SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 78, NUMBER 7

EXPLORATIONS AND FIELD-WORK OF THE SMITHSONIAN INSTITUTION IN 1926

(PUBLICATION 2912)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
1927

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

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FIG. 1.—Table Mountain Solar Observatory. The bolometer which measures $\frac{1}{1{,}000{,}000}$ degree temperature is in the tunnel, and sunlight is reflected into it.

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INTRODUCTION

Field-work is essential to the advance of nearly all branches of science, particularly those which the Smithsonian Institution is at present engaged in promoting, namely, geology, biology, anthropology, and astrophysics. The Institution therefore embraces every opportunity of putting expeditions in the field to obtain desired information or collections, either under its own auspices through financial assistance from its friends, or in cooperation with other agencies which will benefit equally from the work. During the past year more expeditions, in which the Smithsonian was represented, have gone out than ever before, and this in spite of the fact that the Institution has practically no unrestricted funds for field-work. Had it the unfettered income from an adequate endowment, much more extensive field-work in accordance with a definite plan would be accomplished each year, and the advance along the whole front of human knowledge would be greatly accelerated. The Smithsonian holds in abeyance a number of important projects in many branches of science, awaiting only funds to finance them. These include researches, nearly all of which involve work in the field, in astrophysics, meteorology, oceanography, entomology, zoology, botany, geology, archeology and ethnology, physical anthropology, mathematics, and chemistry.

The present pamphlet is intended as a preliminary announcement of the results of the year's field-work. The accounts, although written in the third person, were for the most part prepared by the participants in the various expeditions, and the photographs taken by them.

FIELD-WORK IN ASTROPHYSICS

Does the sun vary, and if so, what effects on our weather do the changes of solar heat produce? For eight years the field-work of the Astrophysical Observatory has been aimed to solve this question. With the generous aid of Mr. John A. Roebling, special observatories were erected on desert mountains in Chile, Arizona, and California.

Daily reports of the condition of the sun are received from the observers, who patiently carry on in these isolated deserts far from

society, provisions, and even (at Mount Montezuma, Chile) from water.

Since January, 1926, these reports have been printed by the United States Weather Bureau on its daily weather map. Those who have followed them will have noticed that many days are missing and many rated unsatisfactory. It was to round out these records that the National Geographic Society on March 20, 1925, allotted $55,000 to Dr. C. G. Abbot, Assistant Secretary of the Smithsonian Insti-

FIG. 2.—Mt. Brukkaros. Looking towards the Observatory site near the top of the rim at the extreme right.

tution, and Director of its Astrophysical Observatory, to enable him to select the best site in the Eastern Hemisphere, erect and equip there a solar radiation observatory and maintain it for several years under the title "The National Geographic Society Solar-Radiation Expedition Cooperating with the Smithsonian Institution."

Accordingly, accompanied by Mrs. Abbot, he sailed from New York on October 31, 1925, examined the advantages of sites in Algeria, Egypt, Baluchistan, and South West Africa, and at length located the new observatory on Mount Brukkaros, South West Africa.

The mountain is 5,200 feet above sea-level and quite 2,000 feet above the plateau. The whole massif is composed of chocolate-colored rock with very little soil, though sparsely tufted with bunches of dry bush and grass, with here and there a queer cactus or dwarf tree. The cliffs are seamed into great cubes and the slopes are littered with fallen fragments.

The summit is like a cup with a flat bottom about half a mile in diameter and a steep rim 1,000 feet high. From a V-shaped

FIG. 3.—The precipice at Mt. Brukkaros leading up to the bottom of the cup. The water pools are just below the precipice.

break in the southeast side of the rim a precipice 60 feet high leaps to the bed of the dry stream, which leads down a 3-mile corridor to the plateau.

Since the observations require the use of the bolometer, that electrical thermometer sensitive to a millionth of a degree, they require very constant temperature surroundings. These are most easily obtained by making a horizontal shaft or cave, some 30 feet deep, right into the slope of the mountain near its summit.

The average yearly rainfall is $3\frac{1}{2}$ inches. Dr. Abbot was 12 days in the vicinity during March, which, equally with February, is

FIG. 4.—Observatory at Mt. Brukkaros.

FIG. 5.—Observer's quarters at Mt. Brukkaros.

the rainiest time of the year. On 11 days there were fine observing conditions each forenoon, though a bit of rain fell sometimes towards nightfall. That is surely a favorable record. There were absolutely no cirrus clouds—those wisps that slightly veil the sun and are fatal to our observing. There was very little wind—almost none in the forenoons—though in winter it sometimes blows hard.

Mount Brukkaros lies in a Hottentot reservation, and a vote of the tribe was necessary to permit us to locate there. This was

FIG. 6.—Hottentot village near Mt. Brukkaros, South West Africa, which will be the headquarters of the expedition.

easily carried. Lying about 20 miles to the west of the railroad and 250 miles south of Windhoek, capital of South West Africa, Mount Brukkaros sticks out as the only peak of consequence in a circle at least 50 miles in diameter.

Thus the observers are exiled to a crater in the wilderness seven miles even from Hottentot neighbors (at Berseba) and 60 miles from a fair-sized town (Keetmanshoop). We hope their loneliness will be mitigated by the facts that they are both fine fellows, inured to camp life; that they will have interesting work; that there will be games, music, books, and radio to beguile leisure hours; and that the leopards and other wild game, so plentiful in the vicinity,

will divert them. Perhaps they will raise a garden on the level bottom of the cup, if they can arrange for enough water.

The water supply is not so great a difficulty as it seems. By making a reservoir in the gulch in front of the observatory, the drainage of several square miles may be impounded. Even the few inches of yearly rainfall thus conserved will be abundantly sufficient.

For provisions and mail the observers must arrange with the Hottentots. With their own automobile, our men will make the

FIG. 7.—A Hottentot cattle-team near Mt. Brukkaros of the type which will be used to haul the expedition's instruments and supplies.

60-mile trip to Keetmanshoop frequently, where nearly everything needed can be obtained.

By permission of the Government of South West Africa, Mr. Dryden, of Keetmanshoop, Inspector of Public Works, constructed the observatory and approaches on Mount Brukkaros, last summer. Our expedition with its 60 boxes of delicate apparatus and supplies reached Keetmanshoop in September and was hauled to the foot of the mountain by two 12-ox teams in a 6-day journey. All the apparatus and accessories were at the top by mid-October. Observations began in early November.

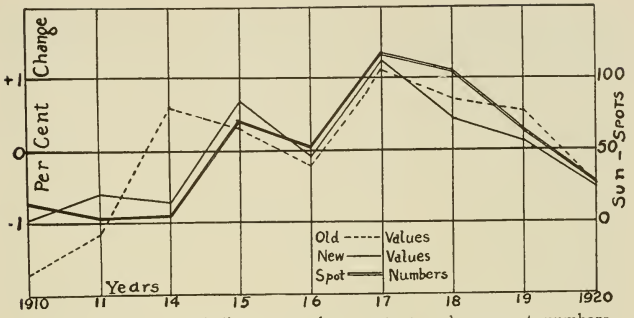


FIG. 8.—Selected pyrheliometry, solar constant and sun spot numbers compared. Mt. Wilson work, Julys 1910 to 1920.

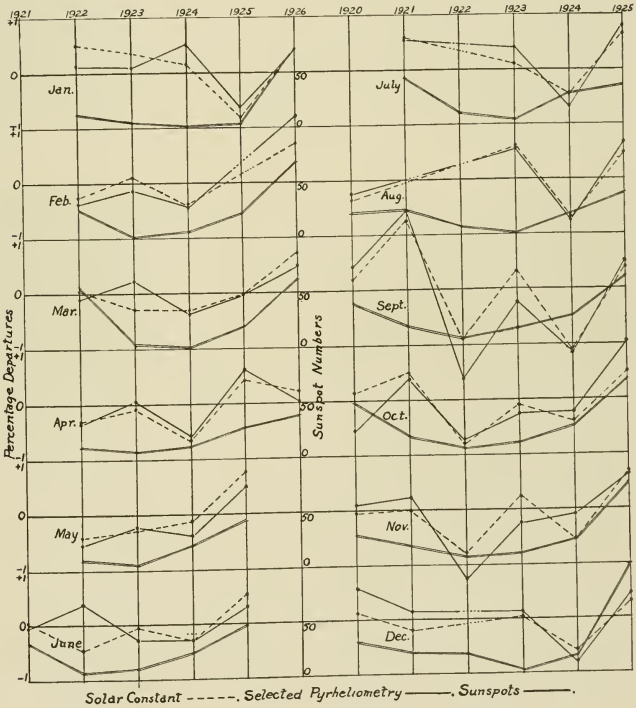


FIG. 9.—Montezuma observations, all months, 1920 to 1925.

FIG. 10.—Observer's quarters at the solar station on Table Mountain.

FIG. 11.—Looking toward the Mojave Desert from Table Mountain.

FIG. 12.—Reading the weather instruments at Table Mountain.

FIG. 13.—Reducing the observations at Table Mountain.

Returned from this expedition, Dr. Abbot, finding various critical papers published during his absence tending to express the view that solar variation is still doubtful, devised a new proof of it depending on a simple inspection, on selected days, of the pyrheliometric measurements of total solar radiation. By choosing for comparison only days of equal atmospheric transparency and humidity, the uncertainties which critics had stressed were largely eliminated. This new treatment supported closely the more elaborate and continuous indications of solar variation obtained by the complex process of spectrum analysis.

In figures 8 and 9 the new and old work is compared for separate months on Mount Wilson and Mount Montezuma, and the parallel variation of sun-spot numbers is also shown.

Having found from this new study, as well as from previous work at Mount Harqua Hala in Arizona, a source of error due to the bright rays of sky light immediately about the sun for very hazy days, an improvement of the silver disk pyrheliometer consisting of a very long vestibule has been made, designed to greatly limit the sky rays admitted to the field of view of the instrument.

In the frontispiece, figure 1, Field Director A. F. Moore is shown observing with the improved instrument at the new solar station on Table Mountain, California, built with the generous aid of Mr. John A. Roebling, and first occupied in October, 1925.

SMITHSONIAN-CHRYSLER EXPEDITION TO AFRICA TO COLLECT LIVING ANIMALS

The Smithsonian-Chrysler Expedition to collect living animals for the National Zoological Park sailed from New York on March 20 and arrived in Dar-es-Salaam, Tanganyika Territory, East Africa, on May 5. The expedition was financed by Mr. Walter P. Chrysler. Tanganyika was chosen as being one of the best localities in which to make a representative collection of the game animals of East Africa.

The party consisted of four members: Dr. W. M. Mann, Director of the Zoological Park and leader of the expedition; Mr. Stephen Haweis, artist and amateur naturalist; Mr. F. G. Carnochan, of New York City; and Mr. Arthur Loveridge, of the Museum of Comparative Zoology at Cambridge. The latter, having previously resided eight years at Tanganyika, some of which had been spent in the Game Department there, was conversant with conditions in the country, and in addition, had a good knowledge of Kiswahili language. The Pathe Review sent with the party Mr. Charlton,

FIG. 14.—Unloading crates at Dodoma. These were made at the Zoo and shipped taken down.

FIG. 15.—Wagogo natives at Dodoma.

one of their field men, to make a pictorial chronicle of the trip and the work of the expedition.

The United States Marine Corps supplied the expedition with cots, blankets, and certain other equipment, and the Freedmen's Hospital, of Washington, through the Chief Coordinator's Office, furnished the medicines.

At Tanga, the first port of call in Tanganyika, Mr. Fair, Assistant Chief of the Game Department of Tanganyika, joined the boat, and on the voyage between there and Dar-es-Salaam arranged a special permit for collecting, which was afterward signed by the Governor of the territory. There is in Tanganyika a well-organized department for the conservation of game. There is a chief, C. T. M. Swynnerton, and an assistant chief, several white rangers, and a considerable corps of native guards or scouts. The latter are much in evidence, and even in the remote parts of the territory would come into our camp, ask to see our license, take its number and our names, and find out from the natives with us just what we were doing. The very generous license that the Governor gave us proved invaluable, as it gave permission to capture specimens of practically all of the game in Tanganyika and, when necessary, to kill females in order to capture the young. This is not often necessary, and on the entire trip we did not take a single animal by the killing of the mother.

Headquarters were made at Dodoma, about 250 miles inland from the coast. The country about there is hot and dry, rolling and dotted with rocky kopjes, and reminds one strongly of parts of southern Arizona. The natives belong to the Wagogo tribe, an offshoot from the Masai, and are a pastoral and agricultural people, living on their flocks and herds and on the small amount of Kafircorn that they cultivate. Not being a hunting tribe, they brought in to us very few large specimens but were very useful in collecting small things. Weaver birds do a vast amount of damage to the crops and the natives are in the habit of trapping these birds in quantities in small woven basket traps. So instead of destroying the birds, they brought them in to us, as well as anything else they happened on, and in this way were obtained a ratel, a fennec, a number of vervet monkeys, and a few reptiles. Mr. Loveridge and Mr. Haweis stayed at Dodoma a good part of the time, but made short trips out, and afterwards Mr. Haweis came down to Morogoro and stayed a month at Mhonde, 60 miles from Morogoro. In this locality we secured five blue monkeys, three golden baboons, and a pair of elephant shrews.

Mr. Carnochan worked in the Tabora district, where he lived among the Manumwezi tribe, experts in snake catching, and his division of the expedition succeeded in forming a considerable collection of snakes, several interesting mammals, including a female eland, and a rare caracal.

The party had been joined on the boat by a Mr. Lyman Hine, of New York, an American sportsman, and he and Dr. Mann, accompanied by two white hunters, George Runton and Guy Runton, left Dodoma by motor car and reached Umbugwe, about two hundred

FIG. 16.—Natives gathered for instruction on game drive.

miles to the north, where they made safari to Lake Manyara. Mr. Hine was able to stay in the field only a month when he returned, business calling him back to America. But Mr. George Runton, a professional hunter and guide, stayed with the expedition during its entire stay in Tanganyika and proved a most valuable addition to the party.

The Governor's license proved important at Umbugwe, for it enabled us to acquire 90 porters, men of the Wamboro and Wambugo tribes. The latter have the reputation of being swift runners, which they bear out from time to time by running down animals. The first catch on the lake was a water mongoose, which was run down on the lake shore and boxed.

FIG. 17.—Our first zebra colt.

FIG. 18.—Herd of white-bearded gnu.

FIG. 19.—White-bearded gnu calves.

FIG. 20.—White-bearded gnu calf.

On Lake Manyara we captured the three white-bearded gnu which we brought to Washington. As we marched along the shore of the lake, the herds of gnu would run in front of us, back and forth the whole day, and when evening came they were very tired and attempted to cut back between us and the lake. Our porters dropped their loads and headed them off. They got into the shallow lake and mixed together. When the splashing had died down, little groups of natives brought back the calves which they had seized. These became tame very quickly, fed readily, and were thoroughly satisfactory animals to catch and keep.

Mr. George Le Messurier joined the party to drive the motor car which the Chrysler factory in London had presented to the expedition. He kept the car busy between Umbugwe and Dodoma, carrying in specimens as fast as we had a ton of them accumulated. On the first trip, Dr. Mann accompanied the animals to Dodoma, sending Mr. Runton on to the Masai Steppe to look for young rhinos. We had been told that they were very abundant toward the Ngoro-Ngoro crater. Dr. Mann returned to Umbugwe in a week, climbed the escarpment to Umbulo, and started in the direction of the crater, but on the evening of the first day met Mr. Runton and his party coming down. In one week they had seen only four rhinos, no young nor signs of young, and since Mando, our best native guide, had told of a district, the Ja-aida swamp country, in which he said there were "Faro mingi sana" (very many rhinos) we went down into this region and found what he said to be true. Altogether we saw 22 rhinos. Our safari was charged once while on the march, and four times at night rhinos charged through our camp. But in all of these we failed to locate a single young specimen. Five different times we crawled into the scrub 30 or 40 feet from a rhino to see if it had young and were disappointed each time. One locates these rhinos, by the way, through the tick birds, which make a loud twittering at the approach of any suspicious object to the rhino on which they are clustered for the purpose of eating the ticks which are so abundant on its body. Theoretically they serve a useful purpose to the rhino by warning him of his enemies. Actually we found they were useful in leading us to where the rhino were lying, for we were attracted by the birds to each of the rhinos that we found.

The night charges are simply the result of the stupidity of the rhino. We camped usually in the vicinity of water holes, and when the near-sighted beast came to water late at night or early in the morning he would suddenly notice that there were fires and natives about. Whereupon he would put his head down and charge through

in a straight line. On these occasions the natives have a frantic desire to get into the tents to be near the white men and the guns; the white men on the other hand have a frantic desire to get out of their tents, and the result is a collision at the entrance. Two rhinos came into our camp the same night. When the second one came, Le Messurier heard it snort and the sound of its tramp, and just then a native tripped over one of his tent ropes. He left the tent in a hurry, but was met by twelve boys entering it at the same speed,

FIG. 21.—A serval cub, one of our bottle babies.

and the result was that he was thrown and injured his knee so badly on a tent peg that we had to rush him back to Dodoma for medical attention. This, and the fact that we had spent 28 days without seeing a single young rhinoceros, made us decide to split up the expedition even more. So Messrs. Runton and Le Messurier stayed at Kondoa Irangi, while Dr. Mann secured the services of an additional hunter, Mr. C. B. Goss, and went down the railroad to Ngere-Ngere, and from there southward into the Tula and Kisaki districts to begin another search for rhino.

We saw, on the average, signs of five rhino each day, but again neither young nor fresh tracks of young. So after 10 days, time being

short, we camped at Tula to collect whatever we could, but especially giraffes. Two native sultans, Chanzi and Chaduma, joined forces with us for a week, bringing with them about 500 natives. With the help of these we had the most successful trip of the expedition. Some of the boys from a mountain nearby had had some experience in netting game. They make a coarse seine of native rope in sections about five feet high and 15 feet long. These were placed in a row, until they made about 1,000 feet of native fence, one boy hiding behind each section. The two lots of natives would double over their ends and join in a circle about a mile in circumference, then closing in toward the net. The object was to drive animals into

FIG. 22.—Safari at rest.

the net, but nine times out of ten they would break through the line. Occasionally, however, they came straight on. One day a herd of over 50 impalla was surrounded. This is the most graceful antelope in Africa and a great leaper. Most of them sailed right over the net, but five fell short and we got them all. Fortune was with us as far as impalla were concerned, for it is one of the most delicate animals to handle, and yet all of ours reached Boston alive and in good condition.

Wart-hogs were captured in the same way and a troop of four were added to the collection.

Besides rhinoceros, giraffe was one of our important *desiderata*. They were abundant about Tula but not easy to catch because we had no horses. We tried time after time to run them into the nets, but a herd of giraffe runs in a file led by the biggest bull, and he

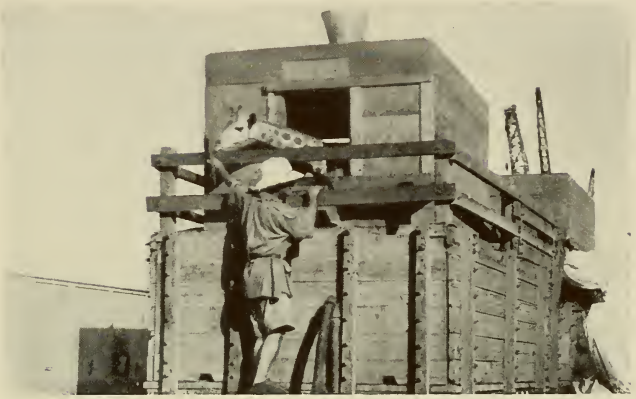


FIG. 23.—Hi-Boy, the male giraffe in crate.

FIG. 24.—Hi-Boy, the male giraffe in crate.

apparently enjoyed kicking the nets into the air as high as possible; whereupon they would all rush through and disappear in the scrub. But once we succeeded in separating from the herd a calf about eight and a half feet tall, and one of the natives grabbed it by the tail, another by the neck, and threw it. We got it into camp, carrying it on a native bed heaped high with grass, and put it in a room of the Kafir native-built house in which we were staying. It became quite tame in a short time, and fed readily on milk and mimosa leaves. Dr. Mann rushed to Dar-es-Salaam and had a crate built for

FIG. 25.—Handling stock at Dar-es-Salaam.

it, which was delivered to Ngere-Ngere. The animal was taken in a motor car from Tula, a distance of about 80 miles, and at last arrived safely in Dar-es-Salaam, where its crate was placed beneath a mimosa tree in the yard of the Government veterinarian. It was then that we telegraphed the Smithsonian that we had captured the giraffe. However, after 10 days, the animal was attacked by pneumonia and died very suddenly, leaving us with our homeward passage engaged on the last steamer to arrive in the States before cold weather and without the main object of the trip attained. We cabled the Sudan Government to see if they could let us have specimens and received word that they could let us have a pair of young giraffe. So all members of the expedition gathered with their respective cages

in Dar-es-Salaam. For three days we maintained a menagerie visited by everybody in the city and finally embarked on the Crewe Hall, which took us to Colombo, where we transhipped on the City of Calcutta for a direct run to Boston. We landed with about 1,700 live animals, including the two giraffe (which were brought to us at Port Sudan by Mr. Skandar Armenius, assistant game warden of the Sudan, who brought also a shoebill stork), five impalla, a greater kudu, an eland, a blue duiker, red duiker, three white-bearded gnu, four wart-hogs, and quantities of birds, small mammals, and reptiles.

FIG. 26.—Aboard the steamship, Crewe Hall.

VISITS TO THE SERPENTINE DISTRICT OF SOUTHERN ENGLAND AND THE GEM-CUTTING TOWN OF OBERSTEIN, GERMANY

Dr. George P. Merrill, head curator of geology in the National Museum, availed himself of the opportunity offered by the Geological Congress in Madrid to visit some of the more important museums of England and on the continent, and also to visit sundry localities of geological and mineralogical interest. Among the more important, mention may be made of a visit to the historical quicksilver mines at Almaden, Spain. The party from the Congress was permitted to descend to the 280 meter level, where a fine massive body of ore (cinnabar) was exposed, embedded in quartzite. A series of typical

specimens was collected and forwarded to the National Museum through the office of the United States Consul. At the close of the Congress a party was formed, of which Dr. Merrill was a member, visiting Barcelona, with side trips to the eminence Tibidabo and the monastery on Mount Serrat, and thence going to the Island of Majorka, one of the Balearic group. Here, from June 5 to 13, inclusive, a series of automobile trips took the party well over the Island, visiting many interesting points and examining in detail the evidence of overthrust faulting and folding which abounds. Later in the season, trips were made to the serpentine and tin mining districts

FIG. 27.—Kynance. The rocks are of the historic *Lizard Serpentine*.

of southern England and the noted gem-cutting town of Oberstein in Germany. A brief account of these two trips is given below.

THE LIZARD SERPENTINES

In the early literature relating to petrographic research are to be found many references to the serpentinous rocks of Cornwall in southern England, and their problematic origin. Concerning this last, it was long ago decided that they were the result of the combined forces of igneous intrusion and subsequent metamorphism. It is with the rocks as they are today that this note has to deal; the exact locality is Kynance, near Lizard Point and but a few miles west of England's "jumping off" place, or Land's End. It is a most fascinating place on a fair, warm day in July. The country is

rough and the shore often precipitous. The rock where exposed to the action of the waves and windblown sand assumes an almost ebony-like hue and polish, but on close inspection it is found to be often filled with small streaks and gashes of a blood-red color. Broken fragments on the beach have given rise to a diversified series of oval pebbles of green, gray, purplish and red colors from which it is a delight to assort and select those which are most beautiful. Below the zone of pebbles the beach is of fine, clean sand over which the warm waters of the cove seeth with seductive softness, making it a bathers' paradise. As bathers are out in force one looks for bath

FIG. 28.—Pendeen. A glimpse of an old tin mining region in Cornwall.

houses, but not one of these ugly conveniences disfigures the landscape. A brief investigation reveals the fact that the numerous caves worn by the sea in the shattered serpentine are made to answer, and in their shallow and not very dim recesses may be seen groups of men and maids making the slight changes in raiment considered appropriate to the occasion. There is a primitive simplicity about it that is very pleasing, though it might have been a trifle shocking to a modest man had he witnessed it before his eyes had become accustomed to the scanty costumes of the present day.

Naturally the beauty of the stone, when polished, long ago attracted the artist and the artisan, and attempts were made to utilize it as a marble for interior decoration. The attempt failed for the same

reason that has brought disaster to a large proportion of like attempts elsewhere, namely, the badly jointed condition of the stone—its dry seams and like defects that prevent the getting out of pieces of more than moderate dimensions. Nevertheless, in the museums and art galleries are frequently to be found turned bowls, vases, urns, and stands for busts, of good design and color, the work of these earlier years. A very considerable souvenir industry still exists. To be counted by the score are the little shops in Kynance, Penzance and elsewhere where the natives work up small pieces into objects more or less—usually less—artistic, but always interesting for the variegated veining and for their colors. One can but regret that an arrangement cannot be made whereby with larger means better work could be done.

For the tourist, the approach to Kynance is by bus from Penzance, a delightful little town, ancient but now becoming popular, though one may hope not fashionable.

A few miles eastward are the historic tin workings of Cornwall now largely discontinued owing to the increasing depth and low grade of the ores. The country is at best bleak, and the miles of stone-walled abandoned pits and ruined shaft-houses, often with little more than chimney standing, add to its picturesqueness but not to its beauty.

GEM CUTTING IN OBERSTEIN-IDAR, GERMANY

The towns of the Nahe Valley are not large. Indeed, there is not room in the narrow valley for large towns, and whatever attempts are made to attain greater dimensions must end only in increase in length. Doubtless the little stream has done and is doing its best, but geological processes are slow. The work that has thus far been accomplished is more in the way of depth than breadth. So narrow is the resultant valley that there is, for the most part, space for but a single street, along which the houses are jammed back against the solid ledges of rock which rise abruptly behind them.

The geological history of the region is interesting, and inasmuch as it is this that has given the towns their industry and importance, it may be briefly touched upon.

Very many years ago, so long ago that it can be approximated only in the rough divisions of geological time, there occurred here an enormous outbreak of volcanic activity. Huge steaming masses of lava flowed out over the region and in time became consolidated into the solid rock now forming the high hills on either side and down

through which the patiently persistent Nahe has cut its way. But the upper portion of the consolidated mass was full of steam cavities, large and small, like those in a well-raised loaf of bread. Into these the heated waters carried silica in solution and formed agates. In turn, as the rock decayed and the stream cut deeper, these agates being less destructible, accumulated in the soil and ravines, to be collected doubtless at first as mere curiosities. Interest in their banded structure was probably aroused from broken fragments which led to laborious grinding of flat surfaces on sharp-gritted sandstones. Later yet they were ground by holding them against huge revolving grind-

FIG. 29.—Grinding agates. Oberstein—Idar.

stones driven by slow-turning undershot water-wheels, the operator lying prone upon a roughly carved wooden form moulded to his chest and abdomen, and with feet braced against a wooden cleat nailed to the floor. This crude system is still followed in many of the smaller shops, but is laborious and unhealthy, the confined position of the lungs and constant dampness from the cold, wet wheel being productive of rheumatism and pulmonary troubles. In all the many "Schleiferei"—shops devoted to gem cutting, and there are some hundreds in the region—the slicing is now done on circular saws of thin metal charged with diamond dust, and the grinding on metal plates revolving horizontally, at which the workmen sit in comfort.

