and without missing a shot completed our group of white sheep. The animals were in excellent condition and had, in greater or lesser degree, black tails.

A cold wind brought a chilly rain, and leaving our specimens temporarily we had to retrace our steps for two hours to where we could find timber to stretch a fly and make shelter for the night. Supper that night consisted of roast sheep, which tasted good; but none of us slept much in the cold.

The next morning Jim Ross and I returned to complete the preparation of the specimens. The task of carrying back the heads and hides was extremely arduous, and the distance which we had expected to cover in two hours took us all day. We were all glad to get back to our base camp at the Gates.

The return in the boats to the forks of the Nahanni and Liard was comparatively easy; whereas we had taken five days in the ascent, we shot back down in half a day. The gas tank of our motor still leaked, and with the last spurt of the motor we just made camp.

A mountain paradise

The next day about noon we took off for northern British Columbia to search for stone sheep and the new found elk which Mr. Snyder had located the previous year in this area. At Nelson Forks, clouds hanging over the mountain peaks halted us for a day. Then climbing to about 7000 feet we crossed the range and dropped down to the Tuchodi

Lakes. Tuchodi in Slave Indian means "rough waters." These lakes occupy a beautiful valley extending in a narrow curve for about thirty miles. They range from half a mile to a mile in width and from about seven to ten miles in length. With the exception of the second lake the waters are deep blue and are very deep, but the upper third of the second lake is discolored by glacial silt. The rugged scenery compares favorably with that of Jasper Park or Lake Louise.

A pack outfit met us here, having come 460 miles from Hudson Hope. It was in the high alpine basins or eight miles back from the lake that we pursued our search for stone sheep. After seeing a few animals here and there and getting some good pictures of them we were amazed upon peering over the ridge to see forty-one rams on a ledge at the foot of a high cliff. With the exception of one or two saddlebacks they were all dark blue stone sheep. Three rams were selected for specimens. Dorothy brought one down with a single shot, a splendid example with wide, spreading horns. Mr. Snyder and Mr. Sackett got the other two, both beautiful sheep with massive heads. These alpine basins offer ample conditions for stone sheep, with splendid feed and cover. We saw no signs of wolves here, and there were apparently few bear.

After a day in camp we started across the mountains for the Prairie River country in quest of elk where we had seen them last year. Though the elk were more wary than we had anticipated, indicating that they had been frequently shot at in spite of the restrictions, we were able to make a fair selection and secure our series.

Joe, one of our Indian guides, felt much put out when he had to spend a whole day with me simply getting pictures. Without a gun, the day was apparently spoiled for him; but I secured some excellent pictures of caribou near a salt lake.

Mysterious theft

Back at the camp at Tuchodi Lakes we were mystified by the disappearance of our cache of sheep meat, which had been strung on a rope between two trees some fifteen feet from the ground and covered with a tarpaulin. The rope was broken, all the meat was gone, and the

tarpaulin showed claw holes. Our Indians could make nothing of it. Both trees were innocent of any claw marks and to add to the mystery a pile of meat scraps on the ground nearby had not been touched.

Then about 2:00 a.m. the following night I was aroused by the snapping of a branch a few feet back of my tent, and hurrying outside made out the figure of a bear moving between the trees. The Indian advised me against shooting at such close range in the dark. The following day the mystery of the disappearing meat was completely solved. A black bear ambled up to inspect our camp and betrayed his guilt by looking up to see if there were any more hams hanging between the two trees.

While some of us remained in camp to prepare our trophies, Dorothy was in the mountains above the second of the Tuchodi Lakes photographing stone sheep and Rocky Mountain goat on the same hillside only a hundred or so yards apart.

Elk, caribou, moose, and stone sheep find a natural home about the headwaters of the Prairie and Henry Rivers, and in the region of the Tuchodi Lakes. The sheep are extremely numerous, and have ample feed. There are a few goats in the same area, some caribou, moose and grizzly. Three grizzlies were observed but none procured.

A quick get-away

When the planes for our return trip were two days overdue, delayed by clouds enveloping the mountain peaks surrounding the lake, a clear day brought them swooping down to our camp. We were so anxious to get out before the clouds closed in again, that we loaded up the two Fairchilds and were on our way within an hour. The heavily loaded planes labored over one-half the length of the lake before they could rise. Skimming then over the tree tops we climbed out of the narrow valley in three or four circles. Beyond the high mountain peaks we headed for Fort St. John, and from there followed the Peace River and the shores of Lesser Slave Lake, back to Edmonton.

Our program had covered a vast territory and many objectives, and it was due entirely to Mr. Snyder's keen interest and unfailing persistence in spite of frequent set-backs that each project was carried through successfully.

8000 Miles of Northern Wilderness



Pine Lake, in the Canadian Wood Buffalo Park: the first objective of the Harry Snyder 1935 Barren Lands Expedition, which had for its purpose a study of the great animals of the Canadian subarctic



A photograph of a small and diminishing race of animals: wood buffalo in the sanctuary which has been established for their protection



(Above) Glimpses of unsuspecting wood buffalo in the jack pine and spruce forest of their range. At this season the buffalo rub against

the trees to rid themselves of insect pests (Below) An old grandfather of the herd: a formidable subject for the animal photographer





Flying northeastward over Great Slave Lake: a photograph from the plane en-route to the country of the musk oxen



Mr. Snyder, the leader of the expedition, with members of the party and local settlers



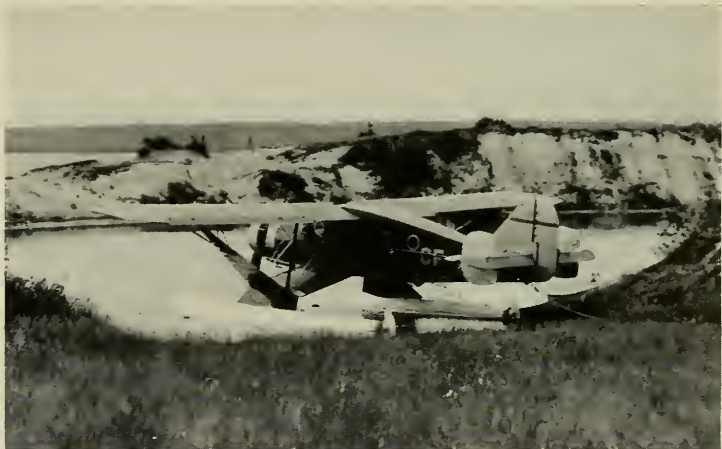
(Left) Looking west from the eastern end of Great Slave Lake

*A solitary old bull musk
ox in the Thelon Game
Sanctuary*



*(Above) On the border of
musk ox country: the expe-
dition's camp and plane at
Clinton Golden*

*(Right) A landing near the
confluence of the Hanbury
and Thelon Rivers, where
the party sighted their first
musk oxen from the air*



(Right) The wild Nahanni, a beautiful but turbulent mountain river which the expedition ascended in quest of a variety of white sheep with black tails



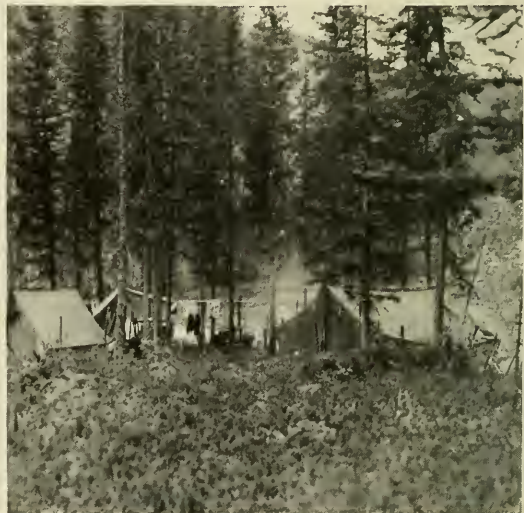
(Below) Pack dogs used by the expedition contentedly riding the swift water of the Nahanni



(Below) On the banks of the Nahanni River, with a specimen of black bear just secured



(Below) Camp at the Gates of the Nahanni in a forested valley





(Left) The scenic Gates of the Nahanni, sheer walls rising to great heights from the water's edge, where the river appears to have cut its channel right through a mountain



(Below) The boat designed for the trip was wrecked on a trial run, and two 28-foot scows of the type shown here were used

(Below) Tuchodi Lake, in northern British Columbia, a region of rugged beauty



(Below) Preparing the stone sheep trophies and smoking the meat





A denizen of the alpine meadows of northern British Columbia: a yearling ram stone sheep



(Above) Harry Snyder, leader of the expedition, and Dorothy Snyder, his daughter, who brought down some of the finest trophies

(Right) The expedition in elk country: along the Henry River, British Columbia



INDIAN TYPES

by

Maaron Glemby



*"Dancing Boy," son of famous
dancer "Turtle." A Black Foot
Indian*



*"Short Face," of the
Black Foot Reservation,
Montana*

*"Weasel Tail," a Blood
Indian warrior of Al-
berta, Canada, in his late
seventies*





*"Bird Rattle," of Blood Indian
Reservation, Alberta, Canada*



"Body," another Blood Indian

*"White Man," a Blood Indian
wearing a necklace of deer or
antelope ankle bones*



*"Tall Man," of Blood Indian
Reservation, Alberta, Canada*





"Laura Buffalo-Boy," Sioux Indian girl of Standing Rock Reservation, North Dakota

"Agnes No-Heart," Sioux girl, wearing shell garment handed down for several generations



"AGNES NO-HEART"



MARY YELLOW LODGE



MRS. PERCY CREIGHTON

*"Mary Yellow Lodge,"
Sioux Indian girl, wearing
neckpiece of beads and bones
of waterfowl*

*"Mrs. Percy Creighton," of
Blood Indian Reservation,
Alberta, Canada*

How Insects Protect Their Eggs

Strange ways in which insects provide for the care and feeding of offspring they will never see

By C. H. CURRAN

*Associate Curator, Department
of Entomology*

THROUGHOUT all the stages of their existence insects are particularly subject to attack by enemies, and relatively few of them survive to a ripe old age. In order that they may survive they have undergone many modifications in habits and structure and some of them have developed what are undoubtedly the most marvelous adaptations to be found anywhere in the animal kingdom.

No end of marvels

The discovery of some unusual trait in any of the vertebrate animals almost invariably results in much discussion and expression of amazement—but not so with the insects. The whole insect kingdom is so filled with startling and inexplicable habits that the entomologist no longer is amazed but accepts new discoveries in a most casual way, even though the newly observed practice may be so astounding as to be scarcely believable.

The dangers to which an insect egg is exposed from the moment it is laid include not only animal and plant enemies, but also frost, heat, moisture, dryness. When all the manifold hazards are considered we must marvel that these creatures are able to survive.

There are many things about the ways of insects that we do not understand. It has been customary in place of complete explanations to refer their remarkable habits to instinct. While this may be the only word that can be applied, it does not tell us how these habits originated. Few if any insects show any evidence of reasoning, yet there is undoubtedly reason behind the development of many of the things that they do, and man has never equalled them in some of their accomplishments.

As an example we might consider one of the ichneumon flies that is parasitic on the European corn borer, a pest that has become very common in the United States since its introduction a dozen years ago. The ichneumons are classed with the bees, ants and wasps but are very different in both habits and appearance. They are almost all long, slender insects, and the female is provided with an ovipositor that varies in length according to the habits of the adult in laying eggs. The ovipositor is composed of three rigid, hair-like appendages which are used for drilling and which form a tube through which the egg passes. The particular species that is parasitic on the corn borer is able to determine the location of the borer within the corn stalk, insert its ovipositor into the caterpillar and lay an egg. Man, up to now, has not devised a method by which the larva can be located. It is all the more remarkable in view of the fact that insects are not considered to be intelligent creatures. We know that these ichneumons do this but we do not know why, nor how the practice developed.

Eggs are hidden

Concealment is the most generally practised of all methods of protecting not only eggs, but also the young of animals. Almost all land animals conceal their young and primitive man was no exception. Just as the tiger, the deer, the birds and other creatures seek a hiding place in which to harbor the young until they are able to fend for themselves, so do insects hide their eggs. There is a difference, of course, because the larger land animals are able to protect their young while most of the insects cease to have interest in their offspring as soon as the eggs are laid. This does not apply to social insects, that actually feed the young and care for them, if not with tenderness at

least with a devotion to duty that might well shame some of us intelligent moderns.

The method of concealing eggs may be of a most primitive nature, consisting merely of placing the eggs in some crevice in bark or under leaves, or it may be extremely complicated. Many insects lay their eggs within leaves or under the epidermis of the stems of leaves or green twigs. Most of the saw flies are equipped with a saw-like ovipositor with which they are able to cut the surface of a leaf and insert an egg beneath the epidermis. The young of these are leaf miners, living within the leaf until they are ready to pupate. Many other insects deposit their eggs in the twigs of plants and thus secure excellent protection for them.

Protection against other insects

The advantage in such a method is the defense against other insects that might parasitize the eggs; and thousands of different kinds of insects have developed it. The young of very many of the insects that lay eggs in twigs, upon hatching out, feed outside the wood.