Exhaustion of the local supply it may be safely assumed resulted in the reaching out into world-wide sources for new materials, and

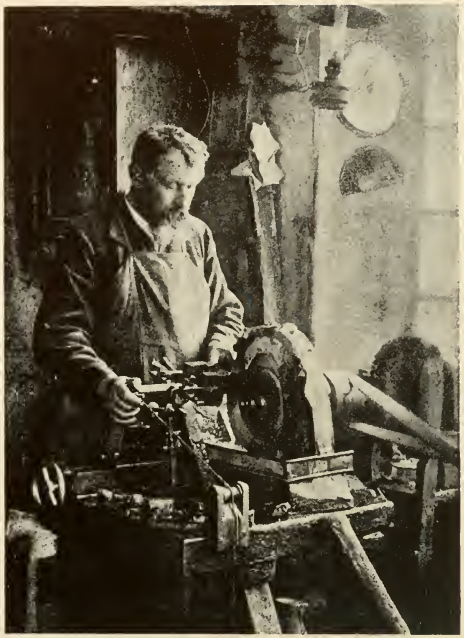


FIG. 30.—Oberstein. Slicing gems with diamond saw.

FIG. 31.—Oberstein. A stone engraver.

a contemporaneous development in the art of cutting as well. Agates, amethysts, and topazes from Brazil, kunzite from California or Madagascar, beryls including aquamarines, golden beryls and morganite from Madagascar and America, peridot from Oriental sources; amazon stone and rose quartz from America, are among the many varieties.

FIG. 32.—Grinding facets on gem stone.

Aside from the facetted forms, beads, pendants, etc., used in jewelry, a variety of ornamental bowls, trays, vases, paper knives, some of which are very beautiful, are cut from the agates, rose quartz, lapislazuli and other of the so-called semi-precious stones, many of which find their way into museums and mineral collections where they are highly prized. A visit to the little local museum is needed to convey a full idea of the variety and beauty of the work now carried on behind the walls of the unimpressive buildings with

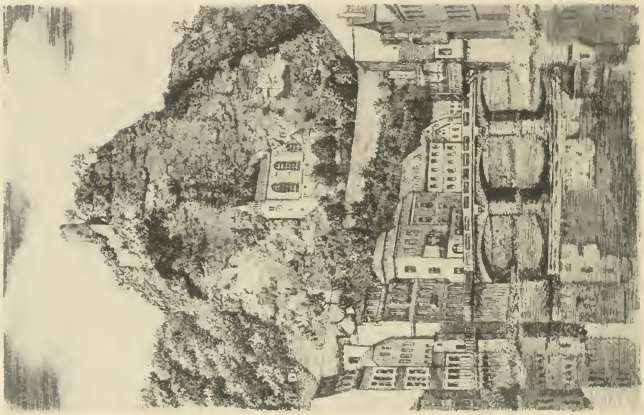


FIG. 34.—Oberstein.

FIG. 33.—Oberstein.

which the street is lined. Today the towns offer an interesting illustration of the continued development of an industry long after the conditions which gave it birth have ceased to exist.

Interest in the two towns is, however, not limited to the " edelstein " industry. High up on the ragged hills that dominate Idar are the ruins of two castles dating back to a very early period—it is said to about the middle of the eleventh century. Tradition has it that in one of these dwelt two brothers. Whether a cat or a lovely maiden was the exciting cause (the tradition varies on this point), a violent quarrel developed which culminated in the younger being thrown from the castle window and dashed to pieces upon the rocks below. Repentant for his hasty act, the elder wandered aimlessly forth, entering first the service of the prior of a Rhenish monastery and afterward becoming a crusader, ultimately receiving absolution on condition that he return and with his own hands erect a sanctuary upon the exact spot where his brother fell. The penalty was carried out, and the now existing church, erected it is said in 1482, occupies the original site. It is an interesting little relic, its steeple alone projecting beyond the face of the cliff, and is well worthy the climb of the 163 irregular stone steps to give it a visit.

EXPLORATIONS FOR MICROFOSSILS IN FRANCE AND GERMANY

Probably no branch of natural history has received more intensive study during the past 10 years than the microscopic fossils which have proved of such great value in the determination of underground structure, particularly in oil geology. The paleontological collections of the U. S. National Museum are rich in species of fossil microorganisms from many American Mesozoic and Cenozoic formations. Although many of these species have been separated and photographed during the past 20 years, their descriptions have never been published because of uncertainty regarding their relationship to the many described European species. Numerous large monographs and thousands of smaller articles upon European microfossils, particularly the moss-animals or bryozoa, the bivalve crustacea or ostracoda and the foraminifera among the protozoa, have been published during the past century but, in most cases, the illustrations are either freehand sketches or diagrammatic drawings which make the recognition of the species uncertain unless specimens from the type locality are available for study. To secure such typical European material for comparison with the American faunas, Dr. R. S. Bassler, curator of paleontology, U. S. National Museum, spent August and Septem-

ber, 1926, in a study of various classic localities in France and Germany.

The first two weeks were occupied in a study of the Paris Basin in company with Dr. Ferdinand Canu of Versailles, France, the most eminent student of microfossils upon the Continent. The various publications upon American fossil bryozoa by Canu and Bassler were prepared entirely by correspondence, dating back to 1909, so that the actual meeting of these co-workers was a long anticipated pleasure. The result was that more time was spent in personal conference upon the past and future work than in actual field investi-

FIG. 35.—Die Pfalz, Rhine Gorge. (Photograph by Bassler.)

gations. However, the main formations of the Paris Basin were studied in a general way, but the most valuable collections of microfossils from this area were donated by Dr. Canu from material secured in his previous researches. In remembrance of this meeting and of his years of pleasant association with the paleontological work of the National Museum, Dr. Canu also presented to the National Museum his entire collection of French Cenozoic and Mesozoic fossils, numbering not less than a hundred thousand specimens. This gift is of particular interest to American paleontologists in that all the specimens are most carefully labelled as to exact horizon and locality, a most necessary item in present-day studies but often lacking in many collections from foreign countries.

Leaving Dr. Canu with much regret, Dr. Bassler proceeded to the Rhine valley where he studied, in succession, the broad plain around Strassburg, the valley to Mainz and the valley of the Main River from Mainz to Frankfort. Next the trip through the Rhine gorge was made, which was particularly interesting in that a first-hand knowledge was obtained of the Devonian stratigraphy of this classic area. Important collections of Devonian fossils were secured here, and the classification of them as well as of other collections from this area secured in the past, can now be made intelligently.

FIG. 36.--Bavarian Plateau at Munich with Deutsches Museum.

Although Rhine valley scenes are familiar to all, the photograph of the Pfalz in the middle of the river, the ruined castle at the top of the plateau, the modern town at the water level and the terraces for vineyards, in addition to the stratigraphy (fig. 35) make a combination of geological and historical interest hard to surpass.

The Early Tertiary deposits of southern Bavaria were next studied, and opportunity was taken here to visit the wonderful Deutsches Museum at Munich (fig. 36) where one can study the underground geology of the earth's crust in the basement halls and proceed from story to story through all phases of human activity until in the planetarium at the top of the building the movements of the heavenly bodies are exhibited. A chance to study the Mesozoic limestones of

the Bavarian Alps quickly and without effort was afforded by a visit to the Zugspitze on the Bavarian-Austrian boundary where the recently completed cable system to the top of the mountain, over nine thousand feet high, conveys one in 20 minutes over this distance which the best of climbers cannot accomplish in less than two days. The tiny car, operated as shown in figure 37, brings one at times

FIG. 37.—Cable road to top of Zugspitze, Bavarian Alps.

close enough to the limestone strata to give a good idea of the geological structure.

Proceeding northward from Munich, various regions in Germany were studied with profit both in the amount of good study material secured and in the information regarding stratigraphic relationships. The classic Mesozoic region north of the Hartz Mountains was visited in company with Mr. Ehrhard Voigt, an enthusiastic student of microfossils at Dessau, Germany. Mr. Voigt also accompanied

FIG. 38.—Baltic Plain, south of Berlin. Taken from train, the shadow of which shows in fore part of view. (Photograph by Bassler.)

FIG. 39.—Chalk cliff along coast, Island of Rügen.

Dr. Bassler to other regions celebrated in German stratigraphy, particularly the potash areas around Stassfurt, the drift region around Dessau and other regions to the north, and finally to the Island of Rügen on the Baltic. During these explorations, a short time was spent in the Berlin Basin where under the guidance of Dr. Kurt Hucke, of Templin, Germany, a good idea of the geology was obtained. This area and that to the north belongs to the Baltic Plain, a flat region covered with glacial deposits (fig. 38) in which the underground stratigraphy is made out with difficulty. However, the pebbles in these drift deposits afford such good clues to the geological structure, from their contained fossils, that a new phase of research has been developed by Dr. Hucke and his associates and a special society for this study has been formed. *Der Zeitschrift für Geschiebeforschung,* the journal of this society, of which Dr. Hucke is President, contains discussions of drift problems which are quite new to the American investigator.

The classic Island of Rügen, off the north coast of Germany, with its chalk cliffs of Cretaceous age, was then visited, and although most beautiful from a scenic standpoint, it proved at first very disappointing paleontologically. Hundreds of species of Cretaceous microfossils have been described from this area and it was believed that the specimens would surely occur in great abundance. However, as shown in figure 39, the cliffs are almost inaccessible and only the chalk blocks which have fallen to the beach are available for material. Upon breaking up these blocks, few fossils were found. The disappointment was lessened by the fact that the shore is composed of undecomposed boulders of various igneous rocks, limestones, sandstones and other types deposited here as drift material during glacial and subsequent times. All the various formations to the north are represented and some of the formations are evidently from outcrops at the bottom of the Baltic Sea for they never have been found in place on the land. The latter formations, curiously enough, were particularly rich in microfossils. The disappointment over the few fossils in the chalk bed was dissipated entirely when the " Kreideschlemmerei " or chalk washing establishments at the town of Sassnitz on Rügen were located. It happens that an important industry has been developed around the use of chalk for various whitening purposes, but the chalk must be pure and free from fossils and flint fragments. To accomplish this, the chalk is passed through the washers and all the fine and coarse débris is sieved out and thrown aside leaving the water with its dissolved material to settle. The

pile of débris resulting from such washing as shown in figure 40 explains why so many fossils have been discovered in this area. Not only were many excellent echinoids, brachiopods and other large fossils picked up in the dump heap, but literally billions of microfossils were obtained simply by shoveling up several boxes of the fine débris.

FIG. 40.—Kreide-schlemmerei at Sassnitz, Island of Rügen, showing chalk cliff in background and pit dump heap of fossils in foreground. (Photograph by Bassler.)

The last few days of the trip were spent in London where an idea of the stratigraphy of the London Basin was obtained although most of the available time was devoted to a study of Museum methods and to conferences with scientific friends. The material results of the summer's work have reached Washington safely and after two months' work are now unpacked and in proper form for study.

GEOLOGICAL FIELD-WORK IN THE ROCKY MOUNTAINS

In continuation of the geological field-work in Rocky Mountain stratigraphy, under the direction of Secretary Charles D. Walcott, Dr. Charles E. Resser, associate curator of paleontology, U. S. National Museum, accompanied by Mr. Erwin R. Pohl, of the paleontological staff, left Provo, Utah, with the regular field outfit late in July, 1926.

The first objective was the determination of the section in Shoshone Canyon west of Cody, Wyo. The strata were here found to be rather badly metamorphosed, and fossils were few, but enough information was obtained to determine the position of the exposed Cambrian beds. An attempt was next made to work out the difficult sections farther north in the Beartooth Range, with the result that the proper stratigraphic position of the rocks was determined although the minor details could not be ascertained because of the ruggedness of the country.

The major objective of the season's work was a restudy of the famous sections north of the Gallatin Valley in Montana. Camp was established at Logan and daily trips made into one or another part of the foothills north of the Gallatin River. Mr. Pohl here investigated the Devonian strata particularly, securing good study collections. The Cambrian beds yielded many fine trilobites and other fossils as they have in the past, but a new locality in Nixon's Gulch furnished a large collection representing the Middle Cambrian Stephen fauna of British Columbia.

After the extended stop at Logan, camp was moved to Pole Creek south of the Madison River in the foothills of the Madison Range. Here ample collections were obtained from Middle Cambrian beds from which the National Museum had previously but a few fragments.

Near the close of the season several days were occupied in the study of the exposures in the Wasatch Mountains north of Brigham City, Utah. Dr. Asa A. L. Mathews, of the University of Utah, joined the party and served as guide to the places where he had previously discovered outcrops of fossiliferous Cambrian and Canadian formations. Two very strenuous trips to the top of the range resulted in obtaining many instructive fossils.

The season as a whole yielded returns beyond the average for several seasons past, in quantity and quality of fossils and in new stratigraphic data.

FIG. 41.—Shoshone Canyon, west of Cody, Wyoming. Upper Cambrian beds directly beyond bridge. Massive limestone below bridge, Bighorn Formation. Wall of Canyon at right, Mississippian rocks. (Photograph by Milwaukee Public Museum.)

FIG. 42.—View northward across Gallatin River, north of Manhattan, Montana. Low hills of Paleozoic rocks. Nixon's Gulch on right side. (Photograph by E. R. Pohl.)

FIG. 43.—Gallatin Valley at Logan, Montana. Upper Cambrian strata at extreme right. Massive cliff, Jefferson limestone. Gully at left typical feature due to outcrop of the Three Forks Shale. (Photograph by E. R. Pohl.)

FIG. 44.—Gallatin Canyon near Cherry Creek Road. Cliffs formed by Paleozoic limestones. (Photograph by Chas. E. Resser.)

FIG. 45.—Details of Middle Cambrian strata, north side of Gallatin River, east of Logan, Montana. (Photograph by Chas. E. Resser.)

GEOLOGICAL FIELD-WORK IN NEW YORK AND ONTARIO

In continuation of work begun in 1925 by the division of paleontology of the U. S. National Museum, Mr. Erwin R. Pohl was detailed to spend four weeks during the summer of 1926 in the field in procuring the detailed data necessary to label correctly as to geological horizon the large collections of Devonian fossils from many classic localities in the eastern United States. Work was continued on the section at Kashong Creek in west-central New York where the beds of lower Hamilton age, including the Skaneateles and Ludlowville shales were made the subject of close stratigraphical

FIG. 46.—Falls of Kashong Creek over upper part of Ludlowville shale. Bellona, Seneca Lake, N. Y. (Photograph by E. R. Pohl.)

study. These strata contain many rare and excellently preserved invertebrate fossil remains, and not only were the collections increased but the information was also acquired to make those already in the Museum of real scientific value under the newer methods of study. Figure 46 illustrates one of the many charming waterfalls that abound in this section of the country. The strata here lie practically horizontal, and the falls are almost invariably due to the resistance of a harder bed of rock and the undercutting of the less resistant underlying layers.

At Ithaca, N. Y., due to the general southerly dip of the strata, excellent exposures of upper Devonian rocks are afforded, and the locality shown in figure 47 is a collecting ground that has long been

favored by geological collectors. The beds exhibited are at the base of a considerable invasion of the Portage during the Upper Devonian and carry a distinct fauna of striking forms. Several other noted localities in central and western New York were also paid brief visits. The most important of these trips, both in purpose and result, was that to examine the Middle and Upper Devonian beds at the celebrated series of sections along 18 Mile Creek and the north and south shores of Lake Erie. In this vicinity the entire sequence of the Hamilton, which in central New York comprises some 400 feet of

FIG. 47.—Ithaca Falls over Ithaca beds of Portage age. Ithaca, N. Y. (Photograph by E. R. Pohl.)

rock and in eastern New York and Pennsylvania is as thick as 3000 feet, is represented in less than 90 feet of superimposed beds. The faunal sequence, however, is as well marked, and the zones even more distinct than those of their eastern equivalents, for here the succession lacks many of the invasions that are represented in the more easterly deposits of the same age. This portion of the expedition was undertaken in cooperation with the Department of Geology of the Milwaukee Public Museum, which institution was represented by Mr. Gilbert O. Raasch, assistant curator of geology.

Following the work at 18 Mile Creek, Mr. Pohl proceeded alone to Thedford and Arkona, Ontario, Canada, for the purpose of

FIG. 48.—Beds of Hamilton age at 18-Mile Creek. The protruding band is the Encrinal limestone, which separates the lower from the upper Hamilton. Section 7, 18-Mile Creek, N. Y. (Photograph by E. R. Pohl.)

FIG. 49.—Section of the middle Devonian shales at No. 4 Hill, Arkona, Ontario, Canada. The beds are divided into lower and upper Hamilton by the Encrinal limestone in the middle foreground. (Photograph by E. R. Pohl.)

determining the correlation of the beds exposed in that region with those of the New York deposits. The country intervening has been subjected to much erosion and is moreover covered under a heavy deposit of glacial material, so that the strata under study are nowhere displayed. This correlation was accomplished on the basis of a bed immediately above the Encrinal limestone, shown in figures 48 and 49, which contains the exact fauna that is carried in one of the zones of the section in western New York at East Bethany. The strata at Thedford and Arkona have been separated into a three-fold divi-

FIG. 50.—Rock Glen, Arkona, Ontario. The Encrinal limestone here forms a small falls due to relative resistance in contrast to that of the soft shales above and below. (Photograph by E. R. Pohl.)

sion according to their fossil content. The lower beds, or as they are locally called, the Olentangy shales, are composed of fine gray shales which easily weather into a soft mud used in making pottery, and carry thin lenses of hard crystalline limestone composed throughout of masses of beautifully sculptured fossil remains. Several large exhibition slabs, besides much other material, were returned to the Museum from these beds. The middle division includes the so-called Encrinal limestone which is made up of an innumerable mass of crinoid remains, and a three-foot bed of shale which is referred to as the "coral bed" on account of the large number of fossil corals

that it contains. This is the bed whose fauna is also found in New York State. The Widder beds, or the upper division, contain an entirely different fauna and one that is not known elsewhere. The entire section is well exposed in several ravines such as those shown in figures 49 and 50, and is followed by black shales of Mississippian age which contain conodonts and plant remains. These beds are best exposed on the shores of Lake Huron at Kettle Point (fig. 51). Included in the shale, which has a high bituminous content, are many

FIG. 51.—Huron shales of Mississippian age, with included "cannon-ball" concretions. Kettle Point, Lake Huron, Ontario, Canada. (Photograph by E. R. Pohl.)

and often large peculiar spherical concretions with a radially crystalline structure. The nucleus of these concretions is usually a single plate of some armored fish of the Mississippian. In emerging from the shales under the action of erosion and frost, these concretions often split in half and lie about as the "kettles" of local terminology. The work in this district was aided by several amateur collectors including Messrs. Charles Southworth and J. R. Kearny, who have also been prevailed on to add to the Museum collections from their lifelong accumulations of local collecting.

COLLECTING FOSSIL FOOTPRINTS IN THE GRAND CANYON, ARIZONA

In continuation of the investigation of the fossil tracks found in the Grand Canyon, so well begun in 1924,[1] Mr. Charles W. Gilmore, curator of the division of vertebrate paleontology, U. S. National Museum, made a second visit to the Canyon in the early spring of 1926.

This investigation, made possible through an allotment granted by the Marsh Fund Committee of the National Academy of Sciences, had as its purpose the acquiring of additional specimens of fossil tracks from the Coconino and Hermit formations and the extension of the explorations into the older Supai formation in which the discovery of fossil tracks had been reported by Mr. J. R. Eakin, Superintendent of the Grand Canyon National Park.

Arriving at the Canyon on April 20, Mr. Gilmore with one assistant spent three weeks in active field-work collecting and exploring these formations as exposed on the Hermit and Yaki trails. The expedition was successful far beyond expectations, as the collection made consisted of a large series of slabs of some 2,700 pounds in weight on whose surfaces were preserved the foot impressions of a great variety of animal life.

The old Coconino locality on the Hermit Trail was revisited and a large series of beautifully preserved tracks and trails secured, which included many kinds that were new to this Ichnite fauna. In the Hermit shale some 1,400 feet below the level of the Canyon rim a large assemblage of fossil tracks and plants was collected. The presence of insect remains was made known for the first time by the discovery of the wing impression of a large dragonfly-like insect; and finally in the Supai formation 1,800 feet below the rim another footprint horizon was definitely located.

Fossil tracks were found in considerable abundance in all three of these formations and at several levels in the Hermit Trail section, and it was along this trail that most of the collecting was done. This later investigation shows that in the perfection of their preservation and in the great variety of footmarks found, there are few localities that outrank this one. It is further unique in probably being the only place in the world where fossil tracks of three successive faunas may be found in one nearly vertical geological section, separated by such great geological intervals. It is now known that these evidences of past life range through over 800 feet of rock strata.

[1] Smithsonian Misc. Coll., Vol. 78, No. 1, 1926, pp. 20-23.

FIG. 52.—Trackway of a small salamander-like animal showing the marks of a dragging tail between the footprints. More than natural size.

FIG. 53.—Trackway of *Laoporus noblei* Lull (on left.) New species of fossil footprints (on right). Both reduced.

At the present time fossil tracks are known in these formations only on the Hermit and Yaki trails, but doubtless their geographical range will be rapidly extended now that the precise levels of their occurrence has been determined.

Previous mention has been made of the curious fact that in the Coconino nearly all of the tracks and trails were going in one direction, that is, up the slopes of the crossbedded sandstones. Examination of many additional hundred square feet of track-covered surface all goes to confirm this original observation, for in the hundreds of trails seen in the field only three exceptions to this trend of direction were observed. While slabs of considerable size were collected, larger and more impressive trackways might have been secured but for the difficulty of transporting them to the top of the Canyon, as all of these specimens were brought out of the Canyon on mule back along a narrow and often precipitous trail. It will thus be seen that the size of the specimens collected was always determined by the carrying capacity of a mule, which is about 150 pounds on these trails.

Preliminary study of this collection of tracks indicates that the known Ichnite fauna of the Coconino will be doubled in the number of genera and species; that an adequate fauna will be established for the Hermit shale; and a beginning will be made in the development of a fauna for the Supai formation. The development of these Ichnite faunas may, in the absence of other fossil criteria, be of great assistance in the correlation of other track-bearing formations of distant localities.

AN ELEPHANT HUNT IN FLORIDA

A mountable skeleton of some species of American mammoth has been long desired for the National Museum exhibition collection. But while remains of these extinct elephants have been gathered from almost all parts of North America, they consist for the most part of isolated teeth and bones. Occasionally jaws and still less frequently skulls with parts of the skeleton have been located. The National Museum has two of these skulls. The smaller, representing the species *Elephas primigenius,* is from northeast Siberia; the larger one, *Elephas boreus,* was found in a Pleistocene deposit near Cincinnati, Ohio. The next in importance of remains of the mammoth in the National Museum is a specimen from Idaho, representing a third species, *Elephas columbi.* This specimen consists of part of a lower jaw and an upper tooth associated with several

other parts of the skeleton. None of this material however, is sufficiently complete to form the basis of a successful skeleton restoration. It was therefore with renewed hope of realizing this desire for a mountable skeleton of one of these great elephants that a message was received, in the early autumn of the present year, from the Venice Company of Venice, Florida, reporting the discovery near that place of a mammoth skeleton. A cordial invitation to the Smithsonian to send and secure this specimen for the Institution's collections accompanied this report, and as this seemed sufficiently promising to warrant investigation, Dr. James W. Gidley, assistant curator, division of fossil vertebrates, was detailed to go to Venice for that purpose. Arriving there on the morning of the first day of November, Dr. Gidley was occupied for the next 10 days with collecting the fossil, and with studying the geological formations in its vicinity.

A preliminary examination revealed the fact that the bones all belonged to one individual but that the skeleton was by no means complete. However, the specimen was very far from valueless, and the portions remaining were of sufficient value to amply repay the time and expense required to collect and preserve them. Among the more important pieces obtained are the lower jaws including the teeth, both upper cheek-teeth, considerable portions of both tusks and many of the more important bones of the feet.

These pieces show that this mammoth, or extinct elephant, had been an animal of very large size. In life it would have stood at least 12 feet high at the shoulders and it carried a pair of great incurving tusks which were eight inches in diameter and, measured around the curves, were each 10 feet or more in length.

The location of this find is the north bank of the main drainage canal of the Venice Company at a point about four miles east of the Venice Hotel. The bones were first discovered by Mr. J. W. Parker, a farmer living in the vicinity, while walking along the water's edge after the subsidence of an unusually heavy freshet which had filled the canal to overflowing and had caused heavy caving of its banks. It was this caving that had brought the bones fully to view. It also broke up and destroyed many of the bones including the skull which evidently had been originally buried there, together with a considerable portion of the skeleton.

This partial skeleton was originally buried about five to six feet below the present surface of the ground in a stratum of sand belonging to the Pleistocene or so-called Ice Age. As revealed by the cut made by the canal, this sand deposit lies directly on an older Pleisto-

cene stratum, several feet in thickness and of very wide extent, which is made up almost entirely of shells representing numerous species which can live only in brackish or salt water. This is evidence that the sea once covered this part of Florida and that in its shallow depth was formed this widespread layer of shells. Later, as it slowly emerged from the sea, the bone-bearing sand layer was formed upon it.

The mammoth bones themselves tell an interesting little story of conditions which prevailed here when Florida was in the process of being transformed into its present day appearance.

FIG. 54.—North bank of Venice Company's main drainage canal, about 4 miles east of Venice, Florida. Location of Venice mammoth bones. Exact spot of find is indicated by canvas shelter at middle-left. Arrow indicates uneven line marking contact plane between fossil-bearing layer and later deposits.

In excavating these bones it was observed that they had not originally lain in a natural position but had been somewhat scattered about and broken before their final covering many thousands of years ago. This together with the fact that they were buried in a sand which contained many broken sea shells, in fact a typical beach sand, suggested that although this spot is now more than four miles inland, it was in that earlier time a sea beach upon which the mammoth carcass had stranded and as the flesh decayed the bones had been considerably tossed about and broken by the waves. That this was in reality a sea beach at the time the bones were buried

there is apparently fully proven by the fact that many of the bones including the lower jaws and teeth had a considerable covering of barnacles which can only live in salt or at least brackish water. The fact that barnacles had attached themselves to the broken surfaces is proof also that some of the bones had been broken before the final covering. The presence of the barnacles also indicates that the bones before their final covering had lain for some time just off shore in shallow water.

In connection with this story of the Venice mammoth, it seems in order here to express to the officers of the Venice Company appreciation for the courtesies extended to Dr. Gidley while engaged in collecting the specimen and to commend them for their public-spirited generosity in supplying all the material and labor needed for the work as well as assuming for the Smithsonian Institution practically all incidental expenses in connection with it.

COLLECTING MINERALS IN MEXICO

Regarding the mineralogy and geology of Mexico comparatively little is known. The country is rich in mineral wealth, producing over 40 per cent of the world's silver, yet very few Mexican mineralogical collections have been made. This present exploration was undertaken by Dr. F. W. Foshag of the Smithsonian Institution in collaboration with the Mineralogical Museum of Harvard University, for the purpose of collecting representative material from as many of the districts as possible. Field-work was confined to that portion of the plateau of Northern Mexico within the states of Chihuahua, Coahuila, and Durango.

The plateau region of Northern Mexico is characterized by a broad high plain from which have been thrust upward numerous monoclinal or anticlinal ranges of mountains. The plains and valleys between the ranges are clothed with grasses or scattered shrubs, and the slopes carry a sparse covering of brush characteristic of the Lower Sonoran life zone. This zone is characterized by a number of yucca and cactus species, the creosote bush and, in numerous places, the showy ocotillo. In a number of places the yuccas form extensive open groves. Some of these desert plants are put to economic uses; maguey and sotol for fermented drinks, lechuguilla for fiber, candelilla as a source of vegetable wax, and guayule for rubber.

The ore deposits of the area visited may be considered a mineralogical unit. The most important are found in limestone of Cretaceous age

and are without apparent direct connection with intruded granitic rocks, although there probably is a connection. This class of ore is comparatively simple mineralogically, consisting of silver, lead and zinc minerals accompanied by only minor amounts of silicates. A number of the richest and most extensive ore deposits of Mexico belong to this type of ore occurrence.

After leaving El Paso, the first district visited was Los Lamentos in the northern part of the state of Chihuahua. This district con-

FIG. 55.—The mining camp of Los Lamentos, Chihuahua. The rocks are fossiliferous Cretaceous limestones. (Photograph by Foshag.)

tains one of the few great ore deposits of Mexico that was not known to the Spanish conquerors. The extremely dry and inhospitable nature of the region probably accounts for this. The ore deposits are of so simple a type and the relations of the ore to country rock so clear, that it has become a standard for this type of occurrence. The ore persistently follows the contact between a hard, dark gray limestone and a lighter fossiliferous one, and consists of the simple lead and zinc minerals without any development of silicate minerals but with a surrounding aureole of recrystallized limestone. Many other North Mexican ore deposits are similar, although not always so simple. The mine is rich in showy minerals of both lead and zinc.

The region surrounding the city of Chihuahua is a rich one. Sixteen miles away is the famous camp of Santa Eulalia, where since 1591 the mines have been in almost constant operation. The ore bodies are quite extensive, carrying silver, lead, and zinc, and occurring in

FIG. 56.—Large crystals of gypsum in a cave in the Maravilla Mine at Naica, Chihuahua. (Photograph by Foshag.)

"mantos," one ore body having been followed for over two miles. Some of the chambers left by the removal of the ore are enormous, one in the Potosi Mine being 600 feet high, 300 feet long, and 200 feet wide. Other nearby localities visited were the La Ceja district, producing lead and zinc; Placer de Guadalupe, a small camp well known for its gold placers and for the combination of gold and pitch-

blende in its lodes; and Cuchillo Parado, a lead deposit on the Conchos River.

About 50 miles south of Chihuahua is the camp of Naica, known to mineralogists for its two crystal caves, the larger being in the Maravilla Mine. Here are several chambers connected by passage

FIG. 57.—A peon carrying lead ore up a "chicken ladder." Encantata Mine, at Esmeralda, Coahuila. (Photograph by Foshag.)

ways, one chamber containing well-formed groups of long, radiating crystals of clear gypsum growing from the floor of the cave. Many of these crystals exceed three feet and some reach six feet in length. Another chamber, reached through a narrow opening studded with crystals, is completely lined with thousands of blade-like crystals one to three feet in length.

Sierra Mojada, the next district visited, owes its discovery to a band of smugglers attempting to elude pursuit. The ore bodies extend for a distance of six kilometers along the foot of a limestone

cliff 2,500 feet high. The district is unusual in that lead, zinc, silver, copper, and sulphur have all been mined here. The great length but shallow depth of these mines makes it more economical to work them by the old Spanish methods than by modern ones. Much of the ore is brought to the surface on the backs of peons, often up ladders made of notched logs, popularly called "chicken ladders." It is said that a strong peon will carry loads in excess of

FIG. 58.—The mining camp of Ojuela at Mapimi, Durango. The rocks are Cretaceous limestone. (Photograph by Foshag.)

100 kilos (220 lbs.). Figure 57 shows a young lad carrying a sack of heavy lead ore by means of a tump line.

In the northeastern part of the state of Durango, near the village of Mapimi, is the Ojuela mine—one of the greatest lead mines of the world. Within this one mine are over 550 miles of tunnels driven to extract the ore. The camp itself is perched on a steep limestone mountain. Before the town, rises an almost vertical cliff of Cretaceous limestone 2,000 to 3,000 feet high. It is in the hills lying at the base of this cliff that the ore bodies lie.

Velardena, a district lying along the Cuencame River in Durango, has mines of copper, lead, and silver. The Ternares mine, located in the San Lorenzo Range, has been worked for over 200 years. The

ore deposits are at the contact of granitic rocks with limestones, or in veins in diorite. At the Ternares Mine the limestone contact zone is characterized by great quantities of velardenite, spurrite, and hillebrandite, minerals first described as new from this locality.

About a mile from the railroad station in the city of Durango, rises a mass of volcanic rock and iron ore called Cerro Mercado.

FIG. 59.—Old church on Cerro Remedios, Durango. The rhyolite of this hill is a low grade tin ore. (Photograph by Foshag.)

The iron ore deposits of this hill constitute Mexico's chief domestic supply. The iron-bearing mineral is almost entirely hematite, the ferric oxide of iron, and it forms large masses in a rhyolitic rock.

Nearly five months were spent in the field and over two tons of specimens collected and shipped. The success of the field-work was largely due to the hearty cooperation of the Mexican government officials and of the American mining engineers in charge of the various properties.

THE CANFIELD MINERALOGICAL COLLECTION

Field-work of Mr. E. V. Shannon, assistant curator, division of physical and chemical geology, U. S. National Museum, was limited to a few trips to nearby Virginia and Maryland, and to nearly a month spent in Dover in northern New Jersey in packing the collection of minerals bequeathed to the National Museum by Dr. Frederick A. Canfield, who died during July of this year. This collection was begun by Mr. Mahlon Dickerson about 1808 and was

FIG. 60.—The collection of Franklin Furnace minerals, made by Frederick Canfield, Sr.

continued by Frederick Canfield, Sr., who secured many uncommonly fine specimens from old American localities no longer available and especially from Franklin Furnace, New Jersey, prior to 1870. Frederick A. Canfield, Jr., continued his father's collection and found in it his principal occupation and relaxation until his death. It now contains some 9,000 specimens, many of which are unique and all of them of exceptional quality. It was housed for over 70 years in the picturesque mansion at Dover, shown in figure 61, before being finally shipped to the National Museum. In order to insure its steady growth and relative standing, Mr. Canfield accompanied his

gift with an endowment of $50,000, the income of which is to be utilized for this purpose. In the work at Dover, Mr. Shannon was ably assisted by Mr. James Benn of the Museum's staff and Geo. M. Hyland.

The opportunity was offered to visit several of the world-famous mineral localities of northern New Jersey. These included the various iron mines of Mine Hill, Wharton, and the vicinity of Dover. Of these the only one now in operation is the Hurd Mine owned by the Replogle Steel Company at Mount Hope.

FIG. 61.—Canfield house at Dover, N. J.

Through the courtesy of the officials of the New Jersey Zinc Company, it was possible to visit the underground workings and surface plant of the great zinc mine at Franklin Furnace, renowned as one of the most productive known localities for rare minerals. The mine and mill are models in efficiency, and the various methods which have been developed for handling the ore are of extreme interest. The quarries which furnish the beautiful zeolites at Great Notch and West Paterson were visited in company with the Newark Mineralogical Society, and a Sunday was spent at the well-known serpentine locality of Montville.

THE ROEBLING MINERALOGICAL COLLECTION

In July, 1926, a second of America's foremost collectors of minerals, Col. Washington A. Roebling, of Trenton, New Jersey, passed

away. His noted collection was bequeathed to his son, Mr. John A. Roebling, of Bernardsville, New Jersey, who, in memory of his father, generously presented it to the Smithsonian Institution, with an endowment of $150,000 for the purpose of maintaining its present high standard.

On October 27, Dr. W. F. Foshag, Miss Margaret Moodey, and Mr. James Benn, of the staff, were detailed to go to Trenton to pack the collection for shipment to Washington. Mrs. Foshag also acted as a volunteer assistant for the greater part of the time. The work occupied a period of approximately six weeks, and the collection, contained in 258 boxes, was transported by truck and safely stored in the National Museum by December 7. It should be stated, incidentally, that Mr. Roebling defrayed all expenses connected with this work.

The career of Col. Washington A. Roebling, soldier, engineer, and mineralogist, is too well known to need narration here. The collecting of minerals was begun as a recreation and was energetically carried on from 1874 until the time of his death. With ample means to indulge this hobby, he spared no expense in securing rare minerals, both from American and foreign sources. In a large room in his beautiful home in Trenton, called by his family and friends "the museum," the collection was artistically arranged, and it was here that the Colonel spent most of his leisure time, delighting in showing his treasures to his friends, and being particularly happy if the caller chanced to be a mineralogist with whom he could discuss his rare finds. So methodical was the arrangement that he could place his hand almost immediately on any specimen desired.

Comprised of upward of 16,000 specimens, embracing almost the entire number of known mineral species, the collection contains much to delight both the eye of the seeker for mere beauty and the heart of the ardent student. Gem minerals are plentiful but there are only a few cut stones; showy examples of the more common minerals—malachite and azurite, quartz, calcites, and especially fine zeolites—are in abundance, but the chief value of the collection lies in the rare specimens which only the student can appreciate. Many of these represent the only example of a species in America. During the Colonel's lifetime, these were always freely loaned for study or comparison, and their usefulness will be increased when their final installation in the national collections makes them accessible to all accredited students.

BIOLOGICAL COLLECTING IN SUMATRA

Lieutenant Henry C. Kellers, Medical Corps, United States Navy, was detailed as representative of the Smithsonian Institution with

the U. S. Naval Observatory Eclipse Expedition to Sumatra. Dr. Kellers reports the following:

The expedition left San Francisco September 1, and arrived at Sumatra October 26, stopping at Java for three days for visé of credentials of the members of the expedition by the Dutch officials. The Astronomical Station was located at Kepahiang, a small village on the Moesi River situated among the foothills of the western range, with an elevation of about 1,900 feet above sea level. Kepahiang is near Mt. Kaba, an active volcano, and about 40 kilometers from the Indian Ocean. This proved to be an excellent location for collecting trips. Most of the collecting was done around and on the slopes of Mt. Kaba.

Two ascents of this mountain were made to the rim of the crater, and on each occasion numerous specimens were collected. Snares and spring traps were set along the banks of the Moesi River and in the jungle, with good results. As the rainy season was on in force by the end of November, hunting in the jungle was rather disagreeable because of the countless leeches that attacked one, no matter what precautions were taken. They bite so softly that their presence cannot be detected except for the blood which trickles from the wound. After covering a few kilometers in the jungle, the legs of my native hunters would change in color from the natural brown to a bright red, when they would rest and scrape off the leeches. The terraced rice fields in the vicinity of the station were worked over with seine and dip net for fresh-water fish and amphibia, with good results, and many reptiles were captured.

Four trips were made to the village of Benkoelen on the coast of the Indian Ocean for marine invertebrates and tow net hauls. A double outrigger canoe was used for towing the plankton nets, and I was able by increasing or furling the sail area, to obtain all the speed needed with the afternoon trade wind. The canoe although rather small, was in no danger of turning over while sailing, as the outriggers used by the natives were the largest I have seen, either in the Solomon group of Islands or the Samoan Islands that I have visited. Two excursions were made to the Island of Poeloetikus in the Indian Ocean where large quantities of marine life were collected.

The advent of the automobile, with the whirr of the engine on the roads skirting the edge of the jungle, makes collecting more difficult, and one must now penetrate far into the jungle to hunt game which formerly might have been obtained comparatively near the borders of the wild territory.

FIG. 62.—Looking into the crater of Mt. Kaba, Sumatra. (Photograph by Kellers.)

FIG. 63.—Community rice mill on the Moesi River, Sumatra. (Photograph by Kellers.)

FIG. 64.—Hauling the seine on the beach at Benkoelen, Sumatra.
(Photograph by Kellers.)

FIG. 65.—Sumatran outrigger canoe used for towing the plankton net.
(Photograph by Kellers.)

Although malaria is very prevalent on the island, the members of the expedition enjoyed excellent health. Mosquitoes were a pest, and none of the houses was screened. The Europeans and natives alike protect themselves by means of mosquito nets only at night. No effort is made to rid the villages of breeding places for mosquitoes. I found that one of the main sources of mosquitoes is the large cement tub or tank that holds the bathing water at every dwelling, the daily bath being taken by dipping the water out of the tank with a small bucket and pouring it over the body. The water in these tanks becomes stagnant, as they seldom go dry, and so becomes a perfect incubator for mosquitoes. The water as used is replenished

FIG. 66.—Poeloetikus Island, Indian Ocean. (Photograph by Kellers.)

two or three times a week during the dry season from surface wells, and during the wet season, rain is caught by means of wooden troughs leading from the roofs.

It is remarkable what cleaning up and proper drainage will do to eradicate the mosquito. The Kaba Wetan Coffee Plantation, situated about four kilometers from the astronomical station, is clean and well drained. The bath house of the manager's residence is screened, but there are no screens in the living quarters. It was a pleasure to remain there and rest without the heavy nets at night. The manager stated that he seldom had a mosquito in or about the house.

All water used for drinking and domestic purposes comes from surface wells and the question uppermost in one's mind is: Has it been boiled? The day's drinking water is boiled in the morning and kept in covered containers until used. The natives are not particular in regard to the water they drink, and suffer considerably from dysen-

tery. At hotels and boarding houses, to be on the safe side, the Europeans usually drink "Apollinaris" to such an extent that it is called by the natives, "Ayer Blanda," or white man's water.

In the department of natural history the natives are quite observant. Their nomenclature is fairly complete. They possess generic and specific names, the descriptive names being numerous and often a source of error. They class all the larger Felidæ under the generic name *harimau,* and the smaller under the name *kuching.* They then designate them by distinct descriptive names. They give the gen-

FIG. 67.—A typical coffee planter's bungalow, Sumatra. Kaba Wetan Coffee Plantation, where the mosquito is unknown. See text. (Photograph by Kellers.)

eric name *rusa* to the larger deer. They apply one name to the tapir and rhinoceros, namely, *bodak.* All of the squirrels are grouped under the name *tupai.* All rats and mice are known as *tockus,* except the bamboo rat, which is called *dkan.* The frogs and toads are classed together under one name, *kodok.* The names of snakes are confusing as all are called *ular,* the specific names being unsatisfactory from a scientific standpoint.

The tiger is the most feared of the mammals, although statistics show that crocodiles claim a larger total of victims. In the native legends and folk-lore, the men inhabiting the Korinchi district of Sumatra have the power of transforming themselves into tigers.

FIG. 68.—The covered wagons of Sumatra bringing in produce for market day. (Photograph by Kellers.)

FIG. 69.—Market day in Sumatra. Note the Durians in the foreground. (Photograph by Kellers.)

I was told that the natives observe a difference in the methods used by the tiger and the tigress in killing their prey, the former by breaking the neck and the latter by biting through it. The other mammals do not cause any terror among the natives, although many are dangerous when hunted.

The native Sumatran, whether an orthodox Moslem or not, believes in spirits both of animate and inanimate objects. On my second ascent of Mt. Kaba, I met a band of natives on the edge of the

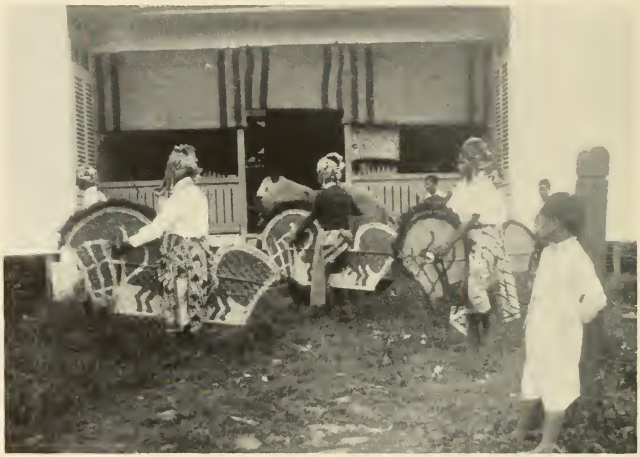


FIG. 70.—Javanese coolies giving an ancient war dance New-year's day for the members of the expedition. Note that the horses are constructed of plaited bamboo and painted. (Photograph by Kellers.)

crater offering up as a sacrifice a white pigeon, sprinkling rice and water on the ground, and conducting religious ceremonies in order to invoke the favor of the spirits for bountiful crops and to the end that their wives would bear numerous offspring. The story of today of the semi-human ape that is supposed to inhabit the southern end of the island is nothing more than the old legend of the Sumatran orang-outang (*mawas*), a semi-human spirit of great strength and ferocity.

The present age is one of transition. How long are the old customs and beliefs to survive? The native Sumatran is being educated, he reads books, he is taking an interest in newspapers, and he has a good opinion of himself.

The Dutch officials and the managers of various coffee plantations in the vicinity of Kepahiang rendered all the assistance possible to make the expedition a success. Transportation for freight and personnel across and about the island was without cost, and the detailing of natives to accompany me on my daily collecting trips shows the interest taken by the Dutch in scientific pursuits. The two trips to Poeloetikus Island could not have been made except for the courtesy of the superintendent of the Dutch Mail Steamship Co., at Benkoelen,

FIG. 71.—A rainy day in Sumatra. Note the basket hats. (Photograph by Kellers.)

who placed at my disposal a sea-going motor boat and a native fisherman.

BIOLOGICAL FIELD-WORK IN FLORIDA

During March and April, 1926, I visited northern Florida for the purpose of making general collections of vertebrates and plants. Work was carried on at several localities in the region extending from Gainesville to Cedar Keys. It was mostly of such routine character as to call for no special comment.

To obtain skeletons of porpoises at Cedar Keys was the chief object in view. The animals were abundant and fearless, coming close to the wharves in pursuit of small fish. Here they were easily shot but less easily recovered owing to the dense opacity of

FIG. 72.—Preparing skeleton of porpoise on beach at Cedar Keys, Florida.

FIG. 73.—Black Skimmers on beach at Cedar Keys, Florida, showing good result of local bird protection.

FIG. 74.—Sponge boats and wharf at Cedar Keys, Florida. The sponge industry is carried on by Greek fishermen.

FIG. 75.—Sponge boat.

FIG. 76.—Building foundations dug in Indian shellheap, Cedar Keys, Florida.

FIG. 77.—Turpentine gatherer. A familiar figure in the pine regions of Florida.

the water, a condition locally attributed to the heavily flooded state of the Suwannee River. The process of skinning and skeletonizing a porpoise (*Tursiops*) is shown in one of the photographs.

Cedar Keys is one of the headquarters of the Gulf sponge fishery, an industry carried on by Greeks. Seaworthy motor boats are used, the divers working in the open waters of the Gulf of Mexico, and remaining at sea about a week at a time. It is said that good commercial sponges could formerly be obtained in the waters of Waccassassee Bay; but this supply was long ago exhausted.

The town of Cedar Keys occupies a site famous for its Indian mounds and shellheaps. Many of the houses rest on foundations dug into these remnants of a vanished culture.

GERRIT S. MILLER, JR.

VISIT TO A CALIFORNIA WHALING STATION

During the summer of 1926 a joint expedition was made to the coast region of northern California by the Smithsonian Institution and the San Diego Society of Natural History, A. Brazier Howell representing the former and Laurence M. Huey the latter. Opportunity was taken to make collections of the local mammals and some things of much interest were secured, including seven specimens of the rare rodent, *Phenacomys albipes*, of which but two specimens had been previously known from California. The main purpose of the expedition, however, was to secure data, rather than specimens, regarding the whales and whale fishery at Trinidad, Humboldt County. This station in summer, and one near Monterey during the winter, are both operated by the California Sea Products Company, a concern that has been active in this field for many years. It is now the only well established whale fishery anywhere on the coast of the United States, although at least one other has recently started work.

Whale hunting is a very old industry and hence is of great interest historically, as well as biologically and economically. The early type of fishery has disappeared never to return because of a number of reasons, among which are the fact that the more valuable species have been practically exterminated, leaving the speedier, less valuable ones which the old-time whalers not only did not want, but could not catch with the methods then in use; and the adoption of the present technique, including small, fast steamers and harpoon guns.

The catch at Trinidad consists almost exclusively of finback and humpback whales, the former reaching a length of about 75 feet

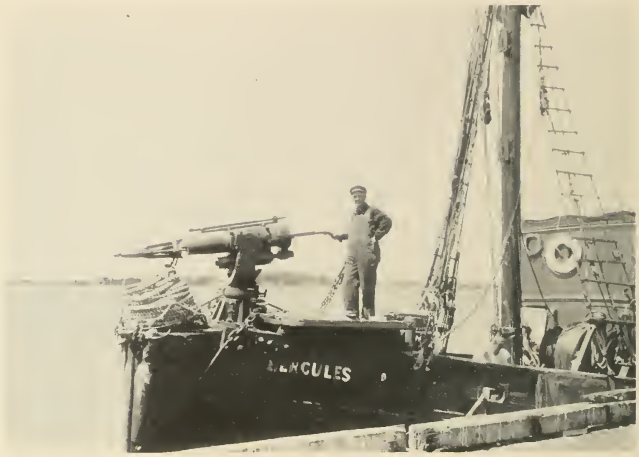


FIG. 78.—The "Hercules," largest of the three whalers, showing harpoon in position for firing and Captain Lane at the trigger. (Photograph by L. M. Huey.)

FIG. 79.—Captain Lane at the instant of firing a harpoon into a finback, shown in line of aim. (Photograph by L. M. Huey.)

FIG. 80.—The "Hercules" bringing a finback whale to the station, with the flukes made fast to the vessel. (Photograph by L. M. Huey.)

FIG. 81.—A large finback at the foot of the slip, ready to be hauled out. (Photograph by L. M. Huey.)

and the latter somewhat less. Each of the three small steamers used leaves the shore station and cruises usually to a distance from the coast of 50 miles, remaining out either until a whale is secured or until the fuel supply needs replenishing—a matter of some three days. If a whale indicates that it is wary, it is better to waste no time on it, for with the finback's maximum speed of better than 30 miles per hour it can play with its pursuer in an exasperating manner; but a close approach may usually be made, by cautious maneuvering, permitting a shot at less than 40 yards. If the bomb

FIG. 82.—The rare California gray whale being hauled up the slip. Note where sharks have bitten great pieces of blubber from in front of the flukes and also mutilated the latter after the death of the whale. (Photograph by L. M. Huey.)

fails to explode or the harpoon, weighing somewhat less than 150 pounds, is placed too far back, a fight of several hours may ensue. The cetacean may take out a mile of cable and must be as carefully played as a game fish, for although the line consists of a five-inch (in circumference) manila hawser with breaking strength of 18,500 pounds, the animal will snap this with ease if too much strain be applied or too much slack be given. When brought close alongside it is inflated with air and then may be marked with a flag and left to float while the vessel continues hunting for some time.

Upon reaching the station in tow of the vessel, a cable is attached to the tail and the carcass is hauled by steam power up the "slip"

to the covered cutting platform, where the blubber near the head is first loosened by means of huge knives, and then torn off by cables. The larger muscle masses are similarly treated and the skeleton disarticulated. The great strips of blubber are cut by hand into pieces of convenient size and so fed into the blubber cutter, which consists of a number of sharp blades revolving at high speed. The resultant sludge is then led to giant, steam-heated vats and the oil tried out. The lean meat of better quality is cut into slabs and

FIG. 83.—Head of California gray whale, the animal lying on its back. Note eye (a), baleen or whalebone (b), and large tongue (c). (Photograph by L. M. Huey.)

placed within large iron retorts in tiers, with iron plates between each layer, where it is cooked for a number of hours, then dried and finally ground. The waste, including the blood and viscera, is dumped into open vats of boiling water and after being cooked. the oil is separated and the solids dried and ground for fertilizer. After most of the meat is cut from the bones the latter are also placed in retorts and cooked. Considerable oil is obtained from them and the dry bones are then dumped in a pile which grows to large proportions as the season advances. The baleen or "whalebone" of this group of whales is short and coarse and is not at present of commercial value, so it, too, is cooked and ground for fertilizer. The

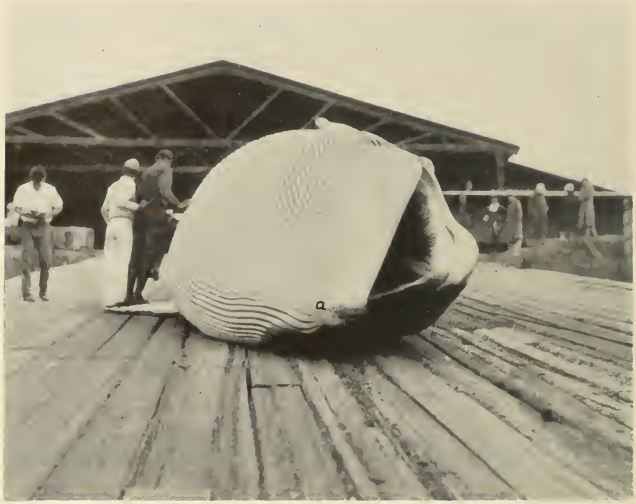


FIG. 84.—A finback on the slip. Note corrugations in the skin of the throat which probably permit great expansion during feeding. The spots on the chin at (a) indicate the positions of short bristles, the last remnant of a hairy coat. (Photograph by L. M. Huey.)