Still more protection is secured when the eggs are deposited well beneath the bark, particularly if the young feed in such places. The horntail, an insect injurious to trees, lays its eggs in the solid wood, having an ovipositor that enables it to pierce the bark. The act of oviposition by this insect is not always without danger to the mother. It often happens that she is unable to withdraw the ovipositor with the result that she dies, her carcass hanging rigidly on the side of a tree to attract the attention of passers-by. Whether these dead horntails are martyrs to an overzealous desire to deposit their eggs deeply or not is a question that is open to some doubt. It is altogether possible that they have already laid many eggs and that death resulted from natural causes due to the wearing out of the organism.

The habit of protecting the egg by injuring the plant on which it is laid in order to prevent the growing plant from crushing the egg is not uncommon. A good many of the long-horn beetles that oviposit in wood make an incomplete circle or arc a short distance from the egg, thus preventing growth until the hatching period has passed.

The long-horn beetles known as twig gir-

dlers lay their eggs inside the tender shoots of blackberry and other plants and girdle the twig both above and below the point of oviposition. The girdle is not complete, consisting of a series of round areas that the beetle chews out, but it is quite sufficient to cause the shoot to die above the lower "girdle." When the egg hatches the young larva bores downward into the pith of the living cane, while the dead tip usually breaks off and falls to the ground. In this instance there is a distinct lack of intelligence, because a single "girdle" beneath the egg would be quite sufficient to halt growth. There is a possibility that some of the eggs do not survive either because the lower girdle does not always do its work or the end of the twig breaks off before the egg hatches, leaving the larva no opportunity to bore downward to the healthy cane.

The plum curculio, an insect that feeds and lays eggs in a number of different fruits, but more particularly in apple, peach and plum, always leaves a telltale mark behind. After laying the egg a half circle is eaten out and as the fruit grows this takes on a lunate appearance. This protection is not always sufficient in the rapidly growing fruits and a very large percentage of the eggs die. Anyone familiar with the work of this beetle can always identify the injury and can determine between the feeding and ovipositional punctures.

Most nuts are attacked by some insect. Sometimes it is only the husk that is affected, but some of the weevils attack the kernel. In order to lay its egg on the prospective food supply the mother weevil eats a small hole through the husk and soft shell and inserts one or more eggs into the hole. Since her snout is long and quite slender she is able to bore with little difficulty and without causing more than passing injury to the growing nut. The wound soon heals and only a small spot remains to show that the nut is infested by her offspring.

Jumping beans

The so-called Mexican jumping beans are a familiar sight at places of amusement during the latter half of summer and autumn, always attracting a great deal of attention. They are not beans, but the seeds of certain species of plants belonging to the genus *Croton*, a relative of the castor oil plant. The "beans" them-

selves have no power of jumping, this being furnished by the caterpillar of a small moth which is closely related to the codling moth which bores into apples. The egg of this moth is laid in the calyx of the young fruit, the young larva boring its way into the pod and attacking the seeds.

The act of jumping results from the activity of the caterpillar within the ripened capsule: it bends downward and takes its tail in its mouth. Then, suddenly straightening itself with considerable force, it causes the "bean" to jump. The larvae of the cheese skippers hop about in the same way, but as they are free living, there is no external covering to be moved by them. It is not positively known why the larvae in the seed capsules jump. It may be for exercise or to move the pod into a position that will prove more comfortable. Heat is often used to increase the activity of the "beans." When it is, the jumping is quite evidently for the purpose of escaping the unwelcome heat.

A first meal of tadpoles

In the preceding paragraphs we have given examples of insects that lay their eggs in or very close to the food that the young will eat. We have dealt with those feeding on plant life or parasitic upon other insects. There are some insects that are parasitic on vertebrates that also lay their eggs directly upon the larval food. Most of the large predacious diving beetles feed upon small fish and tadpoles of certain frogs, and the mother beetle provides for this by laying her eggs in the frothy egg masses of the frogs. When the eggs of both hatch the young larvae of the beetles at once begin to feed upon the tadpoles. As a result the insect larvae secure an excellent start in life and should be in fine condition to carry on their search for individual tadpoles when the egg mass of the frogs is finally depleted of its inhabitants.

The habit of laying eggs within the actual food which the young will eat may be looked upon as a direct protection, since it not only eliminates the necessity of searching for food, but at the same time offers concealment. Some insects are not so considerate of their offspring and the protection sometimes concerns only the species and not the eggs. An example of this is to be found in some Tachinid flies which

scatter more than a thousand tiny black eggs over grassland where caterpillars are likely to come along and swallow them. Inasmuch as these flies are common it is evident that the method is effective even though it may seem to be wasteful.

As to why this habit should have developed we can only guess. Perhaps the adult flies were not sufficiently energetic to search out their prey as most of their relatives do. This, however, is scarcely a good explanation. In any event we may be thankful that this habit serves as an efficient method of retaining the balance of nature. In years when armyworms are abundant, many more of the tachinid eggs are eaten than in a year when caterpillars are less numerous, with the result that probably a uniform percentage of this serious pest is destroyed from year to year. The protection of the eggs in this case is to be found in their small size, as there is very little chance that they will be crushed during the feeding of the caterpillar.

Some of the tangle-veined flies do protect their eggs by laying them in cracks on fence posts or in crevices in the bark of trees, but they have little consideration for the food supply of their larvae because the insects upon which these feed are found in the ground. However, nature has taken care of this situation by providing newly hatched larvae with some long, curved hairs. When the larvae hatch they take a position with these hairs exposed and wait for a gust of wind to come along. When it does arrive they are torn from their seats and carried by the wind, eventually dropping to the ground. Their next task is to find the larva of a June beetle or some other subterranean insect upon which to feed.

Armored eggs

Many insects cover their eggs with a protective substance which may be composed entirely of a special secretion of the insect or it may have attached to it hairs and scales from the mother. One of the better known examples of this type of protection is found in the Chinese preying mantis, an insect introduced into America and now very common in the vicinity of New York. There is no doubt that the covering protects the eggs against some enemies but it also has its disadvantages because it

serves to attract the attention of birds, squirrels and mice. These animals tear open the tough covering and devour the eggs, but they are not the only creatures that attack them for, despite the protection afforded, the larvae of some flies are able to enter the egg mass and develop to maturity. The fly larvae probably receive relatively greater protection than the eggs of the mantis because the apparently empty egg masses will not be disturbed by birds or rodents.

The lowly cockroach

In a group of animals as primitive as the insects we would scarcely expect to find an even greater development of protective covering than demonstrated by the preceding type but it does occur, and, of all places, among the lowly cockroaches. The cockroaches are among the most primitive of living insects, their history dating back at least one hundred million years in geological history. The common and detested cockroach of our kitchen protects its eggs by furnishing a hard egg sac in which the eggs are arranged in rows. When this egg sac is ready to be laid it does not pass completely from the body, a portion remaining within the abdomen of the mother. It is carried by the insect for some days, but before the eggs are ready to hatch it is secreted in some suitable place, the mother taking no further interest in it. Some other cockroaches cover the eggs with only a very thin egg casing and do not carry the case at all.

As to the origin of this remarkable habit we can only speculate. It may have arisen as a result of the inability of the mother to find a suitable place in which to hide the eggs, with the result that succeeding generations carried them for longer and longer periods, or it may have arisen accidentally because of inability to completely discharge the large egg sac.

While we usually think of protection by an exterior covering as embracing only those insects that lay their eggs in masses we know that certain insects cover single eggs. It is also true that we usually consider the protective covering to be a secretion discharged from the abdomen at the time the eggs are laid and we know that practically all eggs are covered with a sticky substance at that time. This sticky substance, which dries very quickly, enables the egg to adhere to the surface upon which it

is deposited and is, of course, essential to the welfare of the egg.

Among the psocids or bark lice the mother protects her eggs in an unusual manner. At least we may consider it unusual, because we know of no other insects that employ the same method. After the egg is deposited the psocid bites off tiny pieces of bark and chews them for a moment. She then ejects onto the egg a drop of saliva in which the masticated bark is contained. This quickly spreads over the egg and dries. The protection offered by this coating is probably twofold—it coats the egg with a substance much darker than the egg itself and at the same time adds a strengthening coating to the thin shell. The food of psocids consists of fungus growths so that the insect has gone outside of its foodstuffs in order to secure a suitable substance.

We are all well aware that bees, wasps and ants build nests in which to lay their eggs and that many of them provision the nests with honey and pollen. These insects not only provide a home and food for the eggs and larvae but many of them actually feed the young and care for them most carefully. However, many of these insects merely provide food, which usually consists of other insects and spiders. The common mud-daubers provision their nests with spiders and lay one egg in each cell. An egg is laid in each cell as soon as it has been stocked with food and the end is then closed to protect the offspring from possible enemies. The enemies of the mud-dauber nest would not have any particular interest in destroying the young larvae, but there are a number of flies that would otherwise welcome the opportunity of depositing living maggots on the spiders. These maggots, having the advantage of being able to feed at once, would devour the food of the mud-dauber larva and leave it to starve to death when it hatched.

A roundabout method

In contradistinction to those insects that protect their eggs by giving them an exterior covering we have others in which the egg shell is very thin in order to allow the larva to escape at the first favorable opportunity. In some of the bot flies this condition exists. The eggs may be laid on the legs of animals, but so long as they remain here they will not hatch.

They are licked off by the animal, hatching almost as soon as they enter the mouth, or at least by the time they reach the stomach. In some of these flies the eggs hatch as soon as they come in contact with the moisture of the animal's nostrils or lips.

Perhaps the most remarkable habit to be found in the insect world has developed in another bot fly that has become known as the "human bot," although it attacks a number of warm blooded animals. This fly actually makes use of other flies to carry its eggs to the host. The carriers most frequently used are mosquitoes but almost any biting fly may be utilized.

The adult bot fly captures a mosquito and deposits a number of eggs upon its under side, sometimes thirty or more, after which it releases the carrier. The mosquito, in search of blood, locates a warm blooded animal and proceeds to feed. As soon as the eggs come in contact with the warm surface of the animal they hatch and the maggots proceed to enter the host. However, they are unable to break the skin but must enter through some wound or a fold where they can exert pressure. The most common point of entry is naturally the puncture made by the mosquito. So this pest not only carries the parasites to their host but actually provides a means for their entrance into it. The same use is made of other biting flies, and in particular of the stable fly, although this latter is less easily captured than the delicate mosquito.

Insect waylayers

There has been published an account of how the adults of the human bot have lain in wait for mosquitoes emerging from pools in order to deposit eggs upon them. When a mosquito emerged it would be observed by the bot adult until it settled. The larger fly would then capture it and proceed to lay its eggs.

If the theory that has been put forward concerning the development of this strange habit is true these egg-layers must have developed their technique to a remarkable degree within a relatively short time. According to one theory the flies originally laid their eggs on the animals themselves, but were limited to those that lived in the forest, because the flies cannot stand the strong sunlight of the American tropics. As a result animals

of the plains were not attacked. However, the flies developed the habit of laying eggs on the leaves of trees overhanging trails which the range animals had made. These leaves would take on some of the odor of the animals and serve as a guide in egg laying. In the same way the mosquitoes and other biting flies are supposed to retain some of the odor after feeding, with the result that the bot fly would be guided in laying its eggs on suitable carriers. It would be a natural step from this to the development of the habit of ovipositing on newly emerged mosquitoes.

These bots do an enormous amount of damage in South America to the hides of range cattle. It is estimated that the actual loss will amount to at least a billion dollars annually if the vast ranges of the continent are ever fully utilized for cattle grazing. At present the damage is placed at a mere ten millions.

A good provider

Some of the wasps show either intelligence or something that closely approaches it. There are many kinds that dig their burrows in the hard ground and provision the nests with caterpillars. After the female wasp has dug the tunnel she comes to the surface and proceeds to plug the hole with soil, packing and smoothing it so that the entrance cannot be distinguished. She then flies away in search of a caterpillar. When she returns with her prey she opens the entrance to the tunnel, drags the caterpillar in, lays an egg on it and once more covers the entrance, this time using greater care than before. Some species employ a small pebble with which to pack the soil placed over the entrance. The reason for this extreme care is obvious if one cares to watch the operation. Several small grayish flies may be observed in the vicinity of the tunnel. They are waiting for the wasp to return with the caterpillar. Their object is to deposit living maggots on the food. The wasp apparently knows this, because, while digging out the opening, she makes many hurried sorties toward the caterpillar in order to shoo the flies away. Once she has it inside she probably feels safe, but it is often while she is dragging it in that the flies drop the maggots onto it. The relationship between the wasp and flies is a most interesting one and while there have been many

observations made it is not fully understood.

In order that eggs may endure the cold of winter they must be protected by a thick shell, one that can expand without breaking, or by some other means. The eggs of the plant lice, and those of some other insects that are laid singly on the twigs of trees, are small and quite hard. During an average winter they are capable of surviving with only a small mortality and in a warm winter almost all will hatch in the spring. But during a season such as we have just endured the mortality is very high because the contents of the eggs freeze to a greater extent than usual and the vital elements are destroyed. In other instances the eggs themselves become cracked.