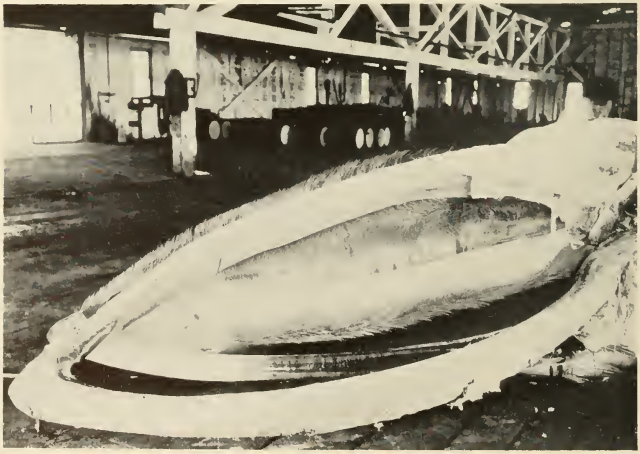


FIG. 85.—Roof of the mouth, showing baleen plates, and bony part of lower jaw of a finback, after the corrugated portion of the throat, shown in figure 84, had been removed. (Photograph by L. M. Huey.)

FIG. 86.—Great mass of skeletal bones of whales—the accumulation from dozens of individuals. (Photograph by L. M. Huey.)

FIG. 87.—The western gulls gather by the scores and hundreds, ever hopeful of snatching bits of blubber and meat. (Photograph by L. M. Huey.)

blubber oil is produced in several grades, some being used by manufacturers of fine soap, some as lubricants, chiefly in combination with mineral oil, and still others in the manufacture of certain foods. The better quality of meat meal is sold as chicken feed, and the bones are shipped in bulk to Honolulu, where, after being made into a fine grade of bone black, they are used in the refining of sugars.

The overhead and other expenses of such a plant as that of the California Sea Products Company are considerable, as it is necessary to have much machinery of various sorts and large size, and a large pay roll, which continues alike through times of cetacean plenty or scarcity. Hence it is necessary that each whale be utilized to as complete a degree as possible, and in this the company is as successful as is the case with the proverbial slaughtered pig. And the work must be done expeditiously, before partial decomposition of the huge carcass has lowered the quality of blubber and meat. Hence, in about three hours after being landed the whale has disappeared to the last shred within vats and retorts.

The prepared products from one whale of average large size may be worth as much as $2,000 and from this it may be seen that our whale supply is a matter of economic importance, and not merely of aesthetic concern to those with emotional tendencies. When whales have become sufficiently numerous in any district a whaling station is at once started and invariably this continues operations as long as whales are to be had in sufficient numbers to offer a margin of profit, after which the station is abandoned. If whales existed in paying quantities along any of the remainder of our coasts, there would be whaling stations there for their capture. In some few cases the whales will regain a part of their former numerical status, but in others they can never recover, and in all cases the rarer species will have been reduced to the point of grave danger. Thus the gray whale was believed by scientists to be practically extinct on the west coast of the United States, but the whalers say there are a very few left, and by great good luck we were at Trinidad when one of these was secured—the first ever brought to that station during the six years of its existence. A number of extremely interesting observations, chiefly of an anatomical character, were made of this specimen, as well as of the commoner species, but it was saddening to realize that this might possibly be the last such opportunity afforded a mammalogist in the United States.

Few naturalists are now so situated as to be able to observe whales at first hand and it is felt that much of value will result from our

stay at Trinidad, our work having been facilitated in innumerable ways by the cordial cooperation of the officials of the California Sea Products Company.

EXPLORATIONS IN SIAM

Many years ago the Smithsonian Institution received from the National Institute, in Washington, a collection of about 100 specimens of birds from Prince Momfanoi (also called Chawfanoi) of Siam, half-brother of the King of that period, and "in truth, rightful heir to the throne" according to Dr. Ruschenberger (Voyage around the World, 1838). He was reported to be an enlightened man, who loved pets, had many live animals and birds, and had a museum in which were many stuffed birds and animals, set up by himself. Due to faulty preservation, a large proportion of the specimens received from Prince Momfanoi have long ago been destroyed through the ravages of insects, but the record of his gift remains.

From 1896 to 1899, Dr. W. L. Abbott, the veteran explorer, spent several months of each year working through the province of Trang, in the peninsular part of Siam, giving the Institution its second collection of birds from that country. Later, in 1914-1916, he supported Mr. Cecil Boden Kloss in the latter's exploration of parts of southeastern Siam and the Franco-Siamese boundary, which resulted in over 130 additional birds. In 1916 and 1918, Mr. Kloss visited the southwestern and other parts of the country, contributing 496 more specimens. In 1924, over 200 birds were received from Dr. Abbott, collected by J. H. Chambai and K. G. Gairdner; these were from south and central Siam. In the same year, Dr. Hugh M. Smith, while engaged in fisheries investigations for the Siamese government, obtained a few specimens in the southern part of the country, especially from the island of Koh Chang, in the Gulf of Siam, including a new species of small "timaline" bird, *Pellorneum smithi*.

During the years 1925 and 1926, Dr. Smith continued his natural history work, with the aid of a Dyak collector, and has sent to the Smithsonian Institution 968 birds from southern and central Siam. In addition to birds, he has forwarded about 70 skins of mammals, several hundred mollusks, crustaceans, fishes, reptiles, and ethnological material. Dr. Paul Bartsch, curator of mollusks, says, "Dr. Hugh M. Smith's work in Siam has enabled him to make distinct contributions in the field of mollusks. I feel sure that quite a few new species and races will eventually be described when this material is worked over with a fine-tooth comb. All of it fills a decided

gap in the collection, for prior to Dr. Smith's enterprise few mollusks from that region were found in our collection. The sendings in 1924 amounted to almost 2,000 specimens, while during the present year over a thousand specimens have been received, among them two new species of shipworms as well as other novelties not yet fully determined."

Count Nils Gyldenstolpe, a Swedish naturalist, has recently published a list of the birds of Siam, enumerating about 730 species and subspecies, of which 113 are water birds and waders, the remainder land birds. The list is confessedly only an incomplete one, for much additional ornithological work must be done before the birds of Siam may be regarded as well known.

Among the birds sent in by Dr. Smith is a specimen of the Openbill or "Shell ibis" (*Anastomus oscitans*), a remarkable species of stork, peculiar for the character of the bill, which is said to be "the result of wear, caused by the shells of the mollusca, on which the bird feeds." In the young bird the lines of the bill are straight, and show no gaping space as in the adult. Several species of fruit pigeons are represented in the collection, a group of birds usually of bright colors, green predominating in many of the species. They are native to the Eastern Hemisphere, a few species in Africa, an increasing number in southern Asia, with the majority in the Dutch East Indies and Polynesia. About 13 species have been recorded from Siam, of which five are restricted to the northern parts of that country.

BREEDING EXPERIMENTS WITH CERIONS

Dr. Paul Bartsch, curator of mollusks, U. S. National Museum, spent the period from August 10 to August 21 at the Tortugas and from August 21 to August 24 examining the Cerion colonies planted on keys between the Tortugas and Miami. An examination of the small island colonies yield the following results:

Island 1. Twenty-five *Cerion incanum* and 25 of a new species of *Cerion* with spiral sculpture were planted here 2 years ago. Last year, 22 of the *incanum* were found dead; this year no additional specimens of this species were noted. Of the *Cerion* new species, 18 were dead last year and 1 dead and 2 living this year, which accounts for 21 out of 25 of these specimens. The missing individuals may be buried in the sand, dead or alive, or they may have been carried away by some agency as, for example, the little Sparrow Hawk, which occasionally indulges in that pastime. In this island were

FIG. 88.—Dr. Bartsch going down with diving helmet.

FIG. 89.—Dr. Bartsch coming up with the diving helmet just removed. (Enlargement from movie film.)

FIG. 90.—A general undersea view showing a field of Gorgonians. (Enlargement from movie film.)

FIG. 91.—Gorgonians and Goat fishes. (Enlargement from movie film.)

also found a number of quite young shells, too young to determine their relationship at this time. Dr. Bartsch therefore refrained from seriously disturbing the sand for fear of exposing these small creatures to unfavorable stresses.

Island 2. In this were planted, 2 years ago, 25 *Cerion incanum* and 25 *Cerion chrysalis*. Last year 11 of the *Cerion incanum* were found dead and this year 4 dead and 1 living, accounting for 16 of the planted specimens. Of the *Cerion chrysalis*, 12 were found dead last year; to this were added 4 this year and 2 living individuals, which accounts for 18 of the 25 planted. Here, too, small young were in evidence.

Island 3. On this island were planted, 2 years ago, 25 *Cerion incanum* and 25 *Cerion mummia*. Last year 16 dead of *Cerion incanum* and this year 2 dead and 5 living were recovered. Of *Cerion mummia* 17 were found dead last year and 1 this year, and 1 living. All but 2 of the *Cerion incanum* are therefore accounted for in this island. Here, too, some young were present, and the interesting observation was made of finding a specimen of *Cerion incanum* mating with a *Cerion mummia*.

Island 4. Here were planted, 2 years ago, 25 *Cerion incanum* and 25 *Cerion tridentatum*. Of these, 13 *Cerion incanum* were found dead last year and 3 this year, and 2 living. Of the *Cerion tridentatum*, 10 were found dead last year and 3 this year, and 10 were living. No young were observed.

In the 8 small islands, all the adults seem to have died, but small young are present in some, which makes it wise to leave them undisturbed for another year as these may prove to be the desired hybrids. However an additional marked specimen of *Cerion incanum* and *Cerion viaregis* were added on each island.

Last year some of the old wooden cages were cut down to mere 4-inch base boards which were partly buried and fastened securely to the ground. To the free edge of each, which projects some 3 inches above the ground, a narrow strip of monel wire was tacked, bending inward to prevent the escape of the mollusks.

In each of these cages a specimen of *Cerion incanum* and *Cerion viaregis* was placed. Upon examining these inclosures this year, most of the shells were found dead and many were crushed, the damage probably having been done by rats. Each of these 75 cages were restocked with a marked specimen of *Cerion incanum* and *Cerion viaregis*.

FIG. 92.—Yellow-Tail and Slippery Dicks, and Sea Urchins. (Enlargement from movie film.)

FIG. 93.—Hogfish. (Enlargement from movie film.)

FIG. 94.—A school of Gray Snappers. (Enlargement from movie film.)

FIG. 95.—A school of Grunts and Gray Snappers. (Enlargement from movie film.)

The two original colonies of Cerions, namely, *Cerion viaregis* and *Cerion casablancae*, are simply swarming in their respective places and gradually spreading over adjacent territory.

The colony of *Cerion uva* from Curaçoa is gradually passing out, but it was a surprise to find that the colony of *Cerion crassilabre*, which was in bad shape a year ago, was not at all on the verge of extinction, but yielded sufficient material to give complete measurements of all the characters of enough specimens to complete the hundred series of both the first and second generations of Florida-grown individuals. This again shows that it is not safe to estimate the strength of a colony merely from the appearance of material above the surface of the sand, for Cerions under certain conditions have a way of disappearing beneath the surface and thus hiding themselves from view.

The huge colony of Cerions, brought from the Island of San Salvador and planted on the east side of the laboratory, does not appear to have found the habitat a suitable one, for there is an endless number of dead strewn about the ground, but not a single living specimen was seen.

The colonies planted on the rampart of Fort Jefferson 2 years ago are holding their own.

On the way north, September 21, a stop was made at Boca Grande Key where it was found that the part of the key bearing the plantings was again burnt over, and the same fate has overtaken the colonies which had been planted on Man Key, Boy Key, Woman Key, and Girl Key.

On September 22 a visit to the two plantings in the grounds of the U. S. Bureau of Fisheries Station at Key West showed both colonies doing fairly well.

On September 22, the *Anton Dohrn* was left at Newfound Harbor Key, and a visit made to the keys containing Cerion colonies between Key West and Miami. The hybrid colony on Newfound Harbor Key was doing splendidly. The last hurricane had not seriously damaged it. Some additional variant specimens were taken to Washington for dissections. This colony, as well as experiences on other islands, shows plainly the desirability of placing colonies not on unoccupied keys but, if possible, to select ground for them near some house where the people will take an interest in the experiment and see that the ground is protected against fire.

Bahia Honda, where the colony of *Cerion casablancae* was placed in 1912, was next visited. The hurricane some years later had cut the ground, where the original colony was planted, to such an extent

that it was felt that it had been wiped out. Examination after the hurricane gave no indication of its survival, but this year's visit showed that it not only had survived, but was flourishing and spreading.

An examination of Duck Key, where a colony of *Cerion viaregis* had been planted in 1912, showed that the tall, dense grass and cactus, which had usurped the places of planting, still prevailed to such an extent that no specimens were visible.

FIG. 96.—Albino Noddy Tern, on Bird Key.

On September 23 Indian Key was visited and it was found that the colony of *Cerion casablancae,* which on our last visit seemed to be on the verge of extinction, was flourishing and doing well. There were enough specimens to warrant taking a series to Washington for measurement.

The colony of *Cerion viaregis,* planted on the adjacent Tea Table Key in 1912, failed to show a single specimen.

On September 25 a stop was made at Sands Key and Ragged Keys where plantings were made in 1912, but here, dredgings, fillings-in, human activity in general, and hurricanes have so overwhelmed the place that not a trace of any of these colonies was apparent. With the rapid spread of habitation in this neglected region of

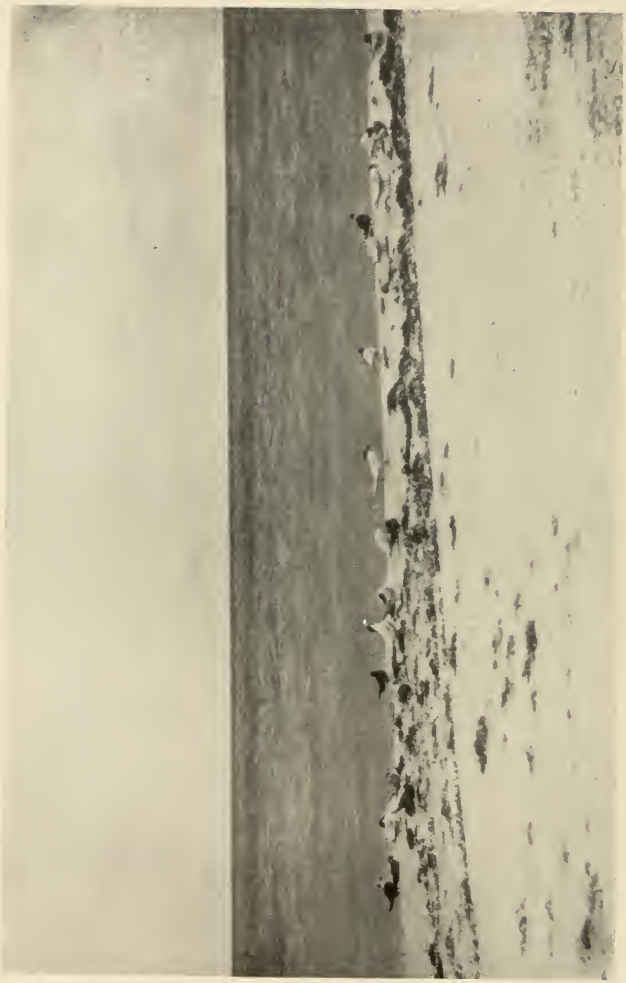


FIG. 97.—A group of Black and Least Terns on Loggerhead Key.

Florida it will be possible to secure the sympathy of interested people to make further plantings among these keys and to have them secure from harm.

During the trip northward from Key West to Miami stops were made at a number of places not before visited and collections of the native *Cerion incanum* were obtained.

At the Tortugas Dr. Bartsch exposed 2,400 feet of moving-picture film among the coral reefs undersea, securing a series of pictures showing faunal associations of marine organisms *in situ*.

As in former years, Dr. Bartsch kept account of the birds observed at the Tortugas from day to day, as well as on the other keys visited.

STUDY OF THE CRUSTACEANS OF SOUTH AMERICA

As noted in the Smithsonian Exploration Pamphlet for 1925.[1] Dr. Waldo L. Schmitt, curator of the division of marine invertebrates, U. S. National Museum, the holder of the Walter Rathbone Bacon Travelling Scholarship, visited South America for the purpose of studying the crustacean fauna of the continent. His activities from August 1 until November 2, 1925, when he arrived at Itajahy, Brazil, were reported on last year. After a short sojourn at that port, he proceeded to Florianopolis, Brazil, where he made valuable collections. He next visited Montevideo, Uruguay, arriving November 10. Here Dr. Schmitt met Dr. Florentino Felippone, a correspondent of the U. S. National Museum, who showed him every courtesy and aided his work in many ways. Here also, through the assistance of Señor Tremolaras, arrangements were made for obtaining rheas for the National Zoological Park at Washington. He arrived at Buenos Aires, Argentina, December 14 and procured from the Buenos Aires Museum the loan of a valuable collection of crustacea. At this point it was found impracticable to proceed to Punta Arenas, Chile, as he had planned. On January 19 he returned to Santos, Brazil, and went by train to São Paulo where he visited the Instituto Butantan and obtained a collection of living Brazilian reptiles. On January 21 he embarked at Rio de Janeiro for New York, where he arrived February 1.

This year Dr. Schmitt is devoting his studies chiefly to the west coast. He left New York August 19, arriving at Cristobal, at the Caribbean entrance to the Panama Canal, August 25. At Panama Dr. Schmitt had the pleasure of meeting Mr. James Zetek, resident

[1] Smithsonian Misc. Coll., Vol. 78, No. 1, pp. 40-44.

custodian of the laboratory at Barro Colorado Island, who in the past has sent many valuable specimens to the National Museum. The ship left Balboa on August 26, and reached Salaverry, Peru, August 30. As hotel accommodations were not to be had there, Dr. Schmitt was obliged to move a short distance up the coast to Trujillo, where Mr. Sears, the agent for the Grace Lines, generously offered to take him into his own residence. The offer was accepted, and during his stay at Trujillo Dr. Schmitt enjoyed the most generous hospitality of a delightful private home. In regard to the climate he remarks, "You will not believe it, but it is like a cold California night. I am sitting here with my hat and overcoat on so as to keep warm enough to write. What will working in the water be like? I'm told the Humboldt current off the coast of Peru is way out of its course; that while it usually turns out to sea off Talara, it is now running way up into the Gulf of Panama; that it affects (kills) the supply of fish and has driven the pelicans up off the California coast in the vicinity of the Catalina Islands where as it is said here, they were never known to occur before. The heavier rains resulting from the shift of the Humboldt current have washed out a lot of land and killed off much of the marine life. The hotel at Salaverry was washed half full of sand by the last wet season's rains, thus the lack of accommodations."

Dr. Schmitt left Salaverry September 1 for Guayaquil, where he arrived September 4. He states that there is much more English spoken on this coast of South America than upon the east coast where he visited last year, and that there is a great deal of American machinery used everywhere. At three places along the route while the boat stopped to take on cargoes of sugar, he succeeded by means of his bottom sampler in getting mud samples. Guayaquil has but one fairly paved street, the main one running from the water front to the main Plaza. Dr. Schmitt finds that great quantities of shrimps and two species of crabs are sold in the markets of Guayaquil. A species of *Callinectes* much like our blue crab of the Chesapeake, and a red *Ucides,* a land crab, appear to be the only two species used as food. He says, "Oysters are very plentiful, but with all the hundreds of thousands that must have been shucked by the men with whom we had converse, none had ever seen a crab in an oyster."

After a week's unavoidable delay, Dr. Schmitt finally reached Santa Elena, which is on the coast directly west of Guayaquil. Collecting here was excellent, but dredging was impossible as the only two motor boats of the place were laid up, and the only other avail-

able boats were the native dugouts. A number of species of crabs and shrimps were taken here, some of which Dr. Schmitt believes will prove to be new. A most interesting assemblage or association of marine animals was found to be inhabiting old worm galleries. Dr. Schmitt thought the coast around Santa Elena, if he could have given the time to it, would probably have proved to support the richest fauna of all the regions that he had visited in the past two years, but his time being limited, he was obliged to return to Guayaquil on September 19. He says, "We started early Sunday morning and between auto and train were under way from 6 a. m. to 7 p. m.

FIG. 98.—Paita, Peru, showing the rocky nature of the coast.

just covering 90 miles of country. It took us two hours to make the last 20 miles." Dr. Schmitt had hoped to visit Quito, but owing to the great loss of time in getting to and from Santa Elena he found it impossible. While at Guayaquil, Dr. Schmitt did some excellent collecting in the so-called Salada, an arm of the ocean which reaches up behind the city. There the black flies were a terrible torment, and he suffered severely from their attacks, but to offset in a measure this inconvenience he procured a species of *Upogebia*, the little shrimp that bores holes in rocks. This genus of shrimps had not until then been found on the west coast of South America. Here also were taken some pinnotherid crabs which are symbiotic in the shells of mollusks.

He left Guayaquil October 3 and arrived at Paita, Peru, late the same day. He says, "Here we drop into a holiday in memory of

San Francisco de Assisi. The holiday alone would not keep me out of work, but the Custom House was open only to let our stuff in. We arrived on the fourth, and the fiesta of San Francisco lasted two days, the 4th and 5th. And today the fisherman, families, etc., are resting up." Collecting proved to be very good here, and much fine material was procured from a point of rock jutting out into the water, and from a fine reef well north of Paita.

Dr. Schmitt left Paita October 15 and arrived at Salaverry October 17. Here the coast is just a bold surf-beaten headland with huge immovable boulders. At low tide the collecting was good, and the

FIG. 99.—Chorillos, a suburb of Lima, Peru, showing the cliffs at the water's edge which are in some places 200 feet high.

exposed beach yielded many invertebrates. Here also worm tubes were found to contain interesting and valuable specimens of crustacea and other forms. He found here a genus of shrimps not before reported from the Peruvian coast, and also procured a fine series of fresh-water shrimps.

On October 25 he left Salaverry, Peru, and reached Callao early the next morning. The Ambassador, Mr. Poindexter, procured him a pass to San Lorenzo Island, the naval base in Callao Bay. He made several collecting trips to the island and secured many amphipods and some remarkable porcellanid crabs, which live on the under side of a sea urchin. The fine material obtained here shows how much zoological work is yet to be done on this coast.

When last heard from, Dr. Schmitt was on his way to Valparaiso, Chile, where he expected to arrive on the 18th of November. From there he will proceed to Buenos Aires and then to his destination, Punta Arenas, Chile. Several cases of specimens have already arrived at the Museum.

INVESTIGATION OF THE AMPHIPODA OF THE TORTUGAS

Mr. Clarence R. Shoemaker, assistant curator of marine invertebrates, U. S. National Museum, spent the period from July 13 to

FIG. 100.—Fort Jefferson, Garden Key. Many amphipods and isopods were obtained from the rich growth of algae, hydroids and ascidians upon the wall of the old moat. (Photograph by Shoemaker.)

August 20, 1926, at the Carnegie Marine Laboratory, Dry Tortugas, investigating the Amphipoda of the keys. While studying the collections sent to the Museum by former investigators at the Laboratory, so many new and interesting forms were observed that it was thought advisable to spend some time at the Laboratory making as thorough a survey as possible of the amphipod fauna.

The waters surrounding most of the principal keys, and also the water of the moat at Fort Jefferson, were exhaustively examined. Pelagic species were scarce, but algae and old coral-rocks yielded many forms and almost countless numbers of individuals. Many

of the species, as is usually the case in tropical waters, are very small, so that even sorting the specimens into the different kinds proves to be a long and somewhat tedious process, but enough has already been accomplished to show that many additional new forms have been discovered, and that the range of many species has been greatly extended. Some of the species were found to be very vividly and beautifully colored, while the coloration of others seemed to be of a protective nature, exactly matching their surroundings.

In order to escape their principal enemy, the fish, amphipods avail

FIG. 101.—Bush Key Reef. The abundant marine algae at the edge of this reef afford protection to innumerable amphipods and isopods. (Photograph by Shoemaker.)

themselves of the shelter of old coral-rocks which have been tunneled and bored by other marine organisms. The cavities in sponges and the interstices of algae also afford them the necessary protection. Each of these locations yielded many specimens which when finally identified will, with those already known to occur, probably be an almost complete list of the species inhabiting the waters of the Tortugas.

ENTOMOLOGICAL TRIP TO GUATEMALA

Dr. J. M. Aldrich, associate curator, division of insects, U. S. National Museum, went to Guatemala for the purpose of increasing

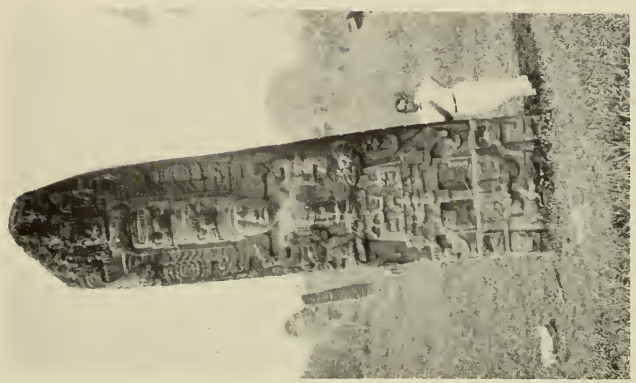


FIG. 103.—Maya monument near Quirigua, Guatemala.

FIG. 102.—Native hut on sugar plantation, Guatemala.

the Museum collection of tropical muscoid flies, while at the same time collecting such other insects as could be obtained. He left Washington on the last day of March for New Orleans, where he took the United Fruit Company's steamship for Puerto Barrios, arriving there April 7, and continuing by train to Guatemala City the same day.

He made his headquarters in that city for about a month, taking trips to the Mexican border at Ayutla, to the Pacific Coast at San José, to Antigua, to the interior lowland at Quirigua, and some nearer places. In the immediate vicinity at Guatemala City the collecting was poor in April, as it was in the latter part of the dry season.

FIG. 104.—Military headquarters on plaza in Coban, Guatemala.

Numerous courtesies were extended to Dr. Aldrich by the Agricultural Department of Guatemala, especially by the Director-General, Mr. J. G. Salas. The Department was at the time very much concerned with an outbreak of the migratory locust and had reared some parasites, which Dr. Aldrich was able to identify. This locust is a great pest of agriculture from Southern Mexico to Argentina, and there was much interest in its parasites. These, it happens, belong to a group of flies which Dr. Aldrich has studied extensively.

About May first the Minister of Agriculture proposed that Dr. Aldrich give up his plans for collecting in the western part of the country and join a government party in a trip to Coban for the purpose of making investigations on the locusts and their parasites and meeting a similar investigating party coming over from Mexico. As it seemed possible that some important information regarding

FIG. 105.—Morazan, Guatemala. Approaching the plaza.

FIG. 106.—Scene in market, Guatemala City.

the parasites might be obtained, Dr. Aldrich acceded to this request, and made a journey on muleback of about 100 miles to the interior town of Coban, where he remained 10 days. Unfortunately he was prevented by illness from doing as much work as anticipated, although continuing to collect flies in the vicinity of the town. The Mexican party was not heard from; and as soon as able Dr. Aldrich returned to the Atlantic Coast by way of the Polochic River, coming out at Livingston. He reached Washington June 6.