The susceptibility to frost and low temperatures is a relative one. Eggs of the same species of aphid occurring in cold parts of Canada and in our South Atlantic States will show a remarkable difference in resistance. Those in the north will withstand temperatures of below zero while those in the south will succumb with only a few degrees of frost. It is not only the cold that enters into this destruction. It is well known that a period of warm and cold spells alternating is much more destructive to insect life than continued cold, because of the relatively sudden changes that take place in the egg. Many insect eggs must have exactly the right amount of moisture and any appreciable deviation from the normal results in death. Some are, of course, laid in water and others in dry sand but these are especially adapted to the particular environment. Some of those that are deposited in water are capable of surviving if they dry out. The eggs of certain mosquitoes are laid at the edges of fresh water pools that will dry up when summer comes, leaving the eggs high and dry as soon as the spring rains have stopped. Under normal conditions the pools will not again fill for almost a year after the eggs are laid. The only moisture the eggs receive must come from occasional rain and thawing snow.

Delayed hatching

In the spring following the laying of the eggs they once more come in contact with water and then hatch. However, it sometimes happens that there is a dry winter, or even two or three, and the thawing snow or spring

rains do not raise the level of the water to the "egg belt." There is undoubtedly a certain amount of drying out of the eggs and some mortality under such conditions but the majority are nevertheless able to survive. They hatch when the pool once more reaches normal height. In seasons of abnormally heavy snow-fall and deep frost it is safe to predict large broods of early spring mosquitoes because the flood conditions reach eggs that may have been laid several years previously.

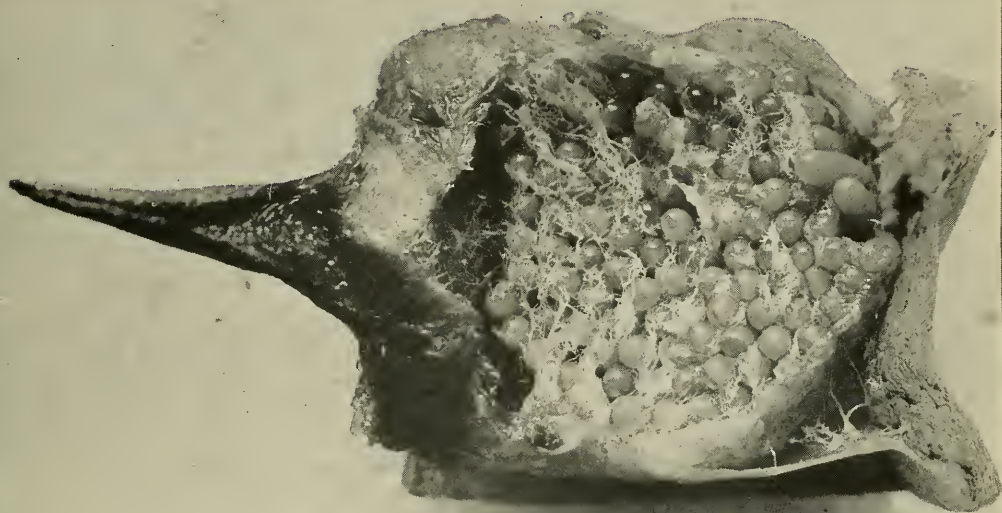
Although we are aware that the above described condition exists, we do not know the real solution of the mystery with which nature has surrounded these eggs. It would seem that there is some element connected with the eggs that allows them to hatch only under conditions found in the spring of the year, thus preventing the destruction of the species which would result from hatching in a short-lived summer pool.

Heat is, of course, deadly to insect eggs and even the most resistant can be killed by exposure for a few minutes to a temperature of 140 degrees F. Continued exposure to a temperature ten or twelve degrees above that to which they are adapted will destroy them, and the vast majority are killed by exposure to the summer sun. As a result most eggs are concealed in some way or are deposited on the under side of the leaf. Such protection is unnecessary during the winter months when the penetrating powers of the sun's rays are greatly reduced. Because of this fact we find the eggs of many insects that overwinter in this stage deposited on the twigs, trunks and branches of trees.

Numbers prove success

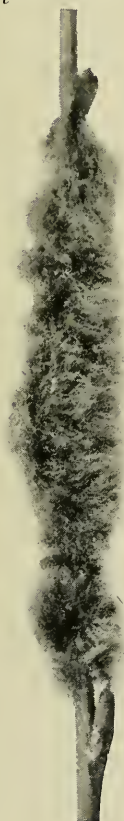
From the standpoint of survival a crucial period in the life history of any species is the period immediately following birth or the laying of eggs. It is then that the creature is usually most helpless. Without such intricately evolved habits as some of those we have discussed, the insects could not have survived to the number of more than a half million known species. There are approximately five times as many species of insects as there are of all other creatures put together. These figures alone prove, among other things, how effective are the amazing methods of insects for the care of offspring they will never see.

HOW INSECTS PROTECT THEIR EGGS



Cornelia Clarke

*Insects, in order to survive, must lay their eggs where natural enemies will not destroy them and where the young larvae upon emerging will find proper food. The large, black water scavenger beetle (*Hydrophilus*) lays its eggs as shown above in a silken case that floats on the water. The young larvae have gills and are adapted for life among aquatic plants*



Cornelia Clarke

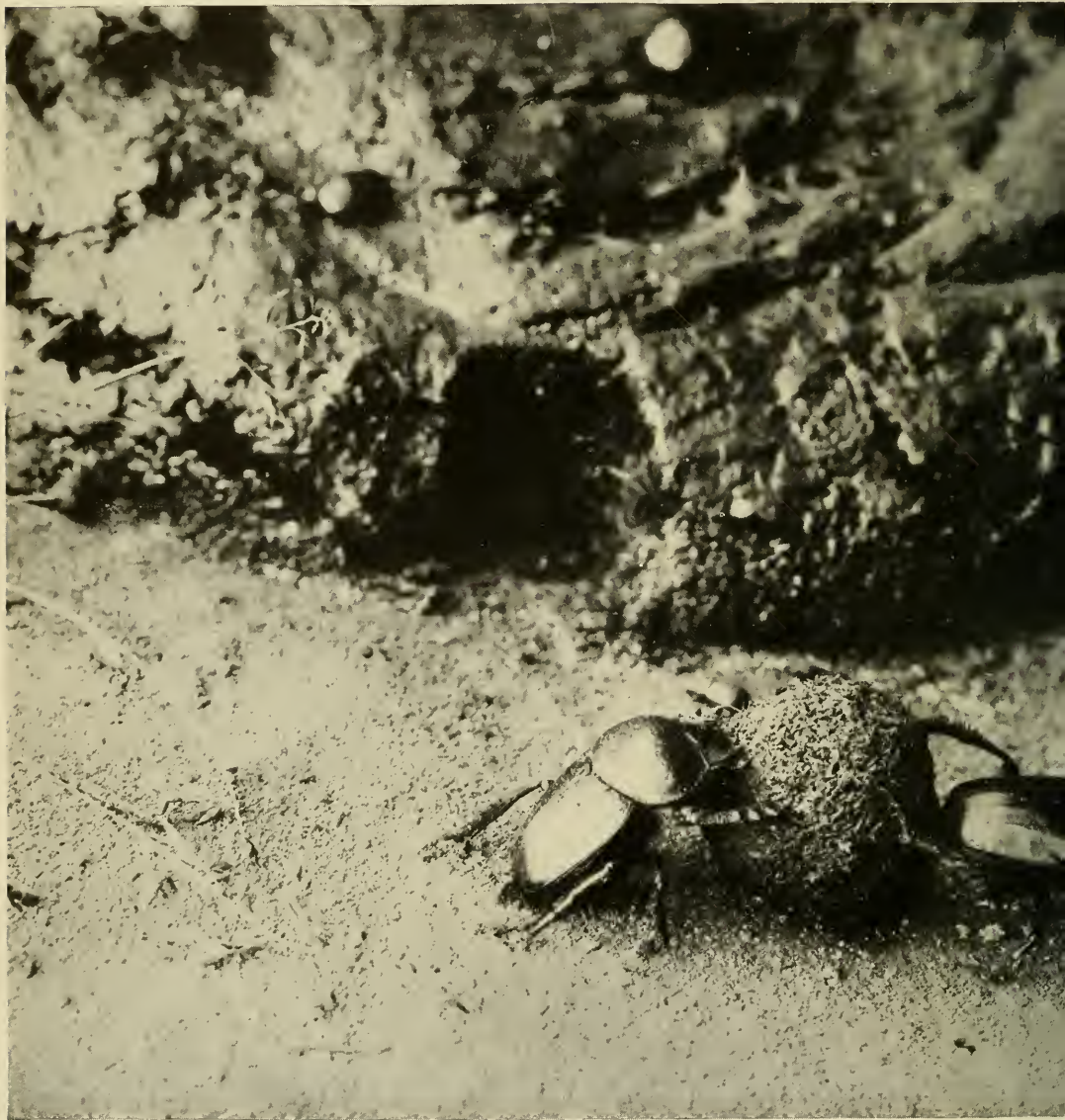
(Above) The mother water bug lays her eggs on the back of her mate. The wing covers are sealed under them and the male is unable to fly until the eggs are hatched

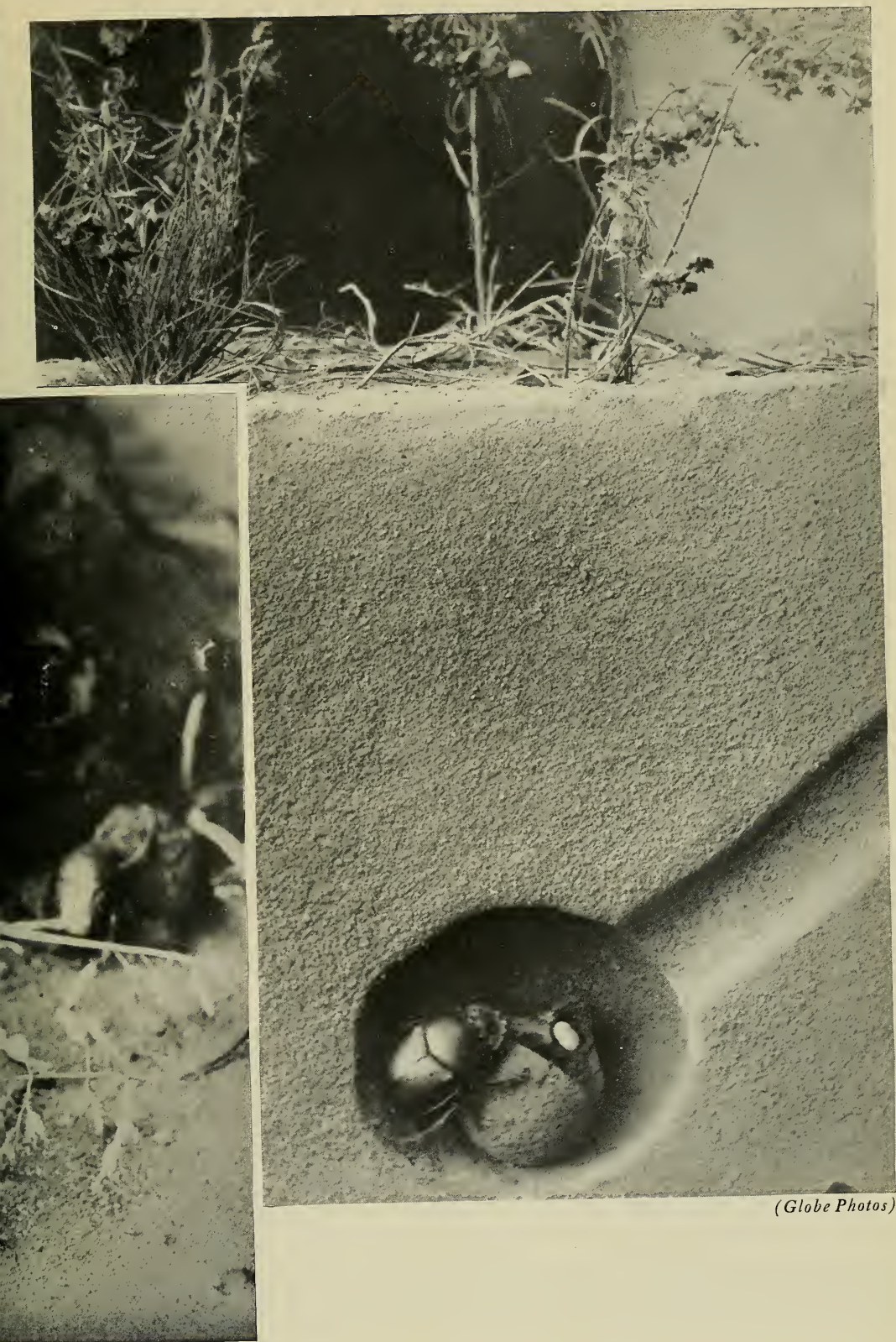
*(Left) The European moth, *Eriogaster lanestris*, covers its eggs with hairs from its own body. The hairs probably serve to protect the eggs against parasites*

(Globe Photo)