While the dry weather and change of plans interfered greatly with the expected results of the trip, a considerable number of specimens were collected and some discoveries of importance were made on grasshopper parasites.

The cordial relations which were established with the Guatemala Department of Agriculture, The International Health Board, the United Fruit Company, and with individuals, will no doubt be of value in future work.

COLLECTING AND REARING FRUIT FLIES IN PANAMA

On March 6, 1926, Mr. Chas. T. Greene, assistant custodian of diptera, U. S. National Museum, sailed from New York for Cristobal (Colon) Panama, on the Steamer Ancon. His primary object was to collect and rear the fruit flies of the genus *Anastrepha* in order to associate their larvae and pupae with the adults and to get all the information possible on their immature stages, as well as to rear any other flies which he might deem of economic importance. This work was carried on at the request of the Federal Horticultural Board. Ancon, Canal Zone, located at the Pacific end of the canal, was selected as Mr. Greene's headquarters because the United States government has a well equipped laboratory or experiment station there. He remained in Panama until May 27, sailing on that day for New York.

During his trip Mr. Greene visited several places on the Pacific and Atlantic coast of Panama, searching for fruit flies, and collected at several places along the Panama railroad which follows the canal across the Isthmus. All of the localities visited yielded valuable information on the fruit flies.

The three species of *Anastrepha* of economic importance were reared from native fruits and their immature stages are associated. The results will be published in the near future. Numerous other species of flies were reared and notes made on their immature stages in connection with this work. A large number of other species of

FIG. 107.—Boat landing and laboratory at Barro Colorado Island.

FIG. 108.—Entrance to one of the large trails on the island.

diptera were collected and many are new to our National Collection. Some insects of the other orders also were captured and brought back to the Museum.

One of the most interesting places which Mr. Greene visited in Panama was Barro Colorado Island. This large island of about six square miles is in the Panama Canal and located about halfway between the Atlantic and Pacific Oceans. Animal and bird life on this island is protected, and the abundant insect life makes it

FIG. 109.—Central Avenue, main business street in Panama City.

almost a paradise for the collector. Mr. Greene caught a large number of interesting species during his several visits to this island.

There is a large well-equipped laboratory on the island with facilities for studying and for lodging. Several large trails lead in various directions from the laboratory, but otherwise the jungle is undisturbed.

EXPLORING FOR FERNS IN THE BLUE MOUNTAINS OF JAMAICA

With the object of obtaining additional material needed in preparing a descriptive account of the fern flora of Jamaica, Dr. William R. Maxon, associate curator of plants in the U. S. National Museum, spent the months of June and July, 1926, in botanical exploration

in that island, paying particular attention to certain areas in the difficult Blue Mountain region, which rises to nearly 7,500 feet.

The ferns of Jamaica were among the first to be described from the New World, but in many instances the names originally given them came later to be applied loosely to related but distinct kinds from other regions, with much resulting confusion. To afford a proper basis for studying the diverse fern floras of tropical America as a whole, it thus becomes of prime importance to know thoroughly that of Jamaica, an end that can be attained, naturally, only with the aid of adequate material.

Of the 500 species of ferns and fern allies described or known from Jamaica nearly all are found in recent large collections brought to American herbaria from that island; yet there are a few collected by Sir Hans Sloane in the latter part of the seventeenth century, and by Swartz about a hundred years later, that still are known only from the original specimens preserved in European museums. Present field-work is concerned therefore in the re-discovery of these "lost" species and of other very rare ones described more recently, but equally also in the discovery of new kinds, and in assembling data as to the distribution, characteristic habitats, habits of growth, and inter-relationship of those other species that are comparatively well known.

The equable temperatures and surpassing beauty of the Blue Mountains are proverbial. What is not appreciated by the traveler or the novice in botanical collecting is that the absence of springs and streams above 5,000 feet, the almost complete lack of trails and habitations, the steep, often precipitous character of the forested rocky inclines, and extremely fickle weather conditions make exploration difficult and laboriously slow. Approach must be through the drier coffee-producing regions on the south side of the range, except for two trails that cross at either end, nearly 25 miles apart; the wet northern slopes, from 1,500 feet to the top of the higher peaks, present an unbroken forest which can hardly be easier of penetration today than at the time of discovery.

It happens thus that our knowledge of the high mountain fern flora—which invariably in tropical regions is more luxuriant and diverse than that found at low elevations—is based mainly upon material collected on several peaks and in a few high passes near the former botanical station at Cinchona (5,000 feet) and on Blue Mountain Peak itself. The extremely rugged eastern end of the range and almost the whole heavily wooded north slope, with its

FIG. 110.—Looking westward from Blue Mountain Peak. The dense low forest is characteristic of the high peaks, several of which are shown in the background; Mossman's lies at the left. (Photograph by Duncan S. Johnson.)

deep, wet, hothouse valleys, have scarcely been touched; and this notwithstanding the work done by a host of collectors.

Accordingly, except for a few days of collecting in the denuded Port Royal Mountains, the region of Mount Diablo, the famous Fern Gully, and several localities reached readily from Kingston, effort was centered by Dr. Maxon at two points in the Blue Mountain range: Cuna Cuna, and the high peaks east and west of Portland Gap.

The Cuna Cuna region, which takes its name from a low gap (about 2,400 feet), lies at the eastern end of the Blue Mountain range

FIG. 111.—The fern collection about to leave House Hill, at the edge of the little-known Cuna Cuna region, facetiously dubbed "Back of Beyond."

and is traversed by a passable trail, upon which, however, there is no shelter. By good fortune it was possible to establish headquarters at House Hill, an estate lying southwest of the Gap at about 1,500 feet, in the lee of the range; and from this point many trips were taken to the Gap itself and to several of the neighboring peaks at 3,000 to 3,500 feet elevation—Gossamer Peak, Stone Hole Bump, Maccasucker Bump—all of them previously unexplored. The region is even wetter than the high peaks, an annual rainfall of 200 inches being by no means uncommon, and the luxuriance and variety of the fern flora, especially along the wet culminating crests and in the deep forested ravines, rich beyond all expectation, for so low an altitude. A most interesting feature here was the occurrence,

FIG. 112.—The main, heavily forested Blue Mountain range looking northeast from Cinchona. Mossman's Peak lies at the right. The bare patches in the foreground are newly cleared areas planted to coffee. (Photograph by Duncan S. Johnson.)

often in abundance, of a considerable number of ferns known previously only from the higher peaks to the westward at nearly twice the altitude. One day was given also to collecting in the isolated John Crow range, at a point opposite Mill Bank. The period of three weeks spent in exploring from House Hill was exceedingly productive, and thanks are gratefully tendered to the owner, Mr. C. E. Randall, and his family, for much cordial assistance, without which the work could scarcely have been carried out.

In the latter part of June Dr. Maxon joined a party of botanists at Abbey Green, a famous coffee property at about 4,000 feet, which

FIG. 113.—A "close-up interior" of tropical rain forest, Portland Gap. The ferns shown (*Elaphoglossum*) have simple stiff leaves, in strong contrast to the more usual lacy kinds.

had been leased by Prof. Duncan S. Johnson, of The Johns Hopkins University, and from this point, which lies 1,500 feet below Portland Gap, carried out intensive exploration of the higher peaks and ridges. Of especial interest was the ascent of Mossman's Peak (about 6,400 feet), lying just west of Portland Gap and hitherto unexplored, and the collection of large series of specimens upon the eastern and southwestern slopes of the mountain and at a high pass to the westward, known locally as "Main Ridge Gap." This whole upper region is densely forested and extremely humid. Fortunately a comparative drought prevailed at the time, allowing almost continuous work, and many rare and little known ferns were collected in quantity. In a deep pocket on the northeastern slope of Mossman's, filmy ferns

FIG. 114.—An early morning view of the coffee-producing region south of Portland Gap, with the steep denuded slopes of the Port Royal Mountains in the distance, southwest. (Photograph by Duncan S. Johnson.)

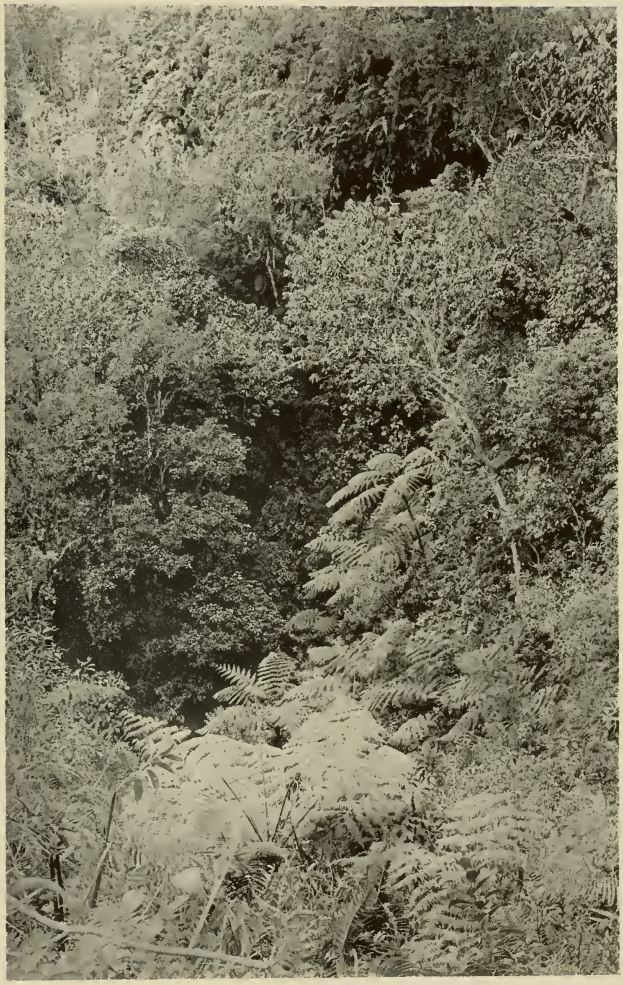


FIG. 115.—Entrance to a deep forest ravine in the higher Blue Mountains; the tree ferns are characteristic. (Photograph by Duncan S. Johnson.)

FIG. 116.—Dense epiphytic growth, chiefly bromeliads, ferns, and orchids, in wet forest near Morce's Gap, Blue Mountains of Jamaica. (Photograph by Duncan S. Johnson.)

(Hymenophyllaceae) were found in extraordinary abundance not elsewhere equaled.

To the east of Portland Gap similar exploration was carried out all the way along the trail to Blue Mountain Peak, the most extended trip being one of three days to the Peak itself (7,428 feet) and the

FIG. 117.—One of the rare tree ferns (*Cyathea Harrisii*), known only from the summit of Blue Mountain Peak. (Photograph by Alexander F. Skutch.)

deep forest sink between that and Sugarloaf Peak. Here a number of locally endemic ferns were collected, and observations made that will be of decided value in future exploration of the heavily forested northern slopes. At the Peak the panorama in all directions unfolds superbly, and one better realizes from the extremely broken topography why progress in exploration has been so slow. From this great height the sea, to north and south, lies only 12 or 13 miles away.

FIG. 118.—A filmy fern (*Hymenophyllum sericeum*), common in the higher Blue Mountains. The tawny-gray woolly fronds, about a foot long, hang limply in masses from tree bases in forest openings. (Photograph by Duncan S. Johnson.)

The present field-work was made possible through the allotment of a grant by the American Association for the Advancement of Science, a contribution from the New York Botanical Garden, and the hearty cooperation of the United Fruit Company. In all, about 15,000 botanical specimens were collected, representing 2,050 collecting numbers, and in addition a few other miscellaneous natural history specimens. The fern material will assist greatly in the projected manuscript, which is planned for publication by the British Museum. It is to be hoped that means will be found for continuing the Jamaican exploration, which, in spite of work already done, offers as fascinating an opportunity of botanical field-work as may be imagined.

BOTANICAL FIELD-WORK IN PANAMA AND COSTA RICA

In November, 1925, Mr. Paul C. Standley, associate curator, division of plants, U. S. National Museum, spent three weeks in the Canal Zone, in continuance of his previous studies upon the flora, as a result of which there is now ready for publication an account of the plant life of the Isthmus. At the invitation of Dr. Thomas Barbour and Mr. James Zetek a week was spent on Barro Colorado Island in Gatún Lake at the Laboratory for Tropical Research directed by the National Research Council.

This island, about six square miles in extent and for the greater part heavily forested, was set aside four years ago as a reservation for the wild life of the Canal Zone. The heavy rainfall, sometimes as much as 30 inches per month, is favorable to a luxuriant plant growth. The huge trees, of great variety, are loaded with aroids, bromeliads, orchids, and other epiphytes, affording a rich field for the study of these groups. Mr. Standley collected about 500 specimens, and has prepared for publication a list of the plants known from the island, amounting to about 600 species.

From the first of December until early April Mr. Standley was engaged in botanical work in Costa Rica. Nearly a month was devoted to exploration of the region of Santa María de Dota in south-central Costa Rica. Santa María, situated at an elevation of 5,000 feet, is surrounded on all sides by high mountains. Originally they were covered with dense oak forest, but much of this has been cut to permit cultivation. Inasmuch as the region was practically unknown botanically, it yielded a rich harvest of new or otherwise interesting plants. Of special interest were several sphagnum bogs lying at a considerable elevation in the dense forest, in which grow

FIG. 119.—An epiphytic cactus (*Epiphyllum ackermanii*) grown in Costa Rica. Flowers red. About half natural size. (Photograph by M. Gomez Miralles.)

FIG. 120.—Scene in the wet lowlands of the Atlantic coast of Costa Rica. Heliconias ("wild bananas") are the most conspicuous herbaceous plants. (Photograph by H. Wimmer.)

many plants of South American types, nearly all of them new to Central America. New Year's eve was spent in a little cabin on the Cerro de las Vueltas, at an altitude of 10,000 feet. This mountain and the near-by Cerro de la Muerte (Mountain of Death) are unique in Central America, but are similar to many regions of great extent existing in the Andes of northern South America. The top of the Cerro de las Vueltas is an extensive tableland, partly forested but consisting chiefly of the type of grassland known in South America as paramo. In these paramos the vegetation consists principally of a velvety sward of fine grass one to two inches high, in which are

FIG. 121.—The volcano of Irazú, Costa Rica, in eruption. (Photograph by H. Wimmer.)

scattered many small plants which are essentially alpine, such as buttercups, violets, gentians, and other groups well represented in the mountains of the United States. Barberry bushes are common in some places, but the most remarkable plant is a giant dock (*Rumex*) 10 to 15 feet high. At this altitude the nights are very cold, owing to the combination of rain, fog, and wind. Ice a quarter of an inch thick forms frequently.

After leaving Santa María, a month was spent in company with Prof. Juvenal Valerio at Tilarán, in the Province of Guanacaste near the Nicaraguan frontier, a part of Costa Rica in which no plants had been collected previously. Tilarán lies at the foot of the cordillera bearing the same name. This range of mountains, one of the most reduced sections of the great backbone of the American continent,

is only 2,500 feet high, but since it is the continental divide, separating the wet Atlantic slope from the comparatively arid Pacific slope, it influences to a remarkable degree the local distribution of the plants. Ordinarily a locality of Pacific Central America with such slight elevation as Tilarán (1,800 feet) would have a hot dry climate; but the rain-laden clouds of the Atlantic plains force their way westward over the crest of the cordillera and reach as far as Tilarán before they are dissipated. At Tilarán it is nearly always raining or misting, even when the sun is shining brightly. This might

FIG. 122.—A characteristic view along one of the rivers of the Pacific coast of Costa Rica. (Photograph by M. Gomez Miralles.)

well be called the land of rainbows, for with clouds, mist, and sunshine it is seldom indeed that a rainbow is not to be seen.

The rain and wind make the climate a cool one, much like that of the central tableland of Costa Rica, whose elevation is twice as great. The flora also is similar, and we find here, at only 1,800 to 2,500 feet, many species that grow at altitudes of 5,000 to 8,000 feet in central Costa Rica.

Westward from Tilarán, beyond the influence of the clouds, the climate changes quickly, and at a distance of one or two miles the soil is parched during the winter months, and the heat excessive. Some collecting was done in this arid region, particularly near the gold mines at Líbano; nearly all the plants were different from those growing but a few miles away in the humid vicinity of Tilarán.

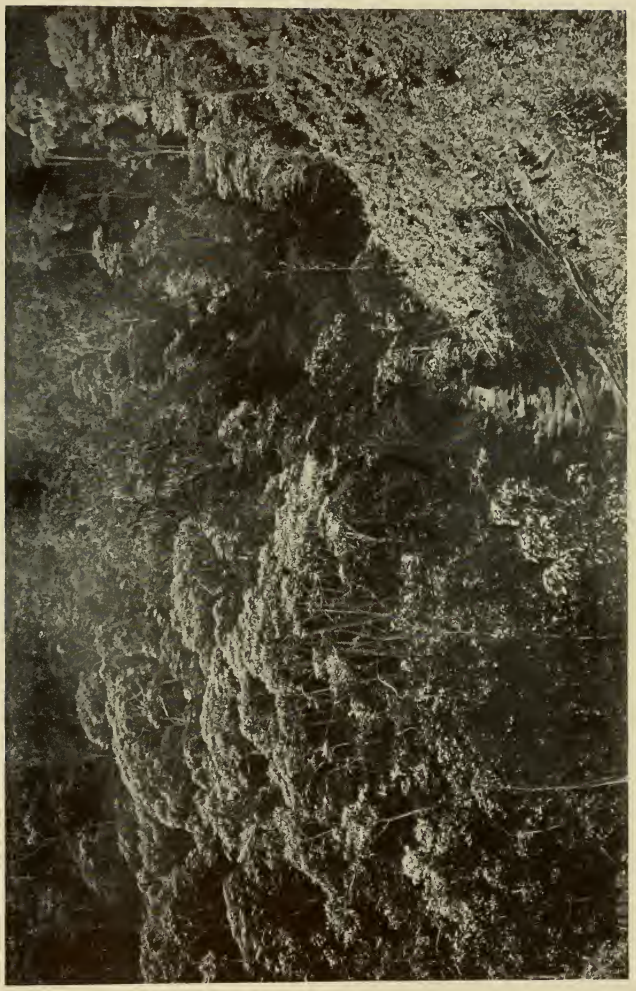


FIG. 123.—A typical view in the high mountains of central Costa Rica. Such forest is almost impenetrable. It is extremely rich in orchids and other plants. (Photograph by M. Gomez Miralles.)

A visit was made to Lake Arenal, across the cordillera on the Atlantic watershed. This lake, several miles long, is curious because of the fact that although the water is deep, its surface, at least during the drier winter months, is completely covered with vegetation. Viewed from one of the overhanging slopes one would never guess the presence of a body of water; it appears like a great savanna. At the end of the dry season the long grass covering the water becomes so dry that it may be set afire, thus affording the anomalous spectacle of a burning lake.

FIG. 124.—Páramo of the Cerro de las Vueltas, Costa Rica, at an elevation of 10,000 feet. The low clumps of vegetation are composed chiefly of a dwarf bamboo.

Field-work in Guanacaste revealed a large number of unusual plants, most of them, however, of technical rather than general interest. Much lumber is cut in this province, especially Spanish cedar (*Cedrela*) and guanacaste (*Enterolobium cyclocarpum*).

After leaving Guanacaste Mr. Standley had headquarters at San José for several weeks, making excursions from the capital and from Cartago to the surrounding high mountains, the richest region for plants in all Central America. In company with Prof. Rubén Torres an excursion was made to El Muñeco, south of Cartago, where there was discovered a new genus of trees closely related to the walnuts. Visits were made also to the lowlands of the Atlantic coast, which likewise have a varied and interesting flora.

In Costa Rica about 11,500 numbers of plants were collected, mostly phanerogams and ferns. As upon an earlier visit, much attention was directed to the collection of orchids, of which there were obtained 2,000 numbers, representing many species. In orchids no other part of the North American continent can compare with Costa Rica, and it is probably not excelled by any area of equal size in South America. About 1,000 species are known from Costa Rica. They range from the beautiful Cattleyas, with flowers equal to

FIG. 125.—Cerro de la Carpintera, near Tres Rios, central Costa Rica. This mountain, now nearly denuded of its forest, is a classic locality for plants. Black howler monkeys still live in the patches of forest about the summit. (Photograph by M. Gomez Miralles.)

those of any hothouse orchid, to diminutive plants less than an inch high, whose blossoms are so minute that they must be studied under a strong lens.

Although Costa Rica is a small country, about as large as West Virginia, its flora is so extraordinarily varied that it is still imperfectly known, in spite of the fact that this has been the favorite collecting ground of a large number of botanists. It may seem strange that so small a country should not have been exhausted long ago, but to one familiar with Costa Rican geography the explanation is simple. Some of the provinces are so difficult of access that they are practically unknown even to the national government. The Republic

consists of a great mass of high mountains separated by steep-sided forested valleys, across which travel is nearly or quite impossible. Each valley and mountain possesses plant species all its own, hence many decades of exploration will be needed to exhaust this narrowly limited portion of the American tropics.

BOTANICAL EXPLORATION IN NORTHERN HAITI

Further field-work in Haiti was undertaken in November, 1925, by Mr. E. C. Leonard of the division of plants, U. S. National Museum. This work was fostered by Dr. W. L. Abbott, who in recent years has made a number of visits to Hispaniola, procuring much valuable material in several branches of natural history. The botanical specimens collected on these expeditions will be studied in the preparation of a flora of Hispaniola which is now under way.

Mr. Leonard commenced the winter's work in the vicinity of St. Michel, using as headquarters, with the permission of Mr. G. G. Burlingame, a house belonging to the United West Indies Corporation. With the invaluable assistance of Mr. F. C. Baker of the United States Department of Agriculture and Mr. E. J. Sieger, Manager of the Atalaye Plantation at St. Michel, it was possible to reach this region almost immediately after arrival at Port au Prince. The plantation is situated three miles east of St. Michel on the northern edge of a large savanna. During the winter season these plains are covered by a dense growth of a tall reddish-yellow grass, *Themeda quadrivalvis,* a native of Africa. It is of no value as a forage crop and is a serious menace to the plantation buildings, since fires started by Haitian farmers are constantly breaking out, and sweep rapidly over considerable areas. The principal crop raised on the plantation is tobacco; both cotton and sugar cane were tried but did not thrive in the black mucky clay of the savanna. A large number of Haitians, four hundred to three thousand, according to the season, are employed to assist with the crops, and, judging from the melodious cadences drifting in from the drying barns and fields, they find happiness as well as a congenial occupation.

The comparatively meager flora of the plains being soon exhausted, excursions were made to the neighboring mountains, the nearest of which, Mt. La Mine, lies a short distance to the north. Its arid, thicket-covered slopes produce many unusual plants. Of great interest in this region are several caves whose floors are covered by a thick layer of dust, débris, and fragmentary bones of an extinct fauna.

Other mountainous regions, more distant but accessible by horseback, were Mt. La Cidre, Mt. Platanna, both southwest of St.

FIG. 126.—The northern slope of Mt. Platanna, showing the xerophytic nature of the vegetation.

FIG. 127.—Logwood ready for export, at Gonaives, Haiti.

FIG. 128.—Cactus plains east of Gros Morne, Haiti. The tall tree-like cactus is *Cephalocereus polygonus*, the lower columnar cactus at its base is *Lemaireocereus hystrix*, the prickly-pear in the foreground is *Opuntia antillana*.

FIG. 129.—One of the interior towers of the Citadel, northern Haiti. The Citadel was constructed by the emperor Christophe as a last retreat in case of a French attack.

Michel; Kalacroix, south of Atalaye Plantation; and St. Raphael, Dondon, and Marmelade, to the north. In the regions of Kalacroix and Marmelade the altitude was great enough to permit an abundant growth of ferns. In climate and character of vegetation the region of Kalacroix resembles in many respects that of Furcy, south of Port au Prince, visited by Dr. Abbott and Mr. Leonard several years before. In the rich valleys of both Kalacroix and Marmelade a great deal of coffee is grown. On the low mountains, between the occasional streams, one usually finds xerophilous grasses or thickets. In some places high cliffs and steep inclines of jagged lime rock, partially covered by tangled vegetation, are the predominating features.

FIG. 130.—Three donkey loads of guinea grass, Gros Morne, Haiti.

Dondon, a picturesque but somewhat inaccessible village, was next chosen as a collecting base. It is near the famous Citadel, that stupendous monument to futile effort erected with so much suffering and loss of life as a final stronghold of Christophe, once Emperor of the North.

Lumbering possibilities in Haiti have long been a subject for investigation. In the regions visited on this trip, timber did not seem plentiful enough for profit. The common tree of the higher regions is *Pinus occidentalis;* yet even it is scattered and of poor quality. On the plains and foothills mahogany is fairly abundant, the trees growing a considerable distance apart and owned, as a rule, by individual landholders. Logwood is found mostly in dense thickets. When the native finds a tree which has produced sufficient heartwood,

it is hewn into convenient lengths with a machete and the useless sapwood removed. The pieces of heartwood, which contain the dye, are then carried by head or on pack animals to the nearest clearing house, a shelter and rude balance erected by the roadside near or in some village, and there offered for sale.

On January 11, 1926, a new headquarters was established at Ennery, a village midway between St. Michel and Gonaives. The high mountains, rising abruptly on the south, resemble Mt. La Cidre and Mt. Platanna in both physiographic features and flora. On the north the Puilboreau or Cape road, winding upward in a continuous grade to an elevation of about 2,700 feet at the Pass, gave excellent oppor-

FIG. 131.—Market at Gros Morne, Haiti.

tunity for collecting the plants of the surrounding region. A dense thicket at the summit of the Pass, wet on its north slope and dry on its south, was especially rich in strange plants. The flora along Trois Rivières in the vicinity of Gros Morne, Pilate, and Plaisance, typical of most river vegetations throughout Haiti, was rather uninteresting, but the arid thickets between Gros Morne and Gonaives were extremely productive. These undoubtedly would furnish excellent botanical material if visited during the wet season.

After completing his field-work in the northern mountain region of Haiti, Mr. Leonard returned to Port au Prince, where several days were spent in packing specimens and in exploring the sources of Thor, Bizoton, and Mariani with Dr. Erik L. Ekman and Dr. H. D. Barker.

As a result of this expedition, a collection of 3,143 numbers (about 9,000 specimens) was procured, some of the species being new or rare ones not previously represented in the National Herbarium. In addition to the herbarium material, a number of land shells and insects were collected.