(Below) An example of the beginning of co-operative effort among insects: a male and female beetle joining forces to provision the "nest." After locating fresh dung these relatives of the sacred Egyptian scarab dig a tunnel and excavate a broad chamber. The two beetles then prepare a ball of the material, which is to serve as food, and roll it into the mouth of

the tunnel, the female going in ahead of it. (Right) Once in the chamber the female deposits an egg in the ball. In the sectional illustration shown here the ball is cut open to show the egg. Her mate waits at the surface to help her plug up the opening when she emerges. This prevents the food ball from drying out and insect enemies from entering





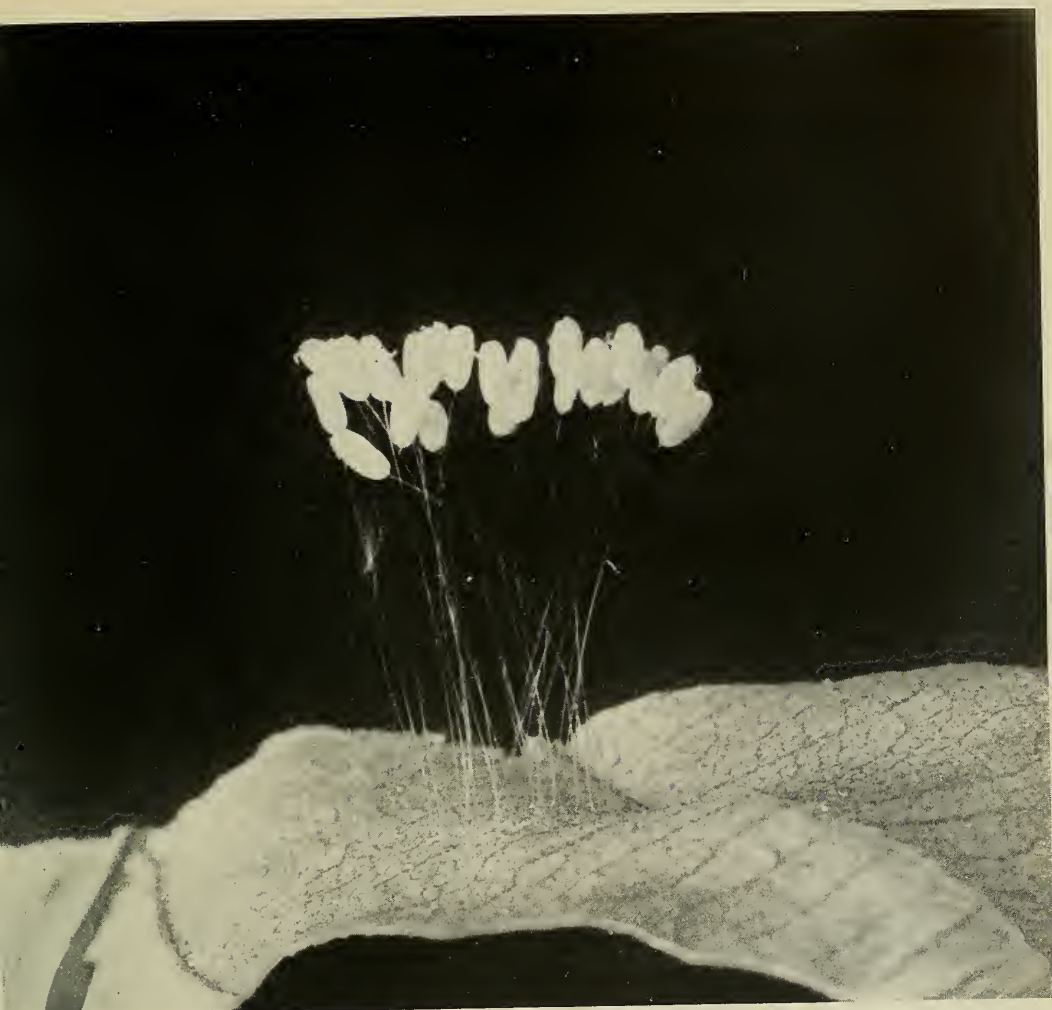
(Globe Photos)



The grasshopper shown at the left is engaged in the serious occupation of laying her eggs in the broken stem of a plant. She has forced almost the whole of her abdomen into the stem in order to deposit the eggs far inside, where they will be well protected (Globe Photo)

The paper making wasps of the genus Polistes make small, open nests that hang downward from a slender stem. The cells each contain a single egg glued to the side near the bottom and are left open so that the adult can bring food for the young (Photo by Cornelia Clarke)



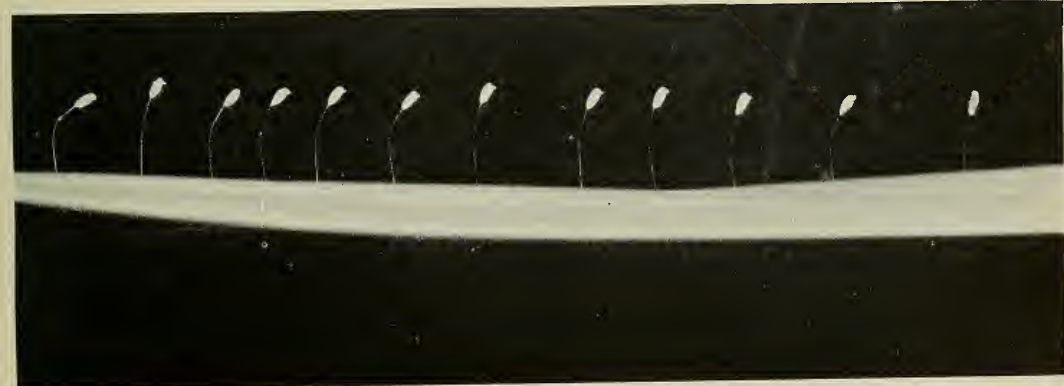


Globe Photo

(Above) The aphid lions lay their eggs at the end of hair-like stalks. If they did not do so the first hatching larvae would eat the eggs of their brothers and sisters. When planted in

a cluster the bases of the hair-like stalks are set in a spiral formation so that the eggs above are kept apart. On narrow leaves, as shown below, the eggs are spaced in a single row

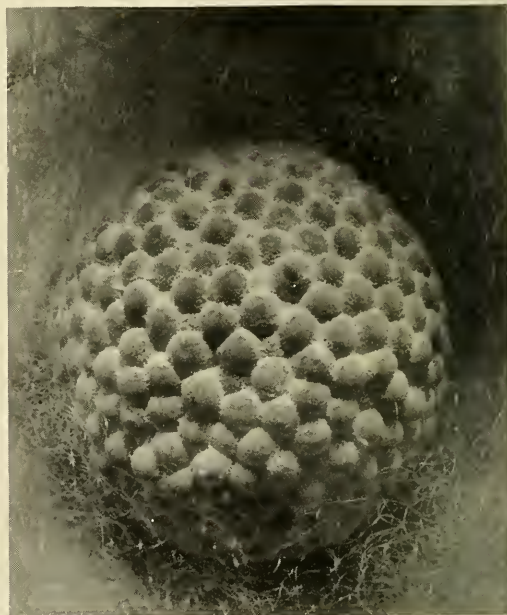
Photo by Cornelia Clarke





Photos by Cornelia Clarke

(Above) Spiders, although not true insects, also protect their eggs in interesting ways. The wolf spider shown above is carrying her silken egg case. It is a bulky load, but she is able to travel quickly with it, and will not discard it until the young hatch



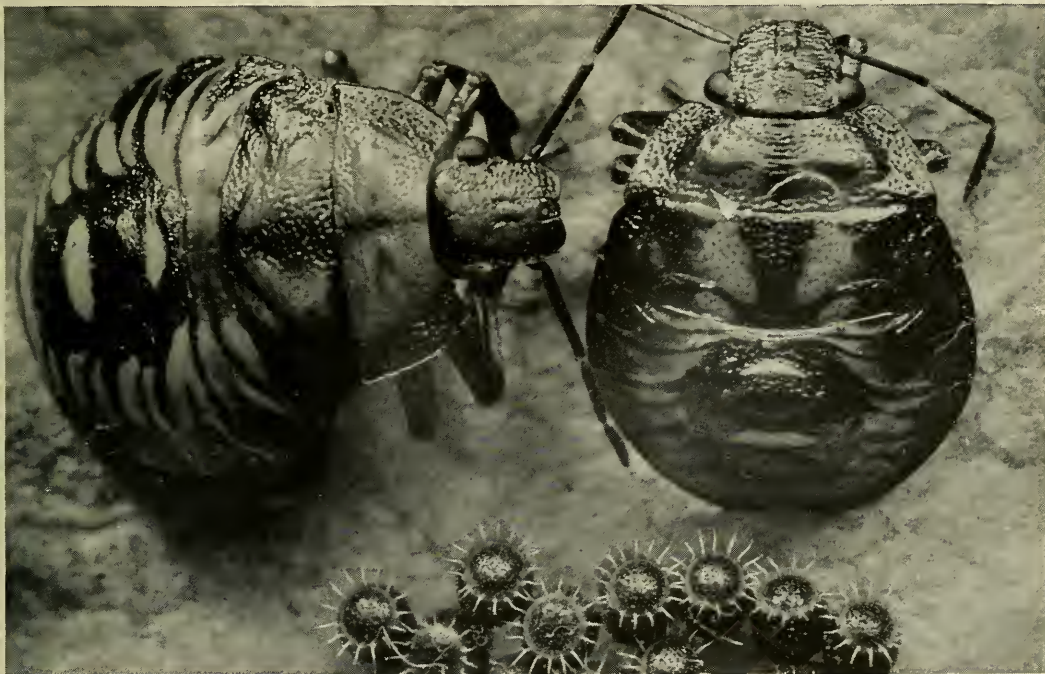
If the silken cover is removed from the eggs of the orb weaving spider they present the appearance shown above. At the left the same eggs are shown after being separated



(Above) The garden spider hangs its light brown egg sac in a network of silken threads woven among weeds or long grass. The sac is closely woven and quite tough so that the eggs are well protected against the buffeting of winter weather

Below are two young "stink bugs" which hatched from eggs similar to the spiny ones shown near them. The eggs of these bugs have a very hard shell but there is a weak ring near the top allowing the whole cap to come off

Photos by Cornelia Clarke





Sharp changes in temperature are a menace to certain insect eggs, especially in arid regions. In order to provide the eggs with even temperature and moisture, the Palestine grasshoppers bury their eggs deeply. At left shifting sands have exposed the egg-laying grounds of the grasshoppers. The projecting plugs are the material cemented by the female in the passages above the egg masses

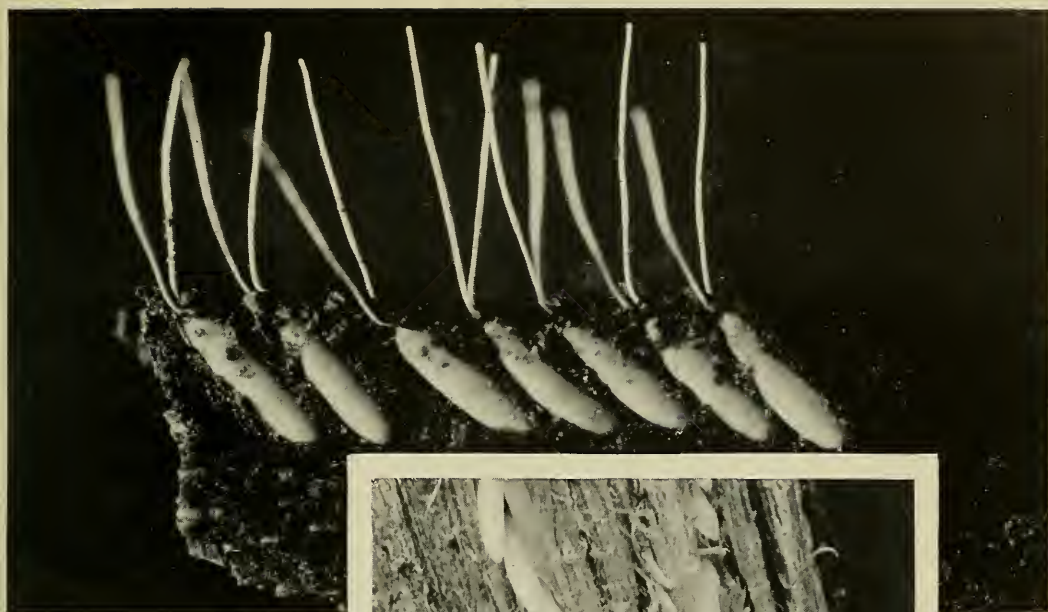
Below are shown the egg masses and the plugs above them in normal relation to the surface of the ground. The tape measure shows the almost unbelievable depth to which the female stretches her abdomen in laying the eggs



William Thompson Photos



In the close-up of a single egg mass to the left the individual eggs may be seen, together with the sand plug above. The tunnel above was occupied by the female's abdomen during oviposition