ARCHEOLOGICAL SURVEY OF THE FÊNG RIVER VALLEY, SOUTHERN SHANSI, CHINA[1]

In the latter part of December, 1925, Mr. Bishop suggested that I undertake some work in the field. The idea immediately occurred to me that before the spade be brought out, a preliminary survey should be made, so it was agreed that I should go to the southern part of Shansi and investigate the archeological possibilities along the Fêng River valley. The president of Tsing Hua College, Mr. Y. S. Tsao, kindly consented to cooperate. In his official capacity, he wrote to Governor Yen Hsi-san and successfully arranged for a permit for me to travel in southern Shansi. By a lucky coincidence also, the Geological Survey of China was on the point of sending Mr. P. L. Yüan to the same region for some field-work in geology. Mr. Yüan is a geologist of much experience, having travelled with Andersson in Kansu for two years and acquired a great deal of interest in prehistoric archeology. So we arranged to travel together. Our start was somewhat delayed, and it was not until February 5, 1926, that we left Peking, just a week before the Chinese New Year.

We arrived at T'ai-yüan on the 7th, and spent the whole day of February 8th in making calls and purchasing equipment. When I left Peking, I brought a large number of letters of introduction to the Governor and the various officers of influence in Shansi. Among these was one written by Mr. Liang Ch'i-ch'ao, now senior professor of the Tsing Hua Research Institute. Similar to many other letters, this one explained the purpose of my visit and the necessity of archeological work at present. The Governor, however, was too much occupied with matters of greater importance to see us; but we succeeded in having an interview with his secretary, who, on behalf of the Governor, promised us all the help we asked. These promises were well fulfilled later on.

[1] EDITOR'S NOTE: It is greatly to be regretted that, owing to lack of space available in the present publication, Dr. Li's excellent report, his illustrations and his interesting conclusions cannot be printed complete at this time. The following excerpts will, however, convey some idea, at least, of what he has accomplished by his preliminary search for archeological sites in southern Shansi.

We left T'ai-yüan on the 9th (fig. 132) and, traversing what is geologically a *loess* area, arrived at Chieh-hsiu three days later. I was much impressed by the extensive use of arches that is noticeable from T'ai-yüan southward. It seems to be quite a peculiarity of Shansi architecture. The first series I saw was along the Chêng-t'ai road. All the way, in houses that were built on a grand scale, as well as in the small inns, we found such arches employed. Buildings of this type are known as *yao-fang*. Native scholars told me that they are warm in winter and cool in summer, the style being derived from the early cave-dwellings. At present, we still find all the transitional

FIG. 132.—Our cart in front of a roadside temple.

stages from the *loess* cave type to the most complicated *yao-fang* represented in this region.

We took advantage of the Chinese New Year to see the city of Chieh-hsiu (fig. 133) and also made some measurements of the natives, who seem to be quite a heterogeneous group. I saw bearded men who can be compared with the average Armenian; I saw also men with 100 per cent yellow moustaches. One of the commonest physical types found in this district is the round headed individual with a long face, a disharmonious type according to physical anthropology. Such an occurrence did not, however, surprise me at all, as both dolichocephalic and brachycephalic people are found in this region. Very likely it is the mixing of these two fundamental types that has given rise to this disharmony.

On the 15th, we started our first trip to the mountain (Mien-shan) in the southwestern part of the district where some of the ancient

temples are found. Of two of these, especially, I made some detailed study. Both temples are Buddhist, one located at the foot of the mountain, the other near the top of one of the peaks. The one at the foot was first built in the T'ang Dynasty, but has been destroyed and rebuilt many times since, only the bell and drum-tower still retaining a pre-Yüan style. The temple on the peak, also, was first built in the T'ang period, but burned during the Ming. The stratification of the three different layers of culture is here plainly visible.

FIG. 133.—Chieh-hsiu: in front of Kuan-yao Miao.

One of the halls is located very near to a cave. The images that are worshipped at present are evidently of recent origin. Behind them is another row of images cast in iron; and finally in the cave I found two broken statues of stone, one with a head and one without, carved in simple, bold style, showing T'ang workmanship; but they are cast away in the rear of the cave and covered by dust. Perhaps, however, the most interesting thing we saw on this trip is a stone ox washed down by a mountain torrent some time ago, from where no one knows.

The river Fêng has its source at Kuan-ch'in-shan and flows in a straight southerly direction till it reaches Chiang Chou. From I-t'ang

southward, it cuts through the Ho-shan range for about 40 miles, after which it flows through the plain again. For a whole day, the 23d, after leaving Chieh-hsiu, we wormed our way through the Ho-shan along the river bed. About noon we reached Hsia-mên Ts'un which is one of the most beautiful villages I have seen in this province: the buildings of brick and limestone, the windows and doors arched.

From there southward, the mountains on both sides rise steeply, and in them are many limestone caves, some of which I explored, but found only traces of modern habitation. We stopped at Ho-chou, between which place and Lin-fêng Hsien there are many historic places; but as I did not intend to make any intensive study north of the latter, we passed this region rather hurriedly and reached Lin-fêng Hsien on the 25th.

Lin-fêng Hsien (or P'ing-yang Fu), a city that has aroused imagination in the past—the ancient capital of the Emperor Yao! What Chinese scholars are not acquainted with the list of virtues of this august monarch? Did he, however, also create a model city? Since he was, perhaps, the most self-denying emperor that the world has ever known, it would not be in harmony with his ethical principles if he should have used the national wealth to build luxurious palaces like those found in Troy and Knossos; but whatever he might have done in this respect, it is a fact that there is not even a tradition as to the exact location of his capital. The modern city of Lin-fêng Hsien is, like every other city in inland China, surrounded by machicolated walls. About a mile west of the city flows the Fêng River, and west of the Fêng is the famous Ku-i-shan where, according to the mythical tales of Chuang-tzŭ, resided many fairies.

We rested in Lin-fêng Hsien for a day, and on the morning of the 27th started to explore Ku-i-shan in the western part of the district, the place being popularly known as Hsien-tung (Fairies' Caves). A mile out of the western gate of the city, we crossed the Fêng River. Between the river and the foot of the mountain there is a series of *locss* terraces ascending higher and higher towards the mountain and dotted here and there by villages, some of which are merely a collection of cave dwellings. It took us more than half a day to reach the Northern Fairy Cave, where we were received by a monk—an old man, widely travelled, and evidently knowing something about his profession.

The temples in this mountain are for the Buddhists. They were originally built in the early part of the T'ang Dynasty; but in later periods they were repeatedly ruined and rebuilt. For some time in the

Mongol Dynasty, the Taoists took hold of them and converted them into Taoist temples. They were, however, soon restored to the Buddhists again.

The purpose of my own visit to this place was to explore the limestone caves; that of Mr. Yüan, to investigate the coal region still further west; so on the morning of the next day, each of us pursued his own task. The whole region here is limestone formation, divisible into many different strata. A deep ravine cuts the ground into two perpendicular walls, north and south, in which are several rows of caves, most of them inaccessible, while some are well fitted for early human habitation. Of these I visited five, in the hope of unearthing some paleolithic remains, but the search proved fruitless. We left the mountain on the next day by a different route and made a further search at the foot of the mountain—only to be disappointed again. I had a long discussion with Mr. Yüan in the evening as to the exact route we should follow, and finally came to the conclusion that, so far as my personal work was concerned, I should follow partly the historical sites and partly the probably pre-historic settlements as my guides, so at 10 a. m. on March 2d we left for Yao-ling.

The exact location of the tomb of the Emperor Yao is a long debated question. Previous to the Mongol Dynasty, this tomb was usually located in Shantung. The tomb in P'ing-yang Fu was not so well known at that time. The argument for its location in Shansi is that as Yao retired at quite an advanced age, it is improbable that he should subsequently have inspected his distant domains and died so far away from home. As the tomb in P'ing-yang Fu is near his supposed capital, it is probably the true one—if, indeed, there be a tomb of this Emperor; but since the very existence of such a person is doubtful, we can only consider both tombs as variations, merely, of the same myth. All these considerations passed through my mind while we were riding towards the tomb of the Emperor. When we inquired about the way to Yao-ling, the natives simply stared at us, and it was a long time before we made out that the local name for the place is Shên-lin (Spirit Forest). There we arrived late in the evening, and found it surrounded by a wall enclosing a building of modest size, a solitary temple in the midst of mountains, where we stayed that night.

The tomb is quite high, pyramidal in shape and half encircled by a rivulet (fig. 134). It was officially lost for a long time, but was rediscovered in the Ming Dynasty, according to the inscription in the temple. The arguments as to whether this is the real tomb are diffi-

cult to follow; but in spite of them the question remains a question today, and undoubtedly will remain so until the spade of an archeologist shall clear it up.

We worked about two hours in the morning and left this reputed resting place of the august Emperor at 10 a. m., arriving at Fou-shan Hsien late in the afternoon. On the fourth, we made very little progress. The ground was wet, and there were many steep ascents and descents. We covered about six miles in all and stopped at Hsiang-shui-ho. On this day I picked up my first piece of red pottery of an archaic character on a descending *loess* slope.

FIG. 134.—Supposed tomb of the Emperor Yao. From the southeast.

The next day we started early, while the ground was still wet. The road we followed lies deep down between *loess* cliffs. Such roads make it convenient to observe the exposed surface of the *loess*. The finding of the red pottery sherd was very encouraging and made me look carefully all along the way. Not long after we started from Hsiang-shui-ho, I began to see gray pottery sherds of the Chou and Han periods. All of a sudden I discerned a piece of red pottery decorated with black lying among the withered, wet grass. Then one after another came into view as we traced them to their source. It is a heap of earth about 10 feet in height and cut down vertically on one side to the public road. The upper surface is a long and narrow strip. This piece of land is owned by the Li brothers, who most politely received me and helped me with their spades to gather samples of the painted sherds from the exposed surface of their mound. When

I left them, they were very willing to pose for a picture (fig. 135) by the side of the heap where these pottery sherds were discovered—the first Yang-shao site to be found in southern Shansi. The rest of the day's journey was a cheerful one, and at four in the afternoon we arrived at the city of I-ch'eng Hsien.

It was a whole day's journey from I-ch'eng to Chü-wo which, in turn, is about 60 *li* east of Chiang Chou—one of the most important cities in southern Shansi and a center for curio-dealers. At this city, the Fêng River turns westward. While we were in Chü-wo, we decided to pay a visit to Chiang Chou to have a look at the various

FIG. 135.—Site at Chiao-t'ou-ho where prehistoric pottery of the Yang-shao type was found.

curio shops in that city. This, I thought, might perhaps serve to help us in forming a notion as to the kinds of antiquities which are unearthed in this region. But this idea proved to be a delusion. All the curio-dealers have a common secret: if one inquires about the exact location of the place whence the things they exhibit come, the unanimous and invariable answer is that they do not know. In vain one may tell them that the curios would increase in value if their sources were known. Thus a whole day in Chiang Chou only convinced me that so far as real archeological work is concerned, very little help can be derived from such people. Having gone to Chiang Chou from Chü-wo by the northern route through Hou-ma, we returned over a bypath through mountains in the south which has been gradually elevated from the Fêng River valley by *locss* deposit. A day and a half

was spent in exploring the terraces, and although no particular archeological results were obtained on this trip, we had a fine chance to study the *loess* formation (fig. 136), a certain knowledge of which, I think, is necessary, if the archeology of southern Shansi is to be properly understood.

After we returned to Chü-wo, our next trip was to dash across Chung-t'iao-shan. This range, according to the local estimate, extends for about 800 *li* from east to west, parallel to the Yellow River on the south and the Fêng on the north, and inasmuch as early traditions about the Emperor Shun and the Hsia Dynasty are centered

FIG. 136.—*Loess* terraces south of Chiang Chou. (Photograph by P. L. Yüan. Courtesy of the Geological Survey of China.)

about these mountains, I decided to spend some time here. The next four days, therefore, were devoted to crossing and recrossing Chung-t'iao-shan; but as we found no archeological prospects here, we turned immediately northward to An-i Hsien and Yün-ch'êng.

We arrived at Yün-ch'êng in the evening of the 17th and entered the city on the 18th. On the 19th we set out to visit the supposed tomb of the Emperor Shun, and on the way stopped at certain temples in Yün-ch'êng. In *Shansi-t'ung-chih* (Vol. 52, p. 2), it is recorded that the stone pillars of these temples were formerly the palace pillars of Wei Hui-wang (335-370 A. D.), recovered from the ruined city south of An-i Hsien. Some of them are now used as the entrance pillars in Ch'ên-huang Miao and Hou-t'u Miao, and those of Ch'ên-huang Miao certainly show peculiar features which are worth record-

FIG. 137.—Details of the left hand stone pillar at the entrance to Ch'ên-huang Miao, Yün-ch'êng.

FIG. 139.—Type of Buddhist *stelae* collected by the Magistrate of An-i Hsien.

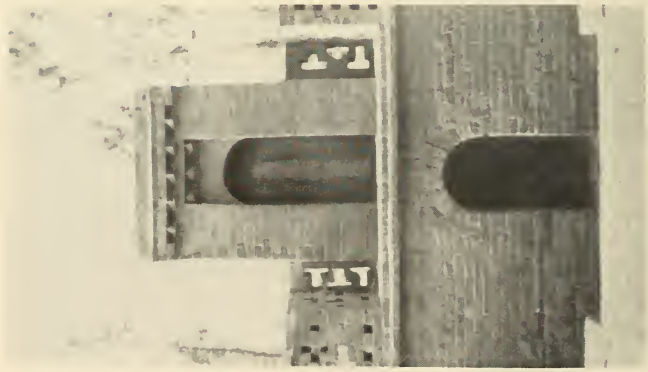


FIG. 138.—Supposed tomb of the Emperor Shun.

ing. Two pillars, hexagonal in section and carved with dragons coiled around them, are found at the entrance. The left one (fig. 137) is especially interesting, because in the claws of the dragon are grasped two human heads with perfect Grecian features: curly hair, aquiline and finely chiselled nose, small mouth and receding cheeks. One head with the tongue sticking out is held at the mouth of the dragon, while the other is held in the talons of one hind leg. It is an unusually fine piece of sculpture in limestone, wonderfully spaced and with the most graceful lines. The right one is inferior in its workmanship: evidently the two were not executed by the same hand. I saw 28

FIG. 140.—Supposed tombs of the Hsia Emperors. (Photograph by P. L. Yüan. Courtesy of the Geological Survey of China.)

of this kind of pillar in the succeeding two days; but most of them were crude imitations. It is possible, however, that some are of the ancient type and were made earlier than others. The whole subject is well worth more detailed study.

The tomb of Shun (fig. 138) has a very different appearance from that of Yao. It is located about 30 *li* northwest of the city of An-i Hsien in the midst of a vast plain with apparently no natural barrier on any side to shelter it from "the wind and the water." Half of the early references to the tomb of this emperor put its location at Ch'ang-wu. Yet Chang Chin-chün quite convincingly argued that it must be in An-i (*Shansi-t'ung-chih,* Vol. 56, pp. 20-23). The problem is similar to that concerning the tomb of Yao, and consequently the solution must be sought in the same way.

On the 20th, we were invited to dinner by the magistrate of An-i Hsien, Mr. Chêng, who is a student and collector of antiquities. He introduced us to a small museum in his *yamên* where he has gathered together a large number of Buddhist stelæ and ancient tablets (fig. 139) which were originally scattered all over the district of An-i. Only a part of all he found has been moved to his *yamên;* but his catalogue includes those which still remain in the different villages. He draws rather a sharp line of demarcation and leaves all the post-Sung sculptures unrecorded. It is an unusual work that he is doing, and gives one a ray of hope that some of the ancient monuments in inland China may yet be preserved. After the dinner we were taken about the city.

FIG. 141.—Site at Hsi-yin Ts'un where prehistoric pottery was found.

where we saw some more of the dragon pillars, mostly in Taoist temples. The ancient city itself, where some of these pillars are supposed to have been found, is less than a mile from the southern gate of An-i. The remains of the old wall are still visible, but, if the place was a city at all, it was indeed a very small one, measuring about 400 by 250 yards. It may, however, be the site of an important ancient building.

We left Yün-ch'êng on the 21st, and on the 22d we arrived at Hsia Hsien—center of the traditions of the ancient Hsia Dynasty. The temple of the Great Yü and the tombs of his descendants as well as many of the famous ministers of that dynasty are said to be located here, and all these I visited (fig. 140) ; but I must confess that I am not at all able to determine whether, judged by their appearance, they are the real tombs or not. They all look like the ordinary burial mounds, except that they are larger. However, while on our way to

visit these tombs the unexpected happened. It was after riding through the village of Hsi-yin that, suddenly, a large field of prehistoric potteries was discovered! Mr. Yüan was the first to see it. The site (fig. 141), extending to several *mou* of land, is apparently larger than the one we found at Chiao-t'u-ho, and the pottery is somewhat different, too. While we were picking up at random the sherds exposed on the surface, the villagers gathered in large number, so we did not stay very long lest there be too much excitement created.

FIG. 142.—Votive *stela* found at Hsin-hua-shih.

When we left An-i Hsien, the magistrate had given us a copied list of the names and locations of the various votive stones which are still scattered in the different villages of his district, and as we were on our way northward again, we determined to stop and see some of them. Three places were visited on the 25th and the 26th, where besides *stelæ*, we saw also a number of individual Buddhist figures which are preserved in good condition, the most perfect piece being in San-lu-li Ts'un. Unfortunately, it is preserved in a dark room, where a picture could not be taken, as I had no flash light with me.

On the 26th, while Mr. Yüan went away on some special geological mission, I started for Chi-san Hsien to have a look at the so-called T'ang wall paintings at Hsiao-ning Ts'un, some of these paintings having been recently sold to curio-dealers who sent them to Peking for sale. Hsin-hua-shih is a Buddhist temple built in the 12th year of K'ai-huang of the Sui Dynasty near Ch'a-tien-chieh. It has been destroyed and repaired many times; but the front hall still retains some reminiscence of T'ang architecture. It is in the central and the third hall that the walls are painted on three sides. The paintings of the side walls of the third hall and those of the southern wall of the central hall (opening towards the north) have been taken away by curio-dealers. The rest is still intact; and the date is to be found on the northern wall of the third hall, being the *wu-hsü* year of Yüan (A. D. 1298 or 1358). The courtyard between the front hall and the central hall was locked, and my guide assured me that there was nothing worth seeing inside the yard. Nevertheless, I had him open it for me, in spite of his assurance, and by sheer accident I found the protruding corner of a stone which lay buried in the ground. I asked the villagers to dig it out for me, and it proved to be a votive stela (fig. 142) carved at the time when the temple was first built. This little discovery rounded out my trip, and from this day on I marched directly northward and returned to Peking.

NOTES

1. Anthropometrical measurements at Chieh-hsiu.

Through the kind arrangements of Mr. Huang Tzŭ-sen, Magistrate of Chieh-hsiu Hsien, I was able to measure 86 of the natives of this District who are serving in the Army Training Camp and the Police Court. With the exception of my series of Huang-p'i and Huang-kang, this is the largest of any series of anthropometrical measurements made in any one district. The following 13 measurements were taken of each individual: stature, auditory height, sitting height, head length, head breadth, horizontal circumference, minimum frontal diameter, bizygomatic diameter, nasion-menton height, nasion-prosthion height, nasal height, and nasal breadth. Observations were also made of the following descriptive characters: hair color, eye, brow, chin, shape of nose, malar bone, shape of face, prognathism, teeth.

2. Pottery Sherds from Chiao-t'ou-ho.

The total number of sherds is 127. Of these, 42 are painted. Of the painted, 20 are with rims: 6 with bent rim, 1 with thickened rim, and 13 with plain rim. The paint used is black. The ground color varies from light brown to dark brown. The patterns consist of triangles with three sides concave, or with two sides concave and one side straight or convex; straight lines; crescent moon; big round dot; cross-hatched lines; shape of X with horns elongated into straight lines; and parallel lines with big dots between. Of the 85 unpainted, 21 are gray in color and are decorated with incised lines in parallel,

cross-hatched or mixed directions; 2 are black and undecorated; 2 are dark violet and undecorated; 60 have the same ground color as the painted, and of these 17 are decorated with incised lines, 1 with ornamentation in relief, and 42 are plain. In addition to these potteries, there are also two broken pieces of finely made black stone rings, and a small piece of the shaft of a human ulna.

3. Pottery Sherds from Hsi-yin Ts'un.

The total number is 86. Of these, 14 are painted. Of the painted, 7 have rims—3 bent and 4 plain. Triangles, straight lines and big dots are the chief decorative patterns. They are often combined. Of the unpainted, 15 are gray or black in color and 57 are red or dark brown. Of the gray or black, 11 have incised lines and 4 are plain. Of the red, 34 are incised and 23 are plain. One complete, rather ill-shaped cup is found in this collection. It is dark gray in color and not uniformly fired. The diameter of the rim varies from 5.5 cm. to 5.9 cm.; the height is 5.3 cm. There are 7 ridges at the bottom with 7 finger depressions between the ridges.

4. Votive *stelæ* seen in An-i Hsien.

In the list of ancient votive *stelæ* given to me by the magistrate, there are 41 dated previous to the T'ang Dynasty. Of these, 28 have been moved to Fang-kung-tz'ŭ, the museum in the magistrate's *yamên*. Twenty others are dated in T'ang and Sung, the latest date corresponding with A. D. 1101.

CHI LI,
Freer Gallery of Art Expedition to China.

ANTHROPOLOGICAL WORK IN ALASKA

Under the auspices of the Bureau of American Ethnology, Dr. Aleš Hrdlička, curator of physical anthropology, U. S. National Museum, made, during the spring and summer of 1926, a comprehensive survey of anthropological and archeological matters in Alaska.[1] The

[1] During the extended trip briefly outlined above the writer has received many courtesies and much help for which he wishes hereby to offer once more his grateful and hearty acknowledgments. It will be impossible to specially mention all who aided in the work, but in the first place thanks are due to Governor George A. Parks of Alaska; Mr. Harry G. Watson, his Secretary; Mr. Karl Thiele, Secretary for Alaska; Judge James Wickersham, formerly Delegate from Alaska; to Father A. F. Kasheroff, Curator of the Territorial Museum and Library of Juneau; Dr. Wm. Chase of Cordova; Mr. Noel W. Smith, General Manager, Government Railroad of Alaska; Mr. B. B. Mozee, Indian Supervisor, and Dr. J. A. Romig, of Anchorage; to Professor C. E. Bunnell, President Alaska Agriculture College at Fairbanks; to Mr. and Mrs. Fullerton, Missionaries at Tananá; to the Rev. J. W. Chapman at Anvik; to Father Jetté, at Holy Cross; to Mr. C. Betsch at Russian Mission and to Messrs. Frank Tucker and E. C. Gurtler, near the Mission; to Mr. Frank P. Williams of St. Michaels; to Judge G. J. Lomen and his very good sons and daughter at Nome; to the Rev. Doctor Baldwin, Fathers La Fortune and Post, and Capt. Ross, U. S. Coast Guard, at Nome; to Mr. Elmer Rydeem, merchant at Nome; to C. S. Cochran, the Captain of the "Bear," and his officers, particularly Mr. H. Berg, his excellent boatswain; to the Rev. F. W. Goodman and Mr. La Voy at

trip was in many respects a noteworthy one and rich in results, which, if followed up, promise to lead to valuable additions to our knowledge regarding the American aborigines.

Since American anthropologists started to study native man, there has always been in the background of the work the question of the origin and antiquity of the American Indian and Eskimo. There were always the questions: Who are they?; What are their true affiliations?; Where did they come from?; and When did they come to the New World? One man after another under the Smithsonian Institution, and more especially under the Bureau of American Ethnology, besides those elsewhere, has given his life to the study of these problems, and research was and still is carried on in all parts of the continent on these basic questions, without the final answers having as yet been reached.

Throughout this work there has always been felt a need of more definite knowledge of those parts of America and Asia that come closest together. In the studies on the origin of the American aborigines in particular, indications invariably point to the furthermost American northwest and thence to the Asiatic continent. Time and again, even to the present day, ideas or opinions have been advanced that the American man, or at least some of the American aborigines, may have reached this continent from other parts of the world—from Europe, Polynesia, Melanesia, Central or Southern Asia, and even Australia. The men who are advancing these ideas generally forget that when we are dealing with the peopling of America we are not dealing with the people of the continent within anything like historic times, but thousands of years back when man was by no means as civilized or apt in any part of the world as he later became, and when he did not control as yet sufficient means of navigation or, especially, of provisioning for any extended journey such as could have brought him into this continent. The best students of the question agree that man, up to relatively late times, could only have come into America over small stretches of ocean; and so everything points in the one direction of Alaska, and beyond to the Asiatic continent. And here many people have assumed that there must have been up to recent

Pt. Hope; to the American teachers at Wales, Shismareff, Kotzebue, Pt. Hope and elsewhere; to Tom Berryman, Jim Allen and Mr. Chas. Brower, traders respectively at Kotzebue, Wainwright, and Barrow; to Mr. Sylvester Chance, Superintendent of Education, Kotzebue, Alaska; to the U. S. Marshals, Deputy Marshals and Postmasters along the route; and to the numerous traders, miners, settlers and others who were helpful with specimens, advice, guidance, and in other matters.

FIG. 143.—Harding Glacier, Resurrection Bay, Alaska.

FIG. 144.—Episcopalian Mission, Yukon Tananá Jct.

FIG. 145.—Chief Thomas, of the Tananá Indians, with his young wife. (At Nenána.)

times a land connection. But Dall and others have shown that we have no sufficient foundation for this assumption within the time that the American man may have come over; nor was such a connection at all necessary. There may have been a land connection preceding, and possibly even during some part of the glacial period, but those times are so far away that they play no part in the peopling of America, however large a rôle they may have had in the exchange of various animals between the two continents.

When one looks on the map of Alaska, it seems a relatively small portion of the world and it would seem that the exploration of it for traces of ancient man should be fairly simple. There are a few large rivers; almost no harbors; there are in general only a few favorable spots in Alaska where ancient man could have established himself, and it would appear easy to reach these points, to survey them, and to see what they promise or can give. As a matter of fact, Alaska is as large as one-third of the United States; the whole of it has less than two hundred miles of good roads; and the interior—and by interior is meant here anything away from the shores of the seas and the banks of the rivers—is practically impassable except for short stretches during the brief summer. In winter the country can be traversed more easily with dog sleds, but winter is not the season for archeological work. And when the explorer comes to the rivers or shores, he finds that transportation facilities by boat have, since the gold rush is over, become very limited, suitable boats being hard to obtain and very expensive. So that the student from the very start is presented with serious difficulties which at times seem almost insurmountable.

Under these conditions it was difficult to carry out systematic work planned ahead from beginning to end; but the writer soon learned that Alaska in general is peopled today by the most helpful, big-hearted and generous men and women, and their help counted for much. With this many of the difficulties were overcome until the Bering Sea was reached, where by good fortune was found the Revenue Cutter "Bear," which was ready to help. On it the writer went to St. Lawrence and other important islands; and with it he was enabled to visit point after point of anthropological interest along the Seward Peninsula, the Kotzebue Sound, and then through the Arctic Sea right up to Barrow. The "Bear" could not give all the time needed, but enough was given to make possible at least the most essential observations on each spot and fair collections.