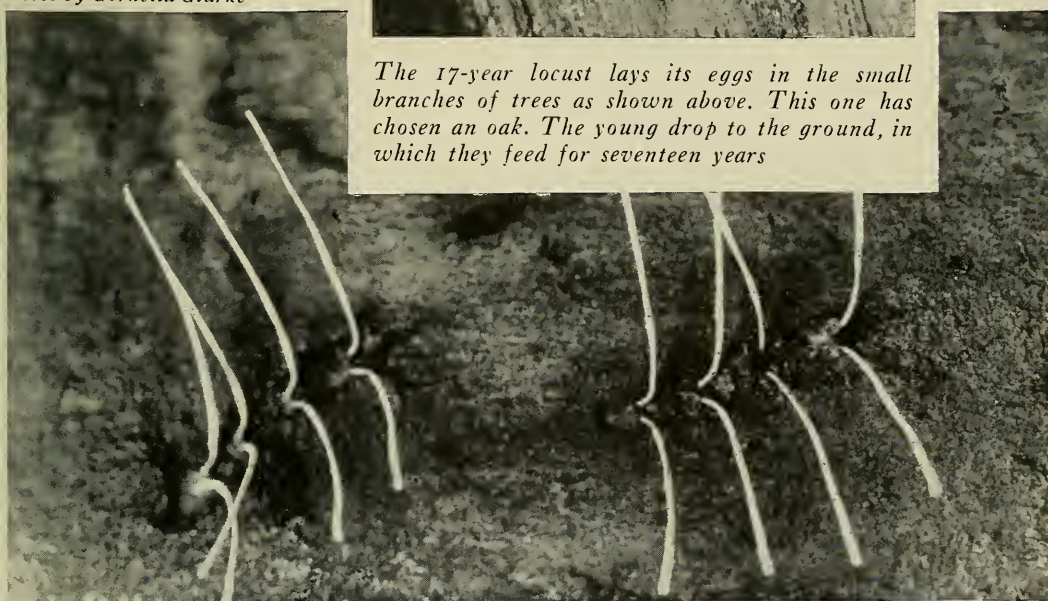


(Above) A piece of submerged wood on which an American water scorpion has laid its eggs. The two filaments that project from each egg into the water are the only indication of the presence of the eggs. At the bottom of the page these filaments are shown as seen from above

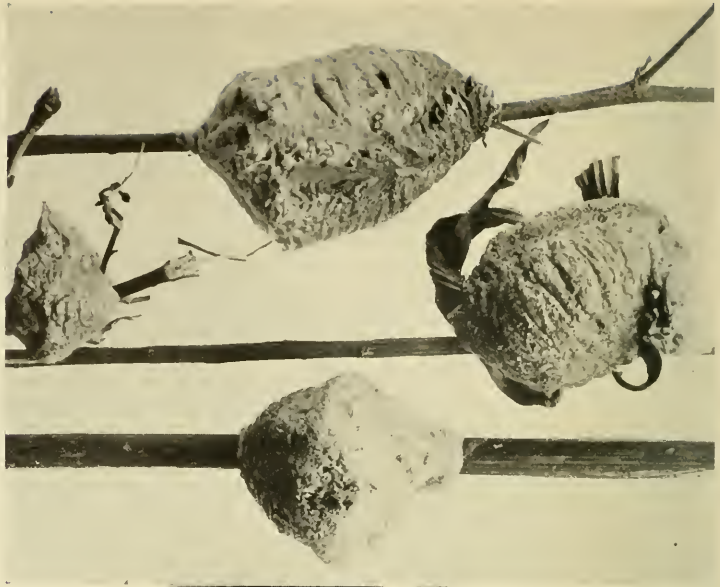
Photos by Cornelia Clarke



The 17-year locust lays its eggs in the small branches of trees as shown above. This one has chosen an oak. The young drop to the ground, in which they feed for seventeen years



The eggs of preying mantids are protected by a tough covering produced by the mother, shown at the right. Each kind of mantid has a different shaped egg mass



(Right) The spiral egg band of a European relative of the American tent caterpillar. Despite the protection offered by the substance surrounding the individual eggs they are subject to attack by small parasites Clarke Photo

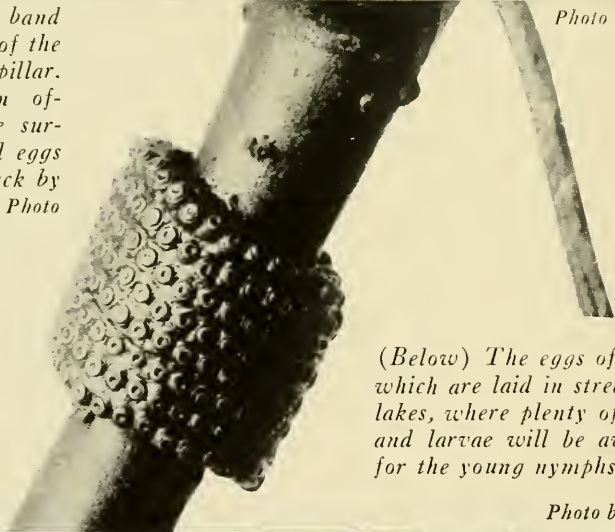


Photo by Cornelia Clarke

(Below) The eggs of the dragon fly, which are laid in streams, ponds, and lakes, where plenty of aquatic insects and larvae will be available as food for the young nymphs

Photo by Cornelia Clarke



Big Money of Yap

In these tiny Pacific isles gigantic stone coins change hands in the market. A six-foot wheel buys villages and plantations

By WILLARD PRICE

PERHAPS the strangest and largest coins in the world are those to be found in isolated Yap, a small group of islands about eight hundred miles east of the Philippines.

It would doubtless cause surprise on Broadway if a man were to come down the street rolling a coin as tall as himself. But in Yap such coins are common. Some are indeed twice this size. Place one such on edge, and a tall man must stand on a tall man's head to reach the top.

In the center of each coin is a round hole. In an important coin, this is as large as a man-hole. When the coin is to be paid, a tree is thrust through the hole and a crew of men partly lift and partly drag the coin over the ancient stone-paved jungle trails to the creditor.

In the port town, Japanese money is used—for Yap is under the control of Japan. But in the jungles of the main island and in the outlying islands of Map and Rumung Japanese money is rarely seen. The ancient stone money is still current.

Shopping with stones

While living in the thatch hut of a native king in a jungle village, studying native customs, I was amused to see how shopping was carried on by the use of stone money. The queen, when she wished to go to the trader's, did not sally forth with a pocketbook. She went down the shore path under the palms followed by a husky slave sweating under the weight of a three-foot stone disc supported on the shoulder by a bamboo pole thrust through the hole.

The village trader accepts such currency cheerfully. Of course he cannot exchange it for foreign goods. No bank in Tokyo, London, or New York would recognize his slab of rock as collateral. But he can pay it to some other native for coconuts.

A chief admired one of my hats.

"May I have it?" he asked. "I will pay for it."

"Please take it—as a gift," I urged.

He would have none of that. He paid, and paid handsomely. Four slaves groaned into our courtyard with a coin measuring four feet and weighing about two hundred pounds. My bewilderment as to what to do with it was soon relieved. The next day the chief took it back and returned the hat. His friends had made too much fun of him in this outlandish headgear. For hats, and most other articles of clothing, are strange to the natives of Yap.

Why such unwieldy coins?

How did Yap get such an unwieldy coinage? There is no record, since the Kanakas of Yap have no written history. But there is a native tradition according to which, some hundreds of years ago, one of the more disreputable gods thought to cause dissension among men. They were at peace because they had nothing to war over. He would give them something to war over. Money.

He whispered to a king of Tomil (one of the sections of the main island of Yap) a plan to make him great and powerful. Obedient to the heavenly vision, the king sailed south over unknown waters to islands of the Pelew group. There he found shining rock (calcite) which the malicious deity instructed him to have his men hew out with their shell-axes into flat

pieces rounded like the orb of the full moon. These were loaded into the canoe and brought to Yap, not without many perils. The god cast a spell over the people that caused every man of them to desire nothing so much as one of these heaven-sent stones. To obtain them, they paid to the king of Tomil great riches in the form of coconuts, canoes, and houses. So the wheels became a medium of exchange for goods.

And those who tell the legend go on to say that there has been no peace in Yap since then. The golden (or stone) apple of discord disrupted the island paradise. Formerly there had been little covetousness; for there was little to covet. No man desired his neighbor's coconuts for he had his own. There was food enough for everyone and no one wanted clothing. Greed was born when money came in. Quarreling began among relatives as to who should inherit which rock. Feuds arose between neighbors, wars between villages. The elders of Yap, ignorant of the fact that the Bible designates the love of money as the root of all evil, have become convinced of this from bitter experience.

"Nine quarrels out of ten are over money," one told me. So we are given to suppose that the god had a great laugh at the expense of the people of Yap.

There was only enough of the first money to be tantalizing. Expeditions set out to get more. They went not only to Pelew but to Guam where an even finer stone could be obtained. But it is four hundred miles to Guam and the seas are stormy. Many canoes were lost, particularly on the return voyages when they were loaded to the danger point with great stone wheels. It was not uncommon for twenty canoes to set out for Guam and only one to return.

No counterfeiting

Of course the difficulty and danger in securing the stone kept up its value. There could be no counterfeiting, for there was no similar stone to be found in Yap. It is a calcite or crystallized carbonate of lime which forms in veins filling the cracks in limestone or other rock. There is nothing inherently precious about it. It has value to the Yap native only because it is hard to get and because it is the accepted medium of exchange.

If these goings-on amused the god, they also amused an Irishman named O'Keefe.

I found a cross-eyed old native sailor with the shamrock tattooed on his brown skin who had sailed with Captain O'Keefe for years. He told me the story.

Buccaneer O'Keefe cast anchor in Yap harbor during the Spanish rule (a rule that was largely characterized by the lack of any) and proceeded to look the natives over with a view to making what he could out of them. He soon found that they would give copra, fish, anything they possessed, for stone money.

Very well, stone money they should have. He had heard that large pieces were especially in demand. That was where he fitted in. On his schooner he could transport pieces many times as large as could be carried in canoes.

"He sailed to Pelew and went to the king," my informant related. "He asked for many men to help dig stone money.

"The king said, 'What will you give?'

"The Captain gave rope. He gave paint to paint the bodies of the dead. Dye to color lavas (cloth garments wound around the waist). And some guns. He promised to give more when the work was done.

"The men of Pelew dug . . . many months, years. Small stones took little time. But it took two years to dig out a great wheel.

"We kept taking the wheels to Yap and selling them to the natives for copra.

Trouble in store

"But the chiefs of Pelew became angry because Captain O'Keefe paid no more and was cruel to the men. They looked for a chance to punish him."

The opportunity came when the Captain was wrecked in the Pelew group on the island of Babeldaob at Alklung. The natives seized all his goods. But this punishment was not enough.

They would give him some of his own medicine. They lashed him to a tree and brought out a cat-o'-nine-tails salvaged from his own ship. They flogged him.

After his release he lost no time in lodging complaint at Hongkong. A warship visited Pelew and demanded an indemnity in the form of large quantities of copra and bêche de mer (sea slugs) from the offending village of

Alklung. When the indemnity was not paid, two more warships came, landed their men and burned the village to the ground.

After a long series of ruthless, picturesque, and piratical exploits, Captain O'Keefe one day stocked his schooner at Yap for a long voyage, kissed his two wives good-bye, and sailed away. He never came back. Some say that he went to an island known only to him, for he was an excellent navigator and knew the South Seas as few men did. Others suppose that he was lost at sea.

A two-ton coin

However that may be, he left behind him monuments that will stand to his memory for thousands of years. The largest coin of his minting that I saw measured twelve feet and its weight was estimated at about two tons. Flip that over the counter! But the greatest of all is said to lie at the bottom of Yap harbor. While being transferred from the schooner's deck to a raft, it slid into the water. The old men who saw it swear that it was twenty feet across . . . but that may be a "fish-that-was-lost" measurement.

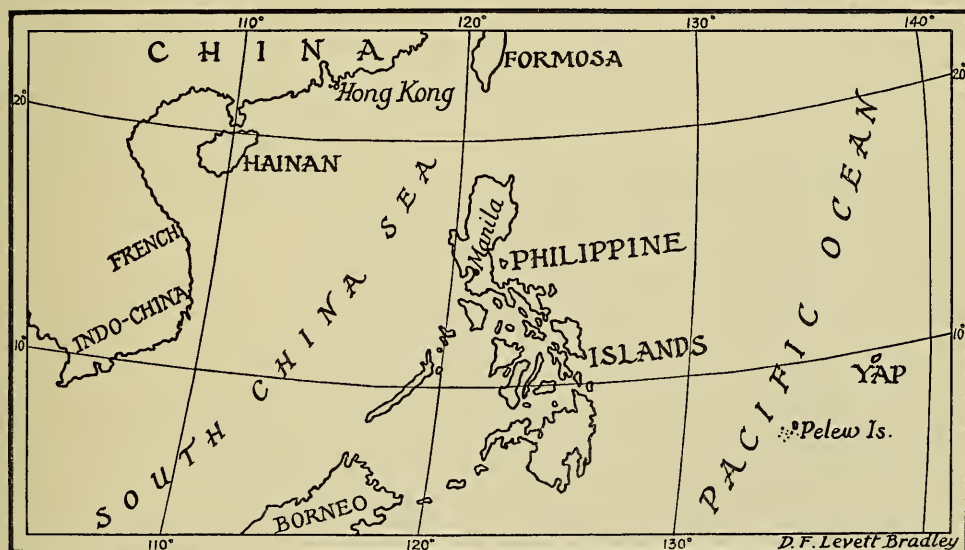
Since this monolithic money is so cumbersome, barter is used for most small transactions. Goods are traded for goods. There are accepted values, recognized as standard. Two

coconuts sell for one match. Ten nuts will buy one roll of bread. Ten nuts are the equivalent of one pack of Golden Bat cigarettes. The man who has brought his nuts from a great distance may demand and get one or two cigarettes extra. Ten leaves of tobacco buy twenty-five nuts. One cider-bottle of petroleum goes for twenty nuts and a beer-bottle of petroleum is paid for forty nuts.