The journey began, strictly speaking, at Vancouver, for at the several stops of the boat between Vancouver and Juneau an opportu-

FIG. 146.—Chief Joseph, Yukon Indians, Tananá. (Photographed at the Mission.)

nity was had of seeing the natives of the coast and the islands. The striking characteristics of these natives are their relatively large faces and big chests, combined with rather short legs and stature. There are large numbers of mixed-bloods among the younger generation.

A stop of several days was made at Juneau, to see the excellent local museum under the able directorship of Father Kashevaroff, and to obtain the needed official papers. The occasion was utilized also for a visit of the last remaining known site of the Auk tribe of Indians, and for some important collections. The chief among the latter is an old Shaman mask of the Yakutat tribe beaten from one piece of copper.

From Juneau, transportation was taken for Seward on a boat which stopped at several stations for a sufficient length of time to enable the writer to see such things as could be found in these places, and to make inquiries of principal local men about Indian remains. Some specimens were collected on this part of the trip, including a very typical skull of an Indian child donated by Dr. Chase of Cordova.

From Seward the journey was continued on the government railroad to Anchorage, with some further collecting and information at the latter place. Through the courtesy of the general manager of the railroad, Mr. Noel W. Smith, a stop was next made at the now small but formerly more important Indian village of Eklutney. Here exists a new and well conducted Indian school in which, thanks to the principal, it was possible to examine a large number of Indians, with a few Eskimo children.

From Eklutney a train was taken to Nenana, where a number of local Indians, headed by their old Chief Thomas, were waiting for a brief talk; and then to Fairbanks, where additional specimens of interest were obtained, and where the writer was enabled, thanks to the kindness of Professor C. E. Bunnell, President of the Alaska Agricultural College, to examine the ethnological, archeological and paleontological collections at the college. From Fairbanks, the writer returned to Nenana, where he boarded a small river steamer with which he proceeded down the Tananá River on which are several small Indian villages.

The main part of the inland journey began at Tananá, at the junction of the Tananá and Yukon Rivers, and extended down the Yukon for a stretch of over 900 miles. It was covered mostly in small boats, some owned by traders, some by Indians. We zigzagged from bank to bank, from settler to settler and camp to camp, making inquiries, observing natives, examining old sites, and collecting what it was possible to collect. In this way considerable light was finally gained on our

problems along the Yukon, which grand stream must have been one of the principal arteries of the ancient movements of population; and the impressions increased until by the time the mouth of the river was reached it was possible to formulate the following conclusions:

1. The living Indian population along the Tananá, and the Yukon below the Tananá, is scarce. It is doubtful if the total number of the natives on both rivers, as far as covered on this trip, reaches 1,000. And many of the younger adults and especially the children, are mixed-bloods. Due to a lucky coincidence—a potlatch at the mission above Tananá, and other conditions—about 400 Indians were actually

FIG. 147.—Anvik, on the lower middle Yukon.

seen. They all belong to one type, of moderate stature and features, moderate pigmentation, and brachycephaly. They are identical with, or very near to, the Alaska Indians further south.

2. The boundaries between the Indian and the Eskimo both culturally and physically, are indefinite and vague. Moreover, in olden times the Eskimo, according to indications, extended somewhat farther up the river than he now does. But the Indian seemingly occupied always the middle two-thirds of the Yukon, and the Tananá. As the trip proceeded down the Yukon below Ruby, the more specimens obtained and especially the more skeletal material gathered, the more difficult it became to say just where ended the Eskimo and where began the Indian. There is no clear line of demarcation between the

two; they interdigitated and mixed together, culturally as well as physically.

3. From Tananá down stream to its mouth, the Yukon is now and was evidently in the past peopled almost exclusively on the right or northern side. This side is essentially that of the heights, the left being mainly that of flats. But even in the flat country towards the mouth of the river (north mouth) the settlements are all on the right bank. The Indians and the Eskimo behaved alike in this respect, as in a good many others.

4. The old banks of the Yukon, where preserved, show occasional sites of human occupation and yield stone tools, fragments of pottery, more or less fossilized animal bones, and now and then barbed points of ivory or other bone objects.

The habitations in general were of the partly subterranean "igloo," or pit-and-tunnel type. Traces of Russian presence are common. The occupation of some of the sites is still remembered. A few appear earlier than the coming of the white man. No trace was found or heard of any remains that would suggest geological antiquity.

So much for the Yukon. When the Bering Sea was reached, the first more important visit was to St. Lawrence Island. This island was formerly not much considered in archeology and anthropology. It was believed to be rather an out-of-the-way place with small if any connection with the American side, and on which there was not much of importance. This idea must now be given up, for as a result of what was seen and learned this large island should be one of the principal points of attack for future research and is one of the most promising. On the St. Lawrence and the little "Punuk" Islands southeast of it, there are now being recovered by the Eskimo quantities of objects made of ivory which through age has become more or less "fossilized," and these objects in some cases show remarkable and beautiful decoration. Definite information was obtained that on one of the Punuk Islands numerous such implements are actually visible frozen in old refuse heaps. A small party from the Revenue Cutter "Algonquin" reached these islands this year (1926) and obtained, according to reliable information, several bushels of such articles and of old ivory. These objects were brought away to be worked up into beads, pendants, etc., which find ready sale. A number of them, parts of which were still extant, showed human workmanship. These and other facts indicate that these islands are of much promise, and it is urgent to explore them before what they can give disappears.

From St. Lawrence the voyage led to the Diomedes, passing King Island. This island was at that time bare of population, all of the

inhabitants having gone to Nome for the summer. At Nome, where they now come every year, these Eskimo work at various trades, and manufacture articles from the walrus ivory which they have gathered during the rest of the year. They do not return until late in the season, when they have sold all they have made. We also passed Sledge Island, with two interesting dead villages which ought to be explored.

The next stop was on the smaller or American Diomede. At this time the writer did not have permission from the Russian Government (received later) to visit the larger island, which belongs to Russia. We found, however, that both the larger and smaller Diomede were

FIG. 148.—June 26, 1926. Bird's-eye view of Cape Prince of Wales, Alaska. Picture taken at midnight on above date showing the midnight sun. The point on the left hand margin of the picture is the nearest point to Siberia.

Note: The village can be seen extending along the coast to a point about 300 ft. beyond Village Creek. Large body of water on the extreme right is Lopp Lagoon. (Photograph by Clark M. Garber.)

nearly deserted, the inhabitants having gone to Nome where they, too, stay through the summer making articles of fossil (mammoth, walrus) or fresh (walrus) ivory. If the student wants to see these islanders in summer he must go to Nome, where on one side of the town live the Diomede, on the other the King Island people. The majority of both were seen there before the start with the help of the very efficient and good Father La Fortune.

Although the small Diomede is difficult for exploration, some interesting features were found. They consisted of rock burials, old refuse heaps, and ruined habitations. The burials have been made among big boulders of granite that cover the steep slopes of the

island. Beneath these boulders are many large crevices in which nest thousands of the little auks. One hears the birds constantly chattering deep beneath one's feet, but never sees them. The crevices are deep and spacious, and into them have fallen beyond redemption many of the skulls and bones of the people buried once among the rocks above. Only here and there a bone or a skull that escaped such fate remained to be collected.

As to the village on the little Diomede, it is a poor little hamlet of only five houses, and could never have been much larger. But it is built upon something that preceded it and the ruins, the tumbled

FIG. 149.—Portion of Native Burial Grounds from which specimens of skeletons and crania were collected for Smithsonian Institution. *Location:* Northern Talus slope of Cape Mountain about ½ mile from Village of Wales. (Photograph by Clark M. Garber.)

buildings of older times, have served for a foundation of the newer dwellings. Dr. Jennes of the Ottawa Museum came out with us from Cape Prince of Wales to do some excavation on the island.

The next stopping place after a brief visit to Wales, was the site of two old native settlements with a living village between them, called Shismareff, located near the middle of the northern coast of the Seward Peninsula. Along this part of the coast are several other old dead villages, some of them particularly promising for exploration. Of the two at Shismareff itself, the more important was unfortunately appropriated recently for a fox farm, the burial grounds were razed, the skeletal remains mostly dumped into holes, the surface of the old igloos levelled and cages for the foxes erected upon the flats thus made.

It seems that there is no protection for such sites and nobody cares sufficiently to save them, and so, in this case at least, what is probably one of the most interesting sites of that coast is lost to science. And there are others.

From Shismareff, the "Bear" proceeded to Cape Blossom, and the Kotzebue Sound, where, with the valued help of Mr. Sylvester Chance, Superintendent of Education for the North-West district, valuable information was obtained concerning a large number of dead villages in this region. Some of these are old and some fairly recent, but all deserve to be explored. Along the Buckland River there is also apparently much archeological as well as paleontological material.

The Kotzebue Sound is an especially important region to anthropology because, as long as either natives or whites remember, here have congregated every year natives from all parts of this region—from the Diomedes, from the East Cape in Asia, from the villages of the Seward Peninsula, and from those of the Arctic coast as far north as Barrow, as well as from the inland rivers. Here doubtless is much to be found and learned, though even here much has already been obliterated or scattered.

From Kotzebue the journey led along the coast to Point Hope. This coast is barren and unoccupied, or almost so; and, except at Cape Krusenstern there is apparently but little in the way of older remains. One of the most important and interesting points however of all these coasts, is Point Hope itself. There we meet with a dead village which was occupied up to 30 years ago but whose beginnings are very old. The people have abandoned the village because, it is said, of the encroachment of the sea. They are now occupying a site a little back of it, and are assiduously excavating the old remains and selling the proceeds to whoever comes along. We were there twice—going north and coming back, and had some interesting experiences. Going north the writer bought a good number of old implements, etc., from the natives, especially from one young woman. When they found that skeletal material also was desired, they brought willingly what they could find from the old village—three human skulls, skulls of dogs and a fox, and other specimens. When the "Bear" came back, the young woman from whom a skull was obtained before, came against all expectation to the boat with a bag on her back containing five very good skulls, which she had excavated from the old burial grounds with her own hands. It was an illustration of the helpful and matter-of-course nature of these natives, who in general are progressing rapidly in civilization.

The old village at Point Hope is yielding large numbers of specimens of great variety—of such variety that one stands astonished at the extent and refinement of the former culture of these far north people. Point Hope is at the extreme end of a spit of sand and gravel many miles long extending into the sea and exposed to all the winds and storms—scarcely a place where one would expect to find a people of such varied or advanced culture. Many old articles of native trade appear from the diggings, trade with the people of Kobuk River to those of the Bering Sea and perhaps even Asia. And in the upper layer occur occasional articles (metal, beads) of white man's introduction.

The further journey to Barrow was a series of difficulties, with not much of anthropological interest except at Barrow itself. Between Point Hope and Barrow there are but few settlements, old or present. There is however Kevaleena, a small new village, with two old and possibly important sites, one along the lagoon and one further inland, on the river. Then comes Wainwright, another small recent village with an older site nearby, followed by a few little camps of reindeer herders. Then, just outside of Barrow, is an interesting old village site, and again another, further on, known as the "Hunting Place," the latter yielding good archeological specimens. Still further north there is a village at Point Barrow; but from Point Barrow eastward the now northern coast is seemingly barren until one reaches Barter Island, where there is a large dead village, which however was still occupied in the time of the earliest sailings in these waters. A collection of material from this village, seen in the possession of Mr. Charles Brower, the intelligent trader and collector of Barrow, proved interesting, though of much the same nature as the material along the coast this side of Barrow and, except for a few objects not as refined or beautiful.

On the return trip, each of the villages along the Arctic coast was re-visited and some small places were seen in addition; and then the "Bear" endeavored once more to stop at Cape Prince of Wales, but was prevented by a storm; it next tried to stop at the Diomedes—prevented by storm; at St. Lawrence—prevented by storm; once more at the small Diomede where Dr. Jenness awaited us, but unable to approach. Then a landing was tried at Nunivak Islands further south, but the boat was again driven away by storms and had to turn towards the Pribyloffs and Unalaska.

The total experience among the Bering and Arctic coasts may be summed up as follows: We are confronted here with an extensive region that is but sparsely peopled—the total population of today probably not exceeding 5,000 individuals—and which evidently has not been

much more peopled at any time during its existence. Here again, as along the Yukon, the only sites available for man and which were doubtless utilized in the past, were the beaches and especially the "spits" or low sand and gravel bars reaching into the sea, or separating the sea and inside lagoons, for these offered man the best facilities for getting at the animals and birds that he most needed for his food. All that was actually seen was, however, recent. The old beaches, the old flats, the old accumulations of rivers, the old lagoons, are filled up or washed away. In places there may be seen three, four, five—a whole series of beaches, and it is not known on which of these ancient man did settle. In some places these older beaches have been or are now being cut away. New lagoons have formed or are now forming, and old ones are filling up before one's eyes, to be converted into pools and marshes.

Still further, entire regions during a large part of the year, that is, during the open season when the ice goes north and again before the new ice forms, are subject occasionally at least to violent storms; and what these storms can do to human remains the writer himself saw. Eighteen miles to the east of Nome is a dead village, one of the largest on that coast. Near this village was an old burial ground, well known to some of the old white pioneers. One of these, who did not know what had happened, advised the writer to go there to collect, for he said he saw the ground covered with skeletal remains and various objects placed with the dead. The writer had, however, already visited the spot and this is what was found. In 1913 there had been a very violent south-wester—so bad that the cemetery at Nome itself was washed out and the bodies were scattered over the country. This storm absolutely washed off and left barren of human specimens the old burial ground east of Cape Nome, and had it not been for the depressions that still show where the ancient igloos of the village stood, no one could possibly guess today that an important burial ground had ever been in that vicinity.

Such storms doubtless happened repeatedly in the past, and they must have destroyed or covered many of the old sites. But many sites and remains of man of moderate antiquity still exist there. Many dead villages invite exploration and will repay excavation. And such explorations, judging from the experience acquired on this trip, will not be as expensive as might be feared.

A few words as to the problem of Asiatic migrations. The last summer's studies gave much definite light on this question. It so happened that upon reaching the upper parts of the Bering Sea we had the three clearest and most peaceful days of the whole journey; and

all this time the sensation was that of floating on a big lake, all boundaries of which could be seen at one and the same time except in the southeasterly direction. There is no problem of migration here. It was no great effort for people to pass from Asia to St. Lawrence Island, or the Diomedes, or Wales, Nome, Teller, and even as far as the Kotzebue or Norton Sounds and along the Arctic coast to Point Hope and northward. The people today think nothing of such trips. They have excellent big skin boats, much like the wooden Haida or Tlinkit boats of the south, which are so seaworthy that in going to

FIG. 150.—East Cape of Asia.

Nome from the King or Diomede Islands the natives fill them to the gunwales with dogs, ivory, and all sorts of household articles, and on the return trip they pile in boxes and barrels of provisions. An example of how little the Eskimo think of these journeys was witnessed during the last call of the "Bear" at Nome. As the year before, the King Islanders at Nome were offered the facilities of the "Bear" for transporting them homeward; but they preferred to be left behind because they had yet some purchases to make and some few articles to sell. They preferred to make the return journey in their umiaks later, regardless of the storms and distance, which shows how seaworthy these boats are and how practical native navigation was and is in these parts of the world. And once they reached the northeasternmost parts of the American continent, it was natural for the Asiatics to pass on. They were not emigrating into a *new* world; they merely saw another land a bit ahead of them and went to it, and they had no

reasons to return with the table better and better spread before them the farther they reached, and no opposition. The only questions can be, what were the exact routes the different contingents of these people took; and where are we to look and watch for their remains?

In this last respect the inquiries made along the Yukon and the coast and the islands were very instructive. There was certainly no single large migration. The people came over the Diomedes, through the Bering Sea, north and south of the Bering Strait; they came in small tribal groups, and this was doubtless repeated over a long period

Fig. 151.—Just south of East Cape of Asia. Native village to left.

of time. Then, judging from historic evidences, their movements were as follows:

It may be presumed that ancient man adhered to very much the same routes as those that are in use today, as the most practical, the most natural and sometimes the only available ones. Undoubtedly the greatest and most frequented route of farther spread was that along the coast down to the base of the Alaskan Peninsula, where with the inlets and lakes there is but a little portage over land to the Gulf of Alaska. Then there were the routes up the Yukon and Kuskokwim Rivers. On the Yukon, the earlier contingents probably did not go right up the whole stream, but branched off at the Tananá River and then went towards the Copper River which brought them into Prince of Wales Sound and the Gulf of Alaska. There were two other routes, one down the Koyokuk River, one of the largest tributaries of the Yukon, by which they would reach the latter; and the

FIG. 152.—Eskimo family of Wales on the "Bear."

FIG. 153.—Eskimo, St. Lawrence Id. Rounded, low vault.

FIG. 154.—Eskimo at Nome, Alaska. Indian-like in type.

other along the Noatak River. The latter route was probably used by but few people, but there are indications that some did follow it until they reached the Colville River, peopled its region and extended farther eastward.

To sum up, as to the routes of migration, outside of the Aleutian Islands, which are a problem of their own and point to Kanitchatka, the most plausible and doubtless most used route was that southward along the shores of the sea; the second, along the Yukon River and its

FIG. 155.—Eskimo mother and child, Indian-like in type, Reindeer Camp, n. Pastolik, Norton Sound.

tributaries; the third and fourth, along the Selavik, Koyokuk and Noatak Rivers in the north; the fifth along the Kuskokwim; and the sixth along the Arctic coast.

The questions of the culture of the older people and their physique are of much interest. So far as culture is concerned it was appreciated, more than ever before, that there existed in these parts of America, not so many hundreds of years ago, remarkable development, especially in what may best be characterized today perhaps by the term "fossil ivory culture." The people of this culture, whoever they were—doubtless ancestors of the Eskimo or Indian or both—reached a high degree of industrial differentiation and art—so high

that we have nothing to compare with it in America except among the more highly civilized and developed tribes of the northwest coast, Mexico, Yucatan and Peru. They attained a high grade of native art, which was characterized especially by decoration in curves and soft lines. There seems to be a distinction between this and the Eskimo art of today, as if some other people were responsible for the older culture; but when one examines the skeletal remains there is no indication of any other people except Eskimo and Indian in this

FIG. 156.—Eskimo woman, Indian-like type, and child, Kevalina (Arctic).

region at any period thus far represented in the collections. Therefore it seems that for the present at least it must be accepted provisionally that this culture was connected with the ancestors of the present natives of these regions. This interesting old culture seems to reach away along the American coasts; but it is not certain that its arts were actually practiced everywhere along these coasts. One of the most striking phenomena in these parts of the world is the extensive trade that, according to many indications, was here carried on in implements and other cultural objects. There is on the Kobuk River a mountain which is called Jade Mountain. This mountain was early

known to the Indians or the Eskimo of the river and its green stone was utilized by them for making adzes, drills, knives, lamps, and other objects. This particular stone is found only in that one place, yet objects and implements made of it occur scattered all the way from

FIG. 157.—Eskimo medicine man, treating a boy.

Point Hope down to Nunivak Island, and probably even the Gulf of Alaska and the northwest coast. Similarly, one finds the highly decorated objects of now fossil ivory on the Diomedes, the St. Lawrence Island, the Asiatic coast, and from Barrow and Point Hope again down to, if not beyond, Nunivak Island. The indications would seem to point to the old ivory culture having been central on the Asiatic side, whence it spread by trading along the American coast.

The skeletal remains collected on this journey will probably prove to be of much importance. They represent skeletal material from Barrow down the coast, spot by spot, including the islands; and they comprise not only recent material but also some older. These remains show at first sight that the Eskimo of these regions are by no means the highly differentiated Eskimo of Labrador and Greenland, but that they approach, in some cases almost to an identity, on one hand the Asiatic and Mongoloid types of people, and on the other the American Indians, more particularly those of Alaska. The writer has no longer any hesitation in believing that the Eskimo and Indian originally were not any two distinct races nor even two widely distinct and far-away types, but that if we could go a little back in time they would be found to be like two neighboring fingers of one hand, both proceeding from the same palm or racial source.

ARCHEOLOGICAL INVESTIGATIONS IN CHACO CANYON, NEW MEXICO

The Pueblo Bonito Expeditions[1] of the National Geographic Society, under the direction of Neil M. Judd, curator of American archeology, U. S. National Museum, were concluded in October, 1926. Pueblo Bonito is a prehistoric Indian village in the Chaco Canyon National Monument, northwestern New Mexico; archeological evidence suggests its abandonment about one thousand years ago. Pueblo Bonito may justly be regarded as one of our finest aboriginal apartment houses for, in its hey-day, it stood four stories high, comprised approximately 800 rooms, and covered more than three acres of ground. Its occupants were sedentary Indians who had surpassed all their known contemporaries in civic organization, architectural development, and dexterity in the manual arts. The National Geographic Society's Pueblo Bonito Expeditions, inaugurated in 1921, have contributed a vast store of information concerning these primitive Pueblo folk and others who, in pre-Columbian times, tilled the desert soil not only in Chaco Canyon but elsewhere throughout the plateau regions of the southwestern United States. The spacious communal dwellings these ancients built and occupied form the major antiquities of their respective periods and cultures.

During the past six years Mr. Judd and his associates have investigated the archeological evidence of the domestic and ritualistic life of the Bonitians and their neighbors at Pueblo del Arroyo and have

[1] Smithsonian Misc. Coll., Vol. 72, Nos. 6 & 15; Vol. 74, No. 5; Vol. 76, No. 10; Vol. 77, No. 2; Vol. 78, No. 1.

FIG. 158.—Pueblo Bonito as seen from the north cliff of Chaco Canyon. In the middle distance, the National Geographic Society's camp and the present arroyo, formed within the past century. (Photograph by O. C. Havens. Courtesy of the National Geographic Society.)

FIG. 159.—Doorways connecting rooms of the fourth or last major period of construction in Pueblo Bonito. (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

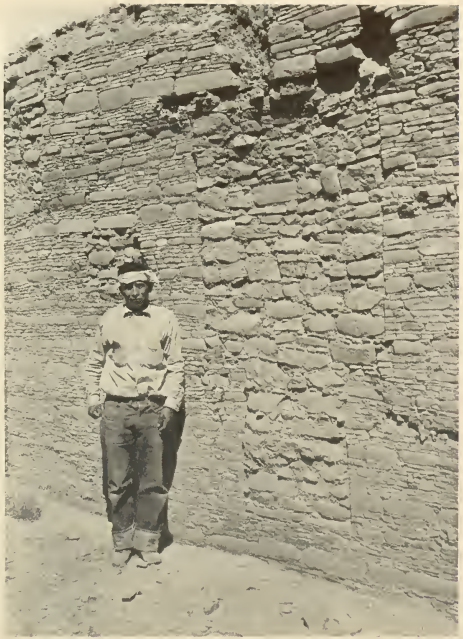


FIG. 160.—Huge, blocked, T-shaped door in a wall of characteristic third period masonry. (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

FIG. 161.—From the north cliff of Chaco Canyon, towering close behind the walls of Pueblo Bonito, enemy warriors hurled defiance and more destructive missiles at the village folk below. (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

also inquired into the probable geophysical changes brought about in Chaco Canyon since Pueblo Bonito was inhabited. It is now known, for example, that Pueblo Bonito was occupied by two distinct groups of Indians; that the type of architecture developed by each group was as unlike the other as were the household utensils employed in the corresponding sections of the village. Both peoples were farmers, however, and their fields of corn, beans, and squash may well have lain side by side. Hunting played no essential part in their means of livelihood despite the variety of mammal and bird bones found in

FIG. 162.—Bonitian cooking pots buried just beneath the floor of Room 350 and used for storage purposes. (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

the rubbish piles. Agriculture was the main dependence of both groups, but there came a time when the harvests were no longer sufficient to support a population of from twelve to fifteen hundred. Arroyos formed, rain waters drained off quickly, helpful chemicals were leached out of the soil, the latter became impervious to water, crops failed to mature. This condition, it appears from the data at hand, was the indirect result of the prodigal manner in which the Bonitians utilized their available timber supply. Altered agricultural conditions, then, in addition to the harassment of nomadic, enemy tribes, unquestionably contributed to the disintegration and ultimate abandonment of both Pueblo Bonito and Pueblo del Arroyo.

Each successive period of constructional activity at Pueblo Bonito witnessed a marked intramural rearrangement of dwellings and a distinct effort to strengthen the outer walls, thus increasing their impregnability. External doorways were eliminated; ventilators were closed; the people drew closer and closer together. The single passageway which gave ready access to the inner courts was barred by a wall through which a narrow door opened; but this door was subsequently closed and thereafter entrance was had only by means of ladders which could, in time of attack, be drawn up to the housetops.

FIG. 163.—The overhang above the Indian's head shows the union of a new addition with older, partially razed walls in Pueblo Bonito. (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

Sporadic warfare is even more vividly evidenced by discoveries made in individual rooms of the ruin.

Among other researches pursued by the 1926 expedition was that concerned with sub-court walls in Pueblo Bonito. Its closely-grouped houses were not hastily constructed from previously prepared plans. Throughout a considerable portion of the village deeply buried walls have been found. These pertain in each case to earlier periods of occupancy; they represent dwellings partially razed and over-built by later structures. Some of these demolished walls have been found as much as 12 feet (3.65 m.) below the last utilized court level. So great an accumulation of blown sand, débris of reconstruction and

FIG. 164.—Superimposed, sub-court walls in Pueblo Bonito, representing successive periods of construction. (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

FIG. 165.—Plastered and whitened masonry of the second period at Pueblo Bonito underlying the last utilized court level. (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

floor sweepings furnishes mute evidence of the passing of many generations.

Mr. Karl Ruppert, one of Mr. Judd's associates in the Pueblo Bonito Expeditions, again supervised explorations at Pueblo del Arroyo. These, in 1926, were chiefly confined to excavation of a much-ruined, lesser structure close on the west side of the larger pueblo. The excavations were complicated and laborious; but upon their conclusion it was found that the site had originally been occupied by a circular tower, 73 feet (22.24 m.) in diameter, of a type

FIG. 166.—Outer south wall of Pueblo del Arroyo, showing varied stonework and later, abutting rooms. (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

well known to the northward but not previously recorded so far south of the Rio San Juan. Interest in this structure was augmented by its apparent relationship to the super-kivas or huge ceremonial chambers of the Bonitians. Later walls joined the tower to Pueblo del Arroyo, but, subsequently, both tower and adjacent buildings were almost wholly razed by prehistoric masons who desired the dressed sandstone blocks for use elsewhere.