The natives sell chickens, eggs, pigs, in the same way—for petroleum, phonographs, harmonicas; not for money. They do not understand money in the form of small silver and copper pieces, so insignificant compared with their majestic coins of stone. They cannot get the values through their heads. Too much mathematics is involved. Besides, who knows how long this foreign money will be good? First Spanish money came. Then German money, and the Spanish was no good. Then Japanese money, and the German was no good. But Yap money is always good. It goes on forever.

Other moneys

Stone is not the only form of Yap money. Shells of the pearl oyster are strung together and used as currency. Bags of copra are used. Also the remarkably fine lava-lavas produced by the artists of the neighboring island of



Yap, where stone coins are used, lies 800 miles east of the Philippines

Mokomok. A sack of these lava-lavas was kept as one of the chief treasures of the "All-Men-House" (council house) in our village. There was no thought of opening it and using the garments. It was kept intact to be paid sometime to another village for a canoe.

But barter and these lesser currencies are used for only small deals. For a great one, stone money comes into play.

The foreigner who regards these stones as of little value will be sharply disillusioned when he tries to buy one. He must pay goods to the value of about seventy-five dollars for a wheel from Guam a foot in diameter! The Pelew wheels cost less. A poor specimen, waist-high, is valued at four thousand coconuts, worth in the islands about twenty dollars. A stone as high as a man is worth many villages and plantations, and the stones two-men-high are considered to be beyond price.

Riches in the front yard

The great stones are not owned by individuals but by communities. They are displayed outside the All-Men-House which thereby acquires the native name, "Febai" (Money House).

Private homes are flanked with smaller pieces from two to five feet high. The Yap resident would consider it just as strange to take his money inside the house as we would to leave ours in the yard. "How," he would say, "can anyone see your money if you keep it in the house? Moreover, there would scarcely be room left for the family."

However, the small pieces, six inches or so in diameter, are kept indoors. Not only because they would be too easily carried away if left outside; but because the householder would be ashamed to show them. It would be like displaying pennies. He would be thought a poor man.

Therefore large stones are in demand. Rather than accept small wheels, the creditor prefers to let the bill mount until he can be paid with a handsome wheel great enough to attract real attention as it leans against his house or against the stone platform upon which his house is built.

Such coins are rarely stolen. It is hard to slip away with a half ton of rock. Still it could

be done while the people of the house are absent. But where could one take the booty? It would be futile to remove it to some island outside of the Yap group because such currency is not used elsewhere. If it were kept in the Yap islands it would be traced. There are no inscriptions on these coins by which to identify them; but the details, irregularities, and measurements of every wheel are memorized by the owner. He would recognize his wheel anywhere. The larger wheels even have individual names and are known by name and appearance to everyone in the islands. They are even better known than people; for people come and go, are born and die, but these familiar faces remain from generation to generation. Every wheel has its story, usually a story of blood, of fighting between villages for possession of the piece of rock, or of feuds between families, or of attempts to steal and hide the money, or of the killing of its owner by poison or a spear-thrust. Most of the tales of trouble and terror in Yap seem to cling like moss to these old stones. There are records of half the men, women, and children of the island being slaughtered in a money foray.

Inflation

Today the mint is idle. No more stone money is being "coined." This may be due partly to the growing competition of Japanese money. There is a greater reason. The population has shrunk to half its former size, while the supply of money has remained the same. So there is more than enough to go around. In other words, Yap's currency is inflated. Also, the value of labor has risen, so that it would cost more to go to Pelew and dig out new wheels than the wheels would be worth.

Although the use of the wheels as currency is slightly decreasing, the hoarding spirit will long keep up the value of the old stones. As each family dies out its stones are quarrelsome claimed by others, still giving delight perhaps to the malicious god aloft. As house after house is abandoned, the wheels pile up around the homes of the survivors. As a result of wars, dissension, and disease, the race may die out. But the great stone wheels will remain, odd monuments to the evil of the love of money.

Big Money of Yap

(Right) In this tiny group of Pacific isles, gigantic stone disks like the twelve-foot piece shown at the right serve as coins. One a foot in diameter is worth up to seventy-five dollars, and those two-men high are beyond price. The difficulty and danger in securing the stone from other islands is the basis for the value of these strange coins



(Left) A scene in Yap: an All-Men-House or Council House. Coins not owned privately but by the community are displayed outside this sort of building, which thereby acquires the native name "Febai," meaning money house

When a coin is to be paid, a pole or tree is thrust through the hole in the center and it is carried or dragged over the ancient stone-paved jungle trails to the creditor





It is the custom to display one's stone money in the front yard. The coins are rarely stolen because they can always be identified in the islands and the thief could not pass them in any other part of the world. The bundle in front of the man at the left also represents wealth. It contains valuable lava-lavas, cloth garments that are wound around the waist

(Right) A woman offering a string of shell money for a bottle of petroleum: a case where barter takes precedence over the cumbersome stone money, a piece of which lies idle in the background



An enormous coin said to be worth many villages. Today no stone money is being "coined." But the hoarding spirit will long keep up the value of the old stones

Science in the Field and in the Laboratory

Back from Panama—Museum Art Show—Glacier Bay—Reptile Hunt—Children's Fair

Entomologists Return from Panama

Curator Frank E. Lutz, Doctor W. J. Gertsch and Mr. Wm. C. Wood of the American Museum of Natural History spent February and March in very successful field work on the butterflies and moths of Panama. Two regions were selected in which to do intensive collecting. One was Barro Colorado, the large island in Gatun Lake, Canal Zone. It is almost entirely covered by a rather dense jungle typical of the low hills near sea-level in Central America and is the laboratory of the Institute for Research in Tropical America. The other was on the western slope of the Volcano (extinct) of Chiriqui near the Costa Rican border. Headquarters there were at an altitude of about 4200 ft. In addition to the high-altitude jungle, this region has a large area of naturally open country. It furnished a good contrast with Barro Colorado. The faunas of the two regions differ markedly, a condition which not only resulted in the expedition's getting a large range of species for the Museum's collection but also will, it is hoped, help in understanding the geographic distribution of insects in Central America.

Frederick H. Douglas

Mr. Frederick H. Douglas of the Denver Art Museum, Denver, Colorado, recently visited the department of anthropology. Mr. Douglas is distinguished for his knowledge of American Indian Art and for having built up in the Denver Museum one of the most important collections in the world. In connection with this work, he has developed the educational use of these materials to a degree not realized in other cities. His work attracted so much attention that it has been supported by the Carnegie Corporation and other foundations interested in the promotion of art and art education. Finally, Mr. Douglas has prepared and issued a series of about 100 leaflets dealing with the technology and art of various American Indian tribes. These are now recognized as classics and have been distributed to every country in the world.—C. W.

President Davison back from India

Mr. F. Trubee Davison, president of the Museum, and Mrs. Davison returned April 21 from a three-month trip to India. Next month NATURAL HISTORY is planning to run an illustrated article describing the interesting experiences Mr. Davison had on this trip.

The Arthur Lecture on the Evolution of the Human Brain

The fifth annual James Arthur Lecture on the Evolution of the Human Brain will be given at the American Museum of Natural History on the evening of May fifteenth. Dr. Samuel T. Orton, Professor of Neurology and Neuro-Pathology in Columbia University, will speak on "The Language Area of the Human Brain and Some of Its Disorders." Professor Orton illuminates his subject by the following brief explanation:

"The exclusively human faculty of language (speaking and understanding speech, reading and writing, and the use of meaningful gestures as in sign language) is controlled from a part of the human brain which is enormously expanded as compared with the similar area in the highest apes. It is also peculiar in that only one side of the brain is necessary for normal language functioning. A very small area of destruction by injury or disease will give extensive disorder of speech or reading if it strikes in the language zone and in the controlling or dominant side. A similar or even larger destruction in the non-dominant side will have no effect on language."

Experimental Biology

At a recent meeting of the American Association of Anatomists held at Duke University, Durham, North Carolina, several phases of the research work of the Department of Experimental Biology were presented.

Dr. G. K. Noble reported on his studies of the relation of brain structure to social behavior of vertebrates. A large part of the fore brain of vertebrate animals is formed by a mass of tissue

called the corpus striatum. The function of this structure has not been fully understood. Doctor Noble showed that in both birds and fishes it serves as a mechanism for co-ordinating instinctive behavior patterns, especially those concerned with social life.

Dr. William Etkin took part in a symposium on the relation of hormones to growth and differentiation. The rôle of the pituitary and thyroid glands in relation to development has in recent years been a matter of extensive investigation. Doctor Etkin discussed the function of these glands in the development of Amphibia.

The American Museum's Annual Art Show

Many people show surprise when told of an annual Art Exhibition at a Museum devoted to Natural History. "Art belongs in an Art Museum" is their instant judgment, and herein lies an unconscious and therefore doubly sincere compliment to the men and women who serve science as artists. Science deals with facts and it is the work of Museum artists to record them. From the figures in black and white line that accompany the first brief reports on material new to science, to the more elaborate work in full color illustrating the final memoirs and monographs of completed research, the artist helps bring the wonders and beauties of our world closer to all. Again, in the exhibition halls, artists specialize in portraying nature so skillfully that one visitor, viewing a group for the first time, commented on the deadness of a wild dog, killed by a sambur deer. In reality, the deer and the attacking dog pack are all as dead as the "dead dog" lying at the base of a plaster rock, bathed in the sunlight of a painted background showing a spot in Asia thousands of miles away.

Thirty-seven contributors including regular staff artists, WPA artists, and other workers are represented by 258 exhibits in the American Museum's annual spring art show.

The paintings cover a wide range of interpretation. There are vigorous, colorful oils of animals and delicate, clean-cut marines that breathe of the briny deep. An old shack forms the inspiration for two paintings by the same artist, one in oil and the other in water color. There are sketches of badlands, the first attempt in oil to record for science the beauty of fossil-bearing formations; and water-colors of foreign scenes, unique for a certain mystic quality seldom encountered. Illustrations of material studied through a microscope and carried out in water color show an unusual use for this medium. Animal sketches in black and white, beautiful studies of insects, fish and shells show the many types of illustration done by museum artists.

The sculpture ranges from portrait heads, of intricate oriental design, to bold simple work in various media. Wood carvings include a young colt, portrait heads and decorative panels. Miniature group models and decorative tiles, a sailing ship model, original designs carried out in gold and silver further emphasize the unusual versatility of the artists employed by the Museum.

—J. C. GERMANN.

The Glacier Bay Monument

The Glacier Bay National Monument in southeastern Alaska, established eleven years ago by President Coolidge, includes tidewater glaciers of the first rank in a setting of magnificent fiords and lofty peaks and a visible demonstration of what was happening all over northern North America at the close of the last Glacial Period—the slow retreat of the ice and the coming in of a new vegetation and a new animal population. Numerous well-preserved relics of interglacial forest make it possible to compare the life and development of the areas which animals and plants are again colonizing with these older associations.

Unfortunately, House Resolution 9275, introduced January 3, 1936, would open up this monument for mining purposes under the same conditions in which the public domain is open. As pointed out by the Ecological Society of America in a letter sent Dr. H. E. Anthony by the American Planning and Civic Association, the glaciers would be in little danger, but even a sparse mining population would result in the cutting of the young trees, the use of the interglacial forest relics as firewood, and the killing of the animal population.

The association requests that friends of conservation write protesting against passage of this bill, H. R. 9275, to Hon. Rene L. DeRouen, Chairman of the Committee on Public Lands of the House of Representatives, and to Hon. Robert F. Wagner, Chairman of the Committee on Public Lands and Surveys in the Senate.

Reptiles and Amphibians

Mr. C. F. Kauffeld, together with two friends of the department, recently returned from a reptile hunting expedition in the southeastern states, particularly Florida.

Although heavy rains which flooded the countryside hindered the work somewhat, they succeeded in securing fifty species, thirty-six of reptiles and fourteen of amphibians. Among the notable specimens were the rare yellow-lipped snake, *Rhadinea flavilata*, and the short-tailed snake, *Stilosoma extenuatum*. Only one large diamond-back rattlesnake was found throughout the trip.

The Hayden Planetarium

A new Planetarium lecture on THE PLANETS will start Sunday, May 3, to continue during the entire month of May. This lecture will present in detail the various aspects of the planetary bodies of the solar system, illustrated not only by the Planetarium instrument itself, but also by the finest planetary photographs made through the world's great telescopes. In addition to the daily and annual motions of the sun and planets, the lecture will include explanations of such phenomena as direct and retrograde motion, inferior and superior planets, morning and evening stars, the Zodiac, and Bode's law. A general view will also be presented of the night sky in May.

Mr. J. V. McAdam, an enthusiastic Amateur

Astronomer, has lent two reflecting telescopes for exhibition in the Planetarium during May. Both of these instruments were made by Mr. McAdam himself. The larger one has a mirror of 12½ inches diameter which is coated with aluminum. Accessories used in the construction and operation of this telescope are also on exhibition. This is a particularly interesting group in view of the fact that some five thousand amateur astronomers in this country have built their own reflecting telescopes.

During this month there will be an exhibit in the Planetarium of astronomical paintings by Mr. James Perry Wilson. This collection includes paintings of solar and lunar eclipses and various views of the planet Venus in the evening and morning sky.

Amateur Astronomers Association

During May the following lectures and meetings will be held by the Amateur Astronomers Association in the large auditorium of the American Museum of Natural History. All those interested are invited most cordially to attend, as the meetings are open to the public free of charge.

May 6—Dr. Joseph Razek, University of Pennsylvania—"Color and Its Measurements."

May 20—Annual Meeting—Presentation of new by-laws. Election.

Short address by Dr. Clyde Fisher, President.

Junior Astronomy Club

A jubilee meeting on the ninth of May will bring the seventh season of the Junior Astronomy Club to a close. Beginning in the afternoon with a special lecture on "The History of Astronomy" by a club member, Lois Saphir, the meeting will close with outdoor observations in the park. A member of the staff of the World Calendar Association will address the club on "What Is Wrong with the Calendar?" Retiring president Robert Fleischer will be succeeded by his sister, Ruth Fleischer, the first girl to direct the activities of the club since its organization.

American Museum Lectures

The following free lectures and motion pictures are scheduled for the month of May:

MOTION PICTURES: Saturdays, at 2:00 o'clock; May 2, "Along the River Nile"; May 9, "Almost to the Pole"; May 16, "Frontier Woman"; May 23, "Medieval Moderns"; May 30, "Dixie."

SCHOOL CHILDREN: Fridays at 10:30 o'clock; May 1, "Birds of Spring"; May 8, "Sightseeing in China"; May 15, "Nanook of the North"; May 22, "Sequoia."

Two lectures for students in elementary biology and general science are to be given Tuesdays at 3:40 P. M. May 5, "Wild Birds and Their Human Appeal," Mr. Paul B. Mann; May 19, "Are You Going to Camp This Summer?" Miss Farida A. Wiley. The last lecture this season for students in general and advanced biology will be "Heredity and Environment as Factors in Life," given by Dr. George C. Wood, May 12, at 3:40 P. M.

Educational Broadcasts and Tours

The program for the American Museum Educational Broadcasts and Tours over WNYC during May is as follows:

May 7—The Story of Eclipses; May 14—The Pleasures of Astronomy; May 21—Canada—Our Northern Neighbor; May 28—China—Topsy Turvy Land.

The first two lectures will be given by Mr. Robert R. Coles and the ones on Canada and China by Mr. John R. Saunders. In June Mr. Saunders will lecture on Siberia, on Japan, and on the Philippines. The broadcasts are given on Thursdays at 5:30 P. M. and the tours of the Museum illustrating the lecture are planned for the Saturday following the broadcast at 3:00 P. M., but announcement about the tour will be made at each broadcast. The tours are free and all are invited.

Children's Science Fair

The eighth Children's Science Fair, sponsored by the American Museum of Natural History, under the auspices of the American Institute, will open in Education Hall May 17 and continue through May 24. Last year more than a thousand exhibits were made by students in the New York City schools, from the elementary grades through the senior high schools. Some 40,000 to 50,000 persons visit the Fair each year.

The exhibits are entered under ten classifications: Stars and the Solar System, Earth Studies, Plant and Animal Life, Biology, Physics, Chemistry, Conservation, Industries, History of Science, and Energy.

Exhibits in Branch Libraries

Many members who live at too great a distance to permit frequent visits to the Museum or whose programs of work or study conflict with Museum hours, may be pleased to learn about the interesting collections which are being shown under the auspices of the Museum's Department of Education in the branch public libraries in the boroughs of Queens, Brooklyn and Manhattan. Among these exhibits are collections illustrating the material culture of the native African tribes, North American Indians, Eskimo, Chinese, Mexicans; a collection of costume dolls; textiles; masks of the Javanese, Africans, Chinese, Tibetans and Japanese; astronomical exhibits; miniature habitat groups; a collection of beautifully colored butterflies; "Sea People and Their Castles"; and a collection of minerals used for gems and costume jewelry.

Bird Study Courses

Mrs. Gladys Gordon Fry, known to bird lovers and students as "The Bird Lady," opened her fifth series of bird and tree walks in Central Park in April, under the auspices of The American Museum of Natural History.

Central Park is one of the best places in the country to study migratory birds, and New Yorkers have a rare opportunity to observe many different species in a restricted area.

An exhibition of the art work of the elementary and junior high schools of Greater New York was held in Education Hall of the American Museum from March 29 to April 19 under the supervision of Miss Edith L. Nichols, assistant director of fine arts in the New York City schools. The major part of the exhibit displayed creative painting and pictorial projects relating to the geography of New York City.

An Appointment

Mr. Paul B. Mann, associate in education at the American Museum since 1928, has been appointed chairman of the Standing Committee on Science and of the Science Council of the City of New York, the highest scientific position in the City's educational system. These two bodies have been established to assist in meeting the problems of science teaching in the secondary schools and to consider the broad aspects of science instruction.

By the death of Peter C. Kaisen on March 18, at the age of sixty-six, paleontology has lost one of its outstanding technicians. In 1897 Mr. Kaisen, a Dane by birth, was a section foreman on the Union Pacific Railway at Aurora, Wyoming, where he came in contact with the American Museum expedition then inaugurating dinosaur work along the famous Como Bluff. Next year he joined the Museum party working in that region and remained with the Museum until his death.

For several seasons Mr. Kaisen engaged in the exploration, under the direction of Dr. Barnum Brown, of that richest of all dinosaur fields, the Red Deer River Valley of Alberta. Later he made expeditions to Alaska and Mongolia and recently worked in the Lower Cretaceous fields of Montana and Wyoming. Through his energy and skill, both in the field and in the laboratory, and his loyalty to the Museum, Mr. Kaisen placed the Department of Vertebrate Paleontology very much in his debt.

RECENTLY ELECTED MEMBERS

A REPORT from the membership department lists the following persons who have been elected members of the American Museum;¹

Patron

Mr. Beverley R. Robinson.

Fellow

Mr. William W. Conrad.

Life Members

Miss Rose Dougan.

Messrs. Townsend Lawrence, Daniel C. Pease.

Annual Members

Mesdames Samuel Shipley Blood, Charles M. Clark, Margarita Derfelden, George R. Fearing, George H. Hazen, Dora R. Isenberg, Walter Nowill, Henry Parish, Charlotte A. H. Smith, William G. Thayer, Jr.

Misses Sue E. Garis, Clara S. Pulsifer, Adele Frances Siegel.

Doctors Mary H. Layman, D. W. Palmer, Geo. A. Wyeth.

Professor Henry E. Crampton.

Messrs. Harold L. Alling, William R. Cady, H. D. Chapin, Sidney A. Hassel, Alfred B. Holt, George Huling, M. A. Monroe, T. Albert Potter, Frederick H. Rike, Frank C. Rude, Bernhard K. Schaefer, Percival C. Smith, A. C. Stamm, Harry H. Warfield, F. L. Yarrington.

Associate Members

Mesdames Gardner Abbott, Richard S. Austin, Leland V. Baker, John Barker, Edward Warren Beach, C. H. Bentley, Anna Voorhies Bishop, Francis E. Bishop, J. H. Blizard, Charles R. Blyth, Gretchen Burleson, Frank Coleman, Charles A. Day, Margaret Power Drum, E. P. Eastman, Mary L. Farraher, Harry H. Fetter, Mary G. Ford, W. W. Gaar, Frederic Gooding, E. M. Green, Henry Theodore Hagstrom, Fannie Harmon, Addie W. Harrison, M. G. Houghton, John H. Hollis, W. L. Hunton, Edward S. Jamison, Luman W. Johnson, Arthur W. Johnstone, Myra W. Kennett, Ada Latham, Geo. L. Lingner, Ruth White Lowry, T. D. Mabry, Daisy Macdonald, Jas. N. MacLean, T. B. Masterson, Leslie M. Mattingly, F. W. McAllister, Frank B. Moses, Harry Loomis Munger, Mary S. Parsons, Charles L. Paulson, Jr., Elizabeth R. Powers, Babette Ramsey, F. E. Richter, Loring G. Robbins, A. M. Schaefer, Sherwood Winslow Smith, William Sztinick, N. A. Thompson, Linnie Tickell, L. F. Timmerman, E. B. Tyler, Camille T. Wagner, J. McLean Walker, Jefferson Brooks Walters, J. F. Wenk, Russell White, Lois E. P. Willis, B. A. Young.

Misses Rosabel Allin, Virginia Armstrong, Dorothy Bartol, Marie Gignoux Bates, Katharine Beverley Bayton, Bertha Forbes Bennett, Ida E. Bliss, Elizabeth Bogart, Mary G. Brown, Laura Buterbaugh, H. Virginia Cahill, Ina Conner Campbell.

¹ New members not listed in this issue due to lack of space will be listed next month.

The New Books

Children of the Mutineers—Life of the Seas—Jennings’ “Genetics”—Books on the Stars

THE HERITAGE OF THE BOUNTY. By Harry L. Shapiro. Simon and Schuster, New York. \$3.00.

ARCTIC ADVENTURE. By Peter Freuchen. Farrar and Rinehart, New York. \$3.50.

WE EUROPEANS. By Julian S. Huxley and A. C. Haddon, with a Contribution by A. M. Carr-Saunders. Harper and Brothers, New York. \$2.50.

DISEASE AND DESTINY. By Ralph H. Major, M. D. D. Appleton-Century Co., New York. \$3.50.

AS THE “Zaca” neared Pitcairn, Doctor Shapiro was terrified lest this “shadow of an island” might fail to equal the image he had treasured for twelve years. He had long been preparing himself for the opportunity to study at first hand this unique blending of English and Polynesian blood and culture. Back in 1923 he almost got to Pitcairn, but found himself obliged to choose a five-months’ stay on Norfolk Island instead. There he was able to study the numerous descendants of the Bounty mutineers now living in Norfolk.

Doctor Shapiro’s successful trip to Pitcairn was made with the Templeton Crocker 1934-35 Expedition, which was described by Dr. James P. Chapin in *NATURAL HISTORY* for November, 1935, and April, 1936. *The Heritage of the Bounty* includes a short history of the Pitcairn Islanders from the first settlement by nine fugitive mutineers, with the Tahitian women they had taken as wives, and the six native men they carried along as servants. Doctor Shapiro makes the astounding story of how a psalm singing and humbly industrious population arose from a heritage of lust and murder as clear as the conflicting early documents permit. He is favorably impressed by the biological results of this unpremeditated experiment in hybridization, isolation, and inbreeding. The islanders seem in no way degenerate and the only noteworthy defect of any kind shown by any large number of these people was the almost universal loss of teeth, which “had produced a curious sucking-in of the cheeks and a collapse of the mouth.” Several of them reminded Doctor Shapiro of the bird man in Barnum and Bailey’s, with their thin prominent noses and atrophied jaws. Fortunately, a dentist has recently settled temporarily among them.

The islanders who eagerly boarded the “Zaca” looked more like English dock workers than the Polynesians of romance. But after living and working with them Doctor Shapiro came to feel friendship and something of admiration for these most interesting hybrids.

Pitcairn, a rocky-shored island, some two miles long, had no inhabitants when the mutineers and their followers landed there in 1790. In 1808 after a series of murders and battles among the few inhabitants (including revolts by the women) there were left “one surviving mutineer, eight or nine Tahitian women, and twenty-five children. These last were the progeny of the Englishmen and their Tahitian wives, the native men having left no offspring.” As Doctor Shapiro points out, the islanders were already showing the orderly characteristics for which they later became famous, “Morning and evening family prayers were made a regular practice and services were held on the Sabbath.”

Morality and a prodigious increase in the population apparently were correlated in the subsequent history of Pitcairn. As Doctor Shapiro says, “Vital statistics are the bookkeeping of a nation. They reveal the present state of affairs, uncover past trends, and cast up a balance, favorable or otherwise.” From 1808 to 1856, the inhabitants increased from thirty-five souls to 193, or over 550 per cent. In 1856, fearing that the resources of their small island would no longer support them, the colony moved *en masse* to Norfolk Island. By 1864 about forty-five of the emigrants had returned to Pitcairn and it is from the voyagers who returned that the present population of over 200 is derived.

The Heritage of the Bounty is an excellent account of the history and present status of the people of Pitcairn, presenting its scientific conclusions in a thoroughly digested and entertaining form. Doctor Shapiro’s style is clear and direct and admirably conveys the flavor of this microcosm of Anglo-Polynesia.

The Great Dane of Greenland

Peter Freuchen’s contribution to anthropology is not based on the friendly objectivity of the scientist; he gained his knowledge of Eskimos by living with them, by eating their stinking food, by enduring their hardships (once cutting off his own toes with a nail puller and a hammer when his foot was

gangrened), and by marrying an Eskimo woman and raising two children. His life with her was an exceedingly happy one and it was not until her death and the crippling of his feet that he began to feel that Greenland was becoming impossible for him.

Since coming to this country Freuchen has written two popular books and has savored the delights of Hollywood; it would be interesting to know if he has conditioned himself to his present environment as happily as he did to such an utterly different one during his fifteen years in Greenland and northern Canada. He went to Greenland first in 1907, because he feared boredom in his native Denmark; he really wanted to work hard, to fight the elements for a bare living in a country where both much labor and good fortune are necessary to secure seal meat and skins. But he was fortunate in his companions. From his, as well as from other contemporary accounts of the Eskimos, the stay-at-home reader gathers the impression that if one were obliged to live in Greenland the Eskimos would certainly be the best companions to live with.

Freuchen relates a good many incidents that could hardly be retold in a family magazine, of which the Eskimos' custom of lending their wives to friendly visitors, is perhaps the least disconcerting. But his book leaves a final impression of being the adventure of a fine and understanding soul among a people admirable for their humor and their kindness.

We Europeans

The approach taken by Messrs. Huxley and Haddon in *We Europeans* is indicated by the subtitle, *A Survey of "Racial" Problems*, in which they put the word which is the focus of so much and such bitter argument in quotation marks. They are convinced that:

"No single scheme of classification can satisfactorily pigeon-hole all known human types, or even deduce without error the number and characteristics of the original 'primary' races of man. Whereas in the evolution of animals, there is a constant branching, each branch being isolated after a certain degree of differentiation by becoming incapable of fertile crossing with other branches, in man the branches constantly meet and unite and produce new types of shoots."

Hence, Huxley and Haddon think that the terms "race" and "sub-species" as applied to existing human groups have no significance. On the Nordic question, they admit that separate types can be distinguished within the white "ethnic group" (to use the phrase they favor), such as the tall fair Nordic, the round-headed Eurasian (often called Alpine) and the short, darker, long-headed Mediterranean. But they believe that there is no concrete evidence to show that "these hypothetical stocks once existed in a state of complete or almost complete purity." They think that six or seven thousand years ago blond and dark hair, tall and short stature, brachycephaly and dolichocephaly, were already widely distributed among the tribes of Europe. However, they admit that the present distribution of the Nordic type in Europe can be ascribed with reasonable certainty to invasion by a group composed largely of "men of this type—

perhaps in the degree in which the type is now found in parts of Scandinavia."

But while Huxley and Haddon admit the existence of the type they are extremely sceptical as to its exclusive possession of qualities that fit it to rule over other types.

Following Hrdlička, Huxley and Haddon think that the Nordic element in the "Old Americans" is small. They point out that observers get very different impressions of a people at different periods: where foreigners were once struck by the prevalence of tall lantern-jawed individuals in the United States they are now impressed by "the prevalence of square-faced stocky business men." As to national character:

"There was a time when England was called 'merry'; during the nineteenth century that epithet was not applicable. In Elizabethan times the English were among the most musical of the European nations; the reverse is generally held to have been true in late Victorian times . . . In Carlyle's time, the German national character was supposed to be peaceable, philosophic, musical and individualist. After the Franco-Prussian war it became arrogant and militarist. Now we are witnessing the blossoming of tendencies to state-worship, mass-enthusiasm and the like."

Perhaps the most interesting chapter of this book is the one on "The Principles of Heredity as Applied to Man" which contains an incisive discussion of Mendelism and the gene-mechanism of heredity and such new light as they cast on human problems.

Did Nietzsche Cause the War?

Disease and Destiny traces the influence malaria, smallpox, the Black Death (bubonic plague according to Doctor Major), and other diseases have had on the human race and its great men. The subject is a fascinating one; Doctor Major has collected many entertaining facts, and he reminds us effectively that malaria probably had a good deal to do with the decline of Greco-Roman civilization and that the plague in Athens may have damaged that city as much as the Peloponnesian War.

Unfortunately, Doctor Major is still toying twenty-two years after 1914 with such questions as "Did a paretic [Nietzsche] cause the World War?" He thinks that, through Nietzsche, "the French disease [syphilis] has changed the course of human thought just as it may have played a leading rôle in precipitating the recent catastrophe." Such weird opinions as this make one doubt the validity of his other conclusions.

—GORDON LAWRENCE.

A NATURAL HISTORY OF THE SEAS. By E. G. Boulenger. D. Appleton-Century Co., New York.

POPULAR interest in all matters pertaining to the life of the seas has been so universally aroused in recent years that there has been a great demand for books on the subject adapted to the general reading public. This new book by Dr. Boulenger is eminently adapted to fill a definite need in this connection. It is a concise review of the animal life in the seas, moving rapidly from the simplest forms of animals through the great invertebrate phyla and concluding with chapters on the fishes, sea reptiles and mammals. Finally, there is even a chapter on the legends regarding sea monsters.

Many striking forms of life are dealt with in the book, and curious partnerships between widely different species are described, such as, for example, the hermit crabs that carry stinging sea anemones on their backs for protection while they themselves furnish transportation and tear food apart to share it with their partners; giant jellyfish which shelter young horse mackerel; and Portuguese men-o'-war which protect certain fish from their enemies. Crabs, shrimps, sea stars and sea urchins are dealt with in turn, while many diverse strange and beautiful species of sea worms add to the picturesque-ness of the fauna described.

In a chapter on mollusks, the author reviews, in brief but interesting manner, the most striking of the sea snails, not only along our own coasts but those found in other seas, from the common periwinkle of the Atlantic coast and the polished cowries of eastern seas with their beautifully patterned shells, to the violet snails which build rafts of air bubbles and swim on the ocean surface. The voracious whelks are described that bore holes in other mollusks to suck out their soft contents. The bivalve mollusks are briefly described, from common oyster to giant clam, and several pages are devoted to description of squids and octopuses.

Descriptions of a remarkable diversity of fishes are packed within a few pages and pictured most vividly, from the familiar food fishes to the odd and grotesque creatures of the deep seas. In another chapter, sea turtles, marine lizards and the poisonous sea snake are mentioned, while manatees, seals, walrus and whales are not neglected.

The book contains somewhat over two hundred pages of text, and is filled with striking figures and photographs. As a whole, it forms a useful and popularly worded introduction to the life of the seas.—ROY W. MINER.

GENETICS. By H. S. Jennings. *W. W. Norton & Co.* 372 pages. \$4.00.

NO FIELD of modern biology has advanced more rapidly than that of genetics. Numerous journals devoted entirely to this field of research have sprung up in many parts of the world. America has from the very beginning taken the lead in this study. Although numerous text-books in English and foreign languages have appeared from time to time, few of the popular accounts which have appeared have been at all comprehensive.

Prof. H. S. Jennings, Director of the Zoological Laboratory of Johns Hopkins University, has been a leader in the field of experimental biology throughout the period that genetics has made its most important strides. In reviewing this field he has brought to bear a considerable amount of critical judgment, while at the same time he has avoided mere technical terms, with a view to making his book attractive to the intelligent layman.

The recent work on the effect of high temperatures, X-rays, radium, and various other physical agents on the hereditary mechanism are fully described. This includes the recent studies of Jollos, Muller, Goldschmidt, Plough, Demerec, Horlacher,

Johnston and others. The work of Stockard on the relation of endocrines to genetics in the evolution of the dog tribe with its possible bearing on human evolution is also discussed. There is a chapter on the constitution of the chromosomes and genes. The latter are no longer theoretical units of heredity. Several workers have claimed to have seen genes. Professor Jennings fully discusses this phase of the problem. There are other chapters which give the reader a clear view of the laws of inheritance and the action of genes during development. The recent discoveries as to the nature of sex both from the genetic and from the endocrine aspect are described, including the latest views on the relation of the autosomes to the sex chromosomes. The rôle of the environment in evolutionary change is also fully considered from the various aspects. *Genetics* is a book which all students of nature will find both comprehensive and inspiring.—G. K. N.

CONSIDER THE HEAVENS. By Forest Ray Moulton. *Doubleday, Doran & Co., Garden City.* \$3.50.

DOCTOR MOULTON is one of the world's leading authorities in astronomy, and especially in the field of celestial mechanics; he is co-author (with Chamberlin) of the Planetesimal hypothesis of the origin of the solar system. His new book is not just another book on astronomy; but it is definitely one of the outstanding recent works on the subject.

The book is intended to give a good picture of the stars and universe, and an idea of the methods of scientific thought, by which the astronomer arrives at his data. It is very pleasing to read, but not too easy by any means; to grasp the full significance without a careful reading would be difficult. Yet this book is very highly recommended by the reviewer because of its authority, the amount of data, the incomparable way in which the story is told, and the point of view of the author.

The first chapters give some history and a good idea of order prevailing in the seeming complexity of celestial motion. The Sun and all his family of planets are described in an absorbing way and there is a long chapter on their origin. Life on other worlds has a good chapter. Moulton says:

"If we could go to Mars! . . . vague visions . . . of rocket cars capable of making journeys through interplanetary space . . . there is not in sight any source of energy . . . to get us beyond the gravitative control of the earth . . . there is no theory that would guide us through interplanetary space to another world . . . no means of carrying the large amount of oxygen, water, and food . . . no known way of easing our ether ship down. . . ."

The last half takes up stars, nebulae, stellar systems, and galaxies. Taking an illustration from geology the author compares the study of paleontology to that of the stellar systems:

". . . Hutton and Lyell . . . read in the records of the rocks geological history extending back over millions of years . . . the dynamical records writ-

ten in the regularities of the globular clusters are expressed in characters which are fully as intelligible and as certain as the records in the rocks, and they cover periods perhaps a million times as long as the entire history of our earth."—HUGH S. RICE.

WORLDS WITHOUT END. By H. Spencer Jones. The Macmillan Company, New York.

THIS is a popular astronomy book—an introduction to the study of Astronomy—by that learned and distinguished man of science, H. Spencer Jones, the Astronomer Royal of Great Britain. That this book is scientifically accurate goes without saying—and this alone would make it a valuable addition to modern popular astronomical literature. That it should be such an eminently readable book as it is, a book which communicates so easily and so conversationally, the high spots of astronomical knowledge, is a matter for even greater rejoicing. There is here no text-book atmosphere, no condescending of the teacher to the taught. One sits down comfortably in the study of this wise astronomer and listens to his simply delivered words. And the picture of the universe here presented is a clear, an understandable one, insofar as it is understandable to any man. The earth, the solar system, the stars, the galaxies,—a review of past history and future possibilities,—all are presented here with no dogmatism, with no prejudices, but with the sanest judgment and a profound understanding of the limitations of our knowledge. The chapter called "Life in Other Worlds," for instance, could serve as a model of this kind of writing, presenting the facts clearly, so far as we know them, and leaving the reader himself to wander about as he pleases among the possibilities. The reader who can look beyond the surface simplicity of this book recognizes the vast amount of erudition and experience which have gone into the presentation of this material. Dr. Spencer Jones seems to be not only a great scientist but an unusual teacher.

The illustrations are excellent, culled from here and there among the world's great observatories. —MARIAN LOCKWOOD.

THE MUSHROOM HANDBOOK. By Louis C. C. Krieger. The Macmillan Co., New York. \$3.50.

AN ILLUSTRATED MANUAL OF PACIFIC COAST TREES. By Howard E. McMinn and Evelyn Maino. University of California Press. \$3.50.

HERE are two excellent manuals, both beautifully illustrated, and of convenient size for carrying in the field.


The *Mushroom Handbook* is impressively complete. It contains thirty-two color plates, from paintings by the author and more than a hundred black and white drawings and photographs. Mr. Krieger tells which varieties are safe to eat and which are poisonous, giving the amateur about as sure a guide as he is ever likely to find (although some of us amateurs would decline to eat any mushroom we had gathered in the field, even after

comparing it with all the handbooks). His account of the history and general characteristics of mushrooms is clear and concise; he tells in an interesting manner where they grow (and how to grow the cultivated species), their economic importance, seasonal occurrence, and the distinguishing characteristics of various species. He includes an appetizing array of recipes for cooking mushrooms.

An Illustrated Manual of Pacific Coast Trees is a thorough guide to the woody plants of one of the most interesting floras in the world. The dominance of the conifers, the pines, spruces, redwoods and their relatives in one of the richest forest regions is the more impressive, considering that similarly favorable locations in most parts of the world tend to be occupied by broad-leaved trees. Professor McMinn lists 59 species and varieties of native conifers against eighty-four ordinary broad-leaved trees, two arborescent yuccas and one palm. In our part of the world, in the whole vast area from Newfoundland to the southern boundary of Virginia and from the Atlantic west to the 102nd meridian, Britton and Brown list only twenty-eight native conifers.—G. L.

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