In addition to his study of the Expedition's ceramic collections, Mr. Frank H. H. Roberts, Jr., now of the Bureau of American Ethnology, undertook exploration of two small-house sites about nine miles east of Pueblo Bonito. Both settlements belong to an earlier horizon than

that represented by the great communal dwellings of Chaco Canyon. One of the two sites had been occupied by pre-Pueblo peoples whose local form of habitation was a semi-subterranean, circular structure the lower wall of which was formed by upright sandstone slabs. Similar houses have been noted elsewhere in the Southwest; their characteristically flat or low, conical roofs were frequently supported by four upright posts, as in Chaco Canyon. The second village examined by Mr. Roberts was much later than the first, both in time and culture. But it was never inhabited; indeed, it was not even completed.

FIG. 167.—South half of a prototype kiva at a pre-Pueblo site 9 miles east of Pueblo Bonito. (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

Excavation established the fact that although some of its rooms had approached completion the larger number was represented merely by foundations prepared but never built upon.

This latter site had been wholly concealed by sedimentary deposits washed down from the borders of the canyon and was only brought to light by a narrow, deep arroyo cut within the past 15 years. As further indication of the not inconsiderable length of time during which prehistoric folk inhabitated Chaco Canyon prior to construction of the great pueblos, it is interesting to note that the arroyo which disclosed the unfinished settlement last mentioned also exposed a "pit-house"

FIG. 168.—In the branches of Chaco Canyon infrequent logs and partially decayed stumps witness the former presence of limited pine forests, exhausted by Bonitian housebuilders. (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

FIG. 169.—Nine miles east of Pueblo Bonito a deep arroyo has exposed the unfinished walls of an ancient communal house and a still older pit-dwelling (at right of Indian boy). (Photograph by Neil M. Judd. Courtesy of the National Geographic Society.)

whose floor level lay 13 feet 6 inches (4.1 m.) below the present valley surface. No one may say what chapters of human history still lie buried beneath the alluvial floor of Chaco Canyon.

Mr. Roberts also superintended stratigraphic studies, authorized by special permit from the Department of the Interior, in the rubbish piles at the two major ruins known as Pueblo Alto and Peñasco Blanco. These enormous heaps consist principally of floor sweepings containing ashes and fragments of pottery broken upon the hearth, intermixed with blown sand and débris of reconstruction. Potsherds are to the archeologist what fossils are to the geologist! The oldest fragments lie at the bottom of the pile; the latest, on top. The evolution or decadence of pottery technique at any one site is thus represented by a cross-section of its ash heap. In consequence of its studies at Peñasco Blanco and Pueblo Alto, the recent Pueblo Bonito Expedition has obtained data which illustrate not only the development of the art of pottery manufacture in both villages but which also indicate their probable positions in the chronology of Chaco Canyon. Mr. Judd finds no reason to alter his original impression that Pueblo Bonito was the earliest of the major Chaco Canyon villages and that it was inhabited for a longer period than any of the others.

The method by which it is hoped to ascertain the absolute age of Pueblo Bonito and Pueblo del Arroyo, namely, through study of annual growth rings in their ancient roof timbers, is already familiar to readers of the Smithsonian Explorations volume. These studies have gone forward during the past field season under the direct supervision of Dr. A. E. Douglass, of the University of Arizona. The data assembled by Dr. Douglass hold much of interest; although his conclusions may not yet be published, it is permissible to say that this phase of the National Geographic Society's explorations in Pueblo Bonito is also certain of contributing to the prehistory of the southwestern United States results not previously recorded.

INVESTIGATING EVIDENCE OF EARLY MAN IN FLORIDA

All research for the accumulation of knowledge pertaining to the early history of man is of human interest, and especially so in that part of it which reaches back into primitive time.

It has long been known that in Europe primitive tribes of the human race for long centuries lived contemporaneously and were well acquainted with many kinds of wild animals which are now extinct. Among these animals were the hairy mammoth, the woolly rhinoceros, the great cave bears, cave hyenas, wild horses, great oxen, etc. In

America also human bones and artifacts have been found associated with the remains of extinct animals of the Pleistocene Age. But usually either the associations or the circumstances of discovery have been of such a nature that doubt has been cast on the contemporaneity of deposition of objects found in the same stratum, it being assumed that the human remains and artifacts belonged to intrusion through later burials or other accident.

While the general problems relating to the first appearances and early development of man in America belong more properly to the ethnologist, this phase of it comes definitely within the province of mammalian paleontology and geology. Thus, members of these sciences from time to time have taken an active part in investigation of the evidences of early man in America. Perhaps the work in this line that has aroused most interest in recent years is that carried on by Dr. E. H. Sellards at Vero Beach, Florida. This work, which followed the digging of a big drainage canal at that place, resulted in the discovery of human remains and artifacts associated with fossil bones of a Pleistocene fauna. Although careful observation was made by Dr. Sellards and evidence was produced to show that the association was normal, this evidence was not accepted by some of the leading anthropologists as conclusive. After much discussion interest in this discovery lagged for a time, but was revived again a few years later by the discovery at Melbourne, about 30 miles north of Vero, of associated fossil bones and human remains in similar deposits and under similar conditions to those observed at Vero. Following this discovery in the summer of 1925, a joint expedition under the auspices of the Bureau of American Ethnology of the Smithsonian Institution and Amherst College was organized for the purpose of further research at Melbourne. I was detailed to cooperate with Prof. F. B. Loomis of Amherst in carrying out this work, and the six weeks' carefully directed field-work which followed revealed three additional localities where human remains or artifacts were found in direct association with bones of extinct species of animals. All these finds, however, were at or near the top of the fossil bone-bearing layer, and for this reason were not accepted by the anthropologists as undisputed evidence of normal association.

Time and funds did not permit completing the exploration of these important and extensive deposits at Melbourne, and in February of the present year (1926) I was again temporarily transferred to the Bureau of Ethnology and detailed to continue this work begun by the Amherst-Smithsonian Expedition. Again lack of funds prevented completing the investigation, but the six weeks' work accomplished

yielded very satisfactory results. In the additional fossil material secured were specimens representing some important species new to this locality, and the geologic observations made at this time are proving to be valuable aids in the study of the general problems involved. For example, one of the most important specimens obtained on the previous expedition was a crushed human skull and jaws which had been found associated with fossil bones. But the exact position in the geological strata was not definitely determined, owing to the fact that much of the overburden or covering layer had been

FIG. 170.—Canal bank on golf course 2 miles west of Melbourne, Florida. Crushed fossil human skull *in situ* in upper layer of fossil-bone-bearing deposit. Skull is at right of trowel handle in middle foreground, as indicated by arrow.

removed before the skull was discovered. At the time it was made certain that the sedimentary layers above the specimen had previously not been disturbed since their deposit, but it was not quite clear whether the fossil skull belonged in the upper six inches of the Pleistocene fossil-bearing deposit, as it appeared, or whether it lay in the dividing zone between this bed and the overlying deposit. This doubt was caused mainly by the fact that the upper 10 inches of the lower bed was changed into a perceptibly darker hue than that observed in the main mass below. Going back to this locality last spring I extended the relatively small excavation which had been made the previous summer, but concluded to follow a different plan than

FIG. 171.—Excavation trench exposing vertical section near spot where was found human skull shown in figure 170. The undulating contact plane is here plainly seen.

FIG. 172.—Section of the deposits near spot where was found human skull shown in figure 170, showing the uneven bedding-plane between the lighter-colored fossil-bearing deposit below and the later deposits above.

FIG. 173.—Section on south bank of main canal about 3 miles west of Melbourne, Florida. Point of trowel indicates pieces of Indian pottery *in situ* in top layer of fossil-bone-bearing beds.

FIG. 174.—Typical flat country in the vicinity of Melbourne, Florida, showing scattered pines with heavy undergrowth of scrub-palmetto.

FIG. 175.—"Mulberry Mound." An Indian burial mound and kitchen-midden at the north end of Lake Poinsett, St. Johns River, west of Cocoa, Florida.

FIG. 176.—Remnant of great Indian shell mound at Grant, Florida. This mound before being excavated for road-building was about 1,000 ft. long, more than 200 ft. wide, and in places 14 ft. deep. Dr. Henry M. Ami, of Ottawa, Canada, is seen pointing to broken pottery *in situ*.

that before adopted. Instead of stripping from the top, the excavation was carried forward with nearly perpendicular walls so that the formation could be studied in diagrammatic cross-section at all points. In this way it was clearly observed: first, that the bone-bearing layer was everywhere plainly distinguishable from the overlying strata; second, that the separation plane was uneven, showing there had been an erosional interval between the two periods of deposition; and third, that the portion of the bone-bearing layer following the undulations of the separation plane presented a uniformly darker color on top which faded gradually into the light color of the formation below. This was exactly the condition observed at the spot where the human skull was taken, hence it may now be confidently stated that its original burial place while near the top of this layer was definitely within it. It is unfortunate that the investigation at Melbourne could not be continued. The field is a promising one and doubtless would amply repay further exploration.

James W. Gidley.

ARCHEOLOGICAL AND ETHNOLOGICAL STUDIES IN SOUTHEAST ALASKA

During April and May, 1926, H. W. Krieger, curator of ethnology in the U. S. National Museum was detailed to the Bureau of American Ethnology for the purpose of inspecting native houses and totem poles at the National Monument of Old Kasaan, with a view to their preservation. The National Monument of Old Kasaan was originally established by Executive order in 1907 amplified by the Presidential Proclamation of October 25, 1916. The monument thus established contains the abandoned Haida Indian village of Kas-a-an and the surounding forested area containing about 40 acres. It fronts on Skaul arm of Kasaan Bay, on the east coast of Prince of Wales Island, and is about 40 miles by motor boat from Ketchikan, the largest town and the first port of call in Alaska for American steamers out of Seattle.

Kasaan, like most of the native villages of southeast Alaska, is abandoned, its former occupants having moved to fish-cannery towns or to towns like Ketchikan where a number of occupations and industries await them. Indians of Alaska have adopted white man's ways, and have never been wards of the nation like the Indians assembled on reservations within the United States. In accepting the new, however, they have forgotten or learned to disregard their own culture with its splendid claim to distinction as possessing the most unique and realistic examples of plastic sculpture of all aboriginal America.

FIG. 177.—Eagle House "hut-nes," Kasaan. Built by Sanixat (Southeast), who assumed the name of the Southeast Wind in retaliation for the wrecking of his canoe in a southeast gale. The house is an old one, and originally there were no windows nor sawed boards on the front wall. Entrance was gained through a small opening reached by a stairway. The charred smoke hole frame may still be noted on the roof, which is covered with split cedar "shakes."

The abandoned village of Kasaan today consists of the ruins of houses and memorial columns. Many of the tall totem poles profusely decorated with carvings of animal and human figures representing

FIG. 178.—Frame and roof timbers of Eagle House "hut-nes" with "Eagle King's" totem pole at the front. This house is the sole remaining structure at Old Kasaan, and with the house of Jim Peel at New Kasaan, is the only surviving native house in southern southeast Alaska. Crests on pole are: eagle, at top; beaver, at bottom; bear, with protruding tongue, beaver, with large projecting upper incisor teeth, and figures illustrating the myth of "Raven Traveling," at center. See fig. 177.

the family crests are still standing. The region surrounding the abandoned village is virgin forest consisting of the giant cedar, spruce, hemlock, and a few other species. The village site itself was overgrown with alders and dense masses of the salmon berry. The salmon berry looks delicious, but is somewhat flat to the taste and is extremely

perishable when picked. Several black bear were seen feeding on these berries and on the succulent grasses within the shadow of the towering memorial columns or totem poles. As the island is uninhabited for many miles in the vicinity of the National Monument of Old Kasaan,

FIG. 179.—Side view of "Eagle House" with totem pole in foreground erected by a wealthy woman "Big Smoke Hole," the first to encounter white men; hence the crest representing a white man at the top. Beneath this is Raven with the moon in his beak. At bottom is the carved figure of "Duchtut," the strong man, splitting open a sea lion with his bare hands. See figs. 177 and 178.

game is rather abundant. Deer come down from the hills out of the forest to feed on the grasses and wild celery near the water or wherever there is a clearing. As there are literally hundreds of similarly situated islands scattered all along the coast of southeast Alaska, it has been thought that fox farming might prove a profitable industry. Thus far, however, the industry is in an experimental stage.

The view from the village of Kasaan is beautiful, looking out towards the distant islands with their hills and occasional snow-capped mountains, and the intervening water channels and inlets. If the site of this ancient Indian village had originally been selected from

FIG. 180.—Interior of Eagle House. Two benches or floor levels rise on each side of the centrally excavated pit. The hearth is at the center of the pit, and the remainder of the floor including the two benches is covered with split cedar slabs. See figs. 177-179.

the standpoint of beauty of location, the choice could hardly have been excelled.

Kasaan was originally a village belonging to a rival tribe, the Tlingit, who were probably driven away by the Haida, according to their traditions, more than 100 years ago. The name Kasaan in the Tlingit language means the "village on the rock." The Haida came from the south, originally from the Queen Charlotte Islands far out

to sea off the coast of British Columbia. The Haida Indians, like all the tribes along this island-studded coast, were great travellers, making journeys of hundreds of miles in their huge dugout war canoes, often for the mere love of adventure, but usually in search of new fishing grounds or to carry on trade with neighboring tribes. The Indian had to follow the salmon to its new spawning places whenever for unknown reasons it migrated to different spawning beds from those near the Indian's ancestral village. In his quest for food, the Alaska Indian was often forced to abandon his well established village with its large framed houses of split cedar slabs and decorative crested totem poles.

The reason for the coming of the Haida to Old Kasaan was of an entirely different order. Family life among them was communal and consequently rather complicated. It often led its members into difficulties. Each house was built large enough to accommodate two or three generations, together with their slaves and retainers. The house floor was arranged in platforms, each succeeding platform being built on a level two or three feet higher, beginning at the deeply excavated centrally located fireplace, until the outer platform or the one next to the walls of the house was reached. This platform was flush with the ground level on the outside. Each section of the house was assigned to different divisions of the large family. The head of the house, who was often the chief of the clan as well, together with his wife occupied the place of honor on the platform back of the carved house posts at the rear of the house. The slaves, strange to say, gathered and slept at the front of the house nearest the only exit.

The fire burned at the center on the lowest part of the excavated floor sections. In one house at old Fort Tongass there are nine different levels excavated so that the fireplace at the center appears from the front entrance to be at the bottom of a pit. The fireplace is a squared section of bare earth or stone; coals and ashes raise it a few inches above the floor level immediately surrounding, and it is enclosed with a frame of hewn logs or slabs. On this level, about the fire on the bare floor or on mats of woven cedar bark, with their feet toward the fire, slept the members of the family during cold and inclement weather.

The narrative of the coming of the Haida to Kasaan is an involved one and includes a story of family dissension culminating in the murder of one chief by his own brother, who was also his rival. The murder caused the villagers to take sides and led to the removal of the slayer and his adherents far to the north and to the ultimate settlement of Old Kasaan.

After an occupancy of considerably more than 100 years by the Kaigani family of the Haida, Kasaan was abandoned. About the year 1900 its entire population removed to the newly established village of New Kasaan some 40 miles distant on another arm of the same Kasaan Bay. This removal was due to the establishment of a salmon cannery there and to the offer of good wages during the canning season. This proved too much of an inducement to the Kasaan natives who were only too ready to adopt white man's ways and wages and who had already forgotten most of their ancestral lore in

FIG. 181.—Western end of Old Kasaan showing cemetery with carved memorial columns representing the family crests of killer-whale, sea lion, eagle, and bear. The dense forest growth in the background is mostly Douglas spruce, hemlock, and yellow cedar.

woodcraft and decorative art. No new totem pole has been built for more than 50 years and the art of totem pole carving is lost to the present generation.

As Kasaan appears today, after being abandoned for more than a quarter of a century, there is practically nothing remaining to remind one of its former glory but a row of tall totem poles facing the beach, still standing as erect as they were when placed there many years ago. The most recently erected pole is more than 50 years old and remains in a fair state of preservation. Many of the older poles still have sound heart wood, although the incised surface carvings crumble to the touch. The oldest poles have completely rotted away

leaving mere traces. It was the duty of the writer to attempt to preserve these realistically carved representations of human and animal figures and the totem pole itself wherever possible.

The task of restoring the abandoned village of Kasaan is practically an impossibility owing to the deterioration and decay of many years. No repair work has ever before been done. Houses have with one exception completely fallen into ruins. The Indians never repainted their memorial columns, once the pole was erected. The rotting process is practically continuous throughout the year. This may be better realized when one considers the number of rainy days in a year,

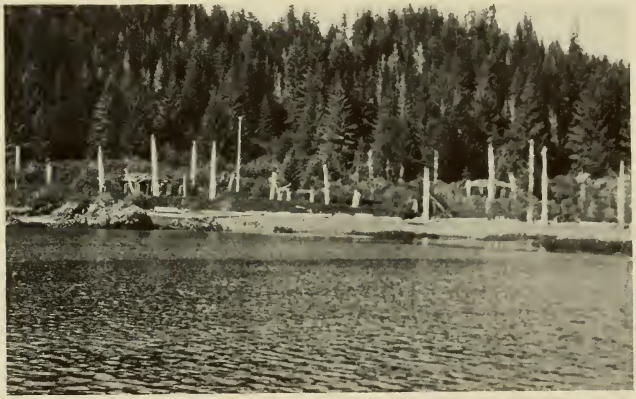


FIG. 182.—Central section of Old Kasaan as it appeared in 1924. Eagle House may be seen on the left, while the front house posts and roof beams of another house, "More-back House," is visible in the background on the right.

reaching a total of 235 at Ketchikan, the nearest observing station. Winters are mild and are hardly severe enough to freeze the rank vegetation. Alders and salmon berry bushes grow in profusion and have completely hidden from view the fallen timbers of the house frames. Large cedars and spruces grow out of what was once a house interior. In one case a cedar sprang up at the base of the hollowed back of a totem pole, and it has now grown up and filled the hollowed cavity, splitting the totem pole which still adheres to the living tree, forming two decorative panels. All remaining poles which were worth preserving were scraped. The rotted wood was removed and the pole was then given a treatment of creosote. No attempt to paint the poles in their original colors was attempted, as such expense would hardly

be justified unless tourist travel should increase materially and a caretaker could be maintained to keep down the alders and salmon berry brush so as to prevent any future danger of destruction by fire during the short dry season in the fall of the year. At Wrangell, at Ketchikan, and in the park at Sitka there are poles which have been repainted in their original colors. Attempts have been made to use the old native colors which consist of red ochre, chrome yellow, and a mordant composed of water and a gluey mass derived from crushed salmon eggs. These colors and several other native coloring agents produced a well blended effect and are not the glaring paints produced by modern white and red leads. Pigments derived from the mineral coloring matter in rocks and ores were formerly much used by the natives. The Indian was indeed an artist who was capable of carving the designs on the totem pole according to highly conventionalized patterns, and who also had the technical knowledge required to procure the proper paints and to properly apply them to the patterned designs in the conventional style.

The totemic memorial columns of tall cedars represent the highest achievement of the Northwest coast Indian. They were also his show property. If the Indian who wished to erect a memorial pole in honor of his maternal uncle was himself incapable of the task, he employed an expert or artist. These skilled wood carvers took as much as a year to complete the task. For his guidance, the native artist had a complicated set of pattern designs in wood. These panels were incised with sections of the conventional designs. It became thus the task of the artist to carefully fit these patterns to the pole to be carved, special effort being made to estimate the proper size of the pole, the entire front surface of which must be covered with the carved figures. No essential part of the animal figure crest must be omitted, although if cramped for space the figures were so highly conventionalized that what might appear to us as essential parts of the animal or human figure represented were often omitted, and no one was offended for all understood what was intended. It was high art with futuristic leanings. Then too the carver had to take into consideration the number of animal totems or crests to which the owner was entitled. If the one in whose honor the pole was being prepared was a great man in the village, he probably had so many totemic crests that the problem was one of overcrowding. If, on the other hand, there were not enough crests to fill the space of the front of the pole, the artist probably suggested that a smaller pole be selected. If this was not done, he could conveniently fill in the spaces between the animal crest carvings with representations of frogs and the ground worm. No

one claimed these lowly creatures as their animal protector, nor represented them among their crests. It was, moreover, an unpardonable offense against the amenities to have on one's pole more totems or crests than one was entitled to.

It is customary among the Tlingit and Tsimshian Indians to erect their totem poles several feet in front of their dwellings or in line several feet to the right or left of the house. At old Tongass village the writer found in front of the ruins of one of the largest houses in the village a number of poles which had been erected in honor of several maiden aunts of the former occupant of the house. The Haida at Kasaan built their totem poles in contact with the front of the house itself, a hole two or three feet square cut through the base of the pole serving as entrance to the house, ingress being possible only by crawling.

Occasionally a niche about one foot square was cut at the hollowed back of the pole some 15 feet above the ground. Into this recessed niche was placed a carved or painted box containing the cremated remains of the former head of the house in whose honor the pole had been erected. Several of such grave boxes were seen by the writer in the poles at Kasaan and at Village Island, another abandoned village.

The houses at Kasaan were placed in an irregular long row facing the shelving beach. The totem poles at the front of the houses are almost at the water's edge at high tide. The action of the salt water on the base of the pole undoubtedly served as a preservative of the wood as all the poles thus situated are still free from decay at their base while those farther removed from the beach are much rotted and decayed at the base.

The frame work of the house and the roof usually rest upon four posts commonly hollowed out at the back. Upon these house posts rest two enormous unhewn log plates sometimes each more than 50 feet long. These unhewn plates extend horizontally the entire length of the building without any other support than that of the end posts. These huge plates, the purlines, the hewn cedar planks for the side walls, "shakes" for the roof, and the logs for the posts and carved columns must be gathered from the forest with great labor, sometimes being brought from a considerable distance. They were towed to the village site where they were hauled up on skids. Forests of southeast Alaska are quite irregular, the large cedar and the spruces growing only in certain favored places where soil deposits are thick enough above the rock substratum to support their growth. Southeast Alaska will never prove a satisfactory place for farming operations as no-

where is the soil deep enough for the plow. The work of smooth finishing and assembling of timbers is undertaken at the site of the house to be erected.

FIG. 183.—Rear corner post of "More-back House" which was erected by Chief Skaul. The carved figures at top and bottom represent the bear, a crest often used by members of the Raven clan. At Kasaan, the raven crest was the vogue with adherents of the Eagle clan who lived for the most part in the western half of the village. The carved figure at the center of the post has to do with the adventures of Raven and the moon. See fig. 182.

Erection of a totem pole or a house was the occasion for much feasting and jollification by the Indians, calling to mind those social gatherings which attended barn raisings in colonial days in the United States. The day of the erection of the house was made known to the natives of neighboring villages sometimes months in advance. All

those who were invited to attend the event were expected to cooperate in the work of erecting the frame and posts. Rivalry sometimes developed between competing clans, each of which was assigned a different log plate to place into position.

FIG. 184.—All that remains of "Furthest Forward House" at Kasaan. Unusual form of house post carving.

The posts, never more than 10 feet high, are first raised into position by means of rope guys and props and firmly planted in deep holes. The log plates are next put into position with skids and parbuckles. Before the posts are firmly planted in the ground, the head of each is cut out to the shape of a crescent so as to exactly fit the log plate which is to rest on it. The plate is then rolled to within working distance of the posts and parallel to its final position. The posts are braced on the opposite side, while on the near side skids are rested

at an angle to form an incline up which the log plate is rolled. Ropes are rove over the top of the post, under and over the log, then back again over the post. The ropes serve as a parbuckle, take the weight of the log and hold it in position. Forked pike poles are rested against the log with their other ends in the ground to help the parbuckle take the weight as the plate is gradually rolled up, the poles being shifted as it rises. The combined efforts of the workers suffice to get the plate to the top of the incline. By means of pushing with poles and by pulling on the parbuckle the log is finally rolled into the rounded notch at the top of the house post. According to old accounts this work was conducted with much confusion, shouting, and sometimes fighting. The clan which finished first taunted their competitors who were still struggling to get the other log into position. The entire procedure, together with the festivities that followed the completion of the task, was the cause of much bad blood between neighboring villages.

The erection of memorial columns or totem poles was accomplished by means of poles, props, and rope guys in much the same manner that construction gangs erect telephone and telegraph poles. The essential difference is in the use of a forked pike pole by the Indians, the more modern method using steel-capped pike poles and the block and tackle.

Long hewn plates are grooved or beveled to receive the upper and lower ends of the split slabs forming the side and front and rear walls of the house. The top purlines form the supports for the roof which is made up of "shakes" or slabs of wood and bark held down by superimposed cross pieces and by rocks. In some of the newer houses at Kasaan the writer found large copper spikes and some made from wrought iron which held the spliced beams and girders in place. Usually there were only wooden pins and pegs placed at strategic points. The method relied on most for holding the framework together was dovetailing or the placing of interlocking mortises at the places of juncture of all beams and girder plates. Mere weight sufficed to keep the two huge main log plates in position.

The smoke hole is surmounted by a shutter which is closed in the direction of the wind. The shutter has a motion about the axle. When the wind changes and blows down the smoke hole a chain or rope is pulled and the shutter revolves to the other position against the wind. As the house faces the beach, and the wind usually blows up or down channel, the shutter faces one side or other rather than the front or rear of the house.

In the more recent years of their occupancy of Kasaan and other villages which are now abandoned, long voyages were undertaken by the natives to Port Simpson, at the head of Dixon Entrance, in British Columbia, for sawed boards and hardware to make a false front for their houses after the fashion of the houses of white men with a door and windows. This custom is reminiscent of the old pioneer store of early villages in the West, when the false store front with its high squared and impressive top section was almost an institution. It must be conceded that the old style of Indian house with its entrance through the base of the totem pole and its huge open smoke hole at the center of the roof, although minus windows, was architecturally more of a unit than the later Indian houses with their hardware and windows from Port Simpson.

During a recent visit by the writer to the village of New Kasaan, rather deplorable conditions with regard to ventilation and sanitation of native houses were observed. The Indian of today in southeast Alaska lives in a house built of sawed boards throughout. There are windows enough, but they are kept closed against the damp air without. There is invariably a stove in the center of the living room which consumes quantities of oxygen. If one were forced to choose between the evils of the cold unlighted slab side native Indian house and the poorly ventilated, unsanitary house of the Indian of today one would not hesitate in preferring the old purely native type of dwelling which was at once both health producing and artistically beautiful.

ARCHEOLOGICAL INVESTIGATIONS IN THE COLUMBIA RIVER VALLEY

During the spring and early summer months of 1926 a regional archeological survey of the middle and upper Columbia River valley was made by H. W. Krieger, curator of ethnology in the U. S. National Museum, on detail to the Bureau of American Ethnology. The project began with a study of the extensive collections obtained by members of the Columbia River Archeological Society from burials and surface finds at various ancient and historic Indian village sites and cemeteries.

Most noteworthy among the collections studied are those of Mr. H. T. Harding, of Walla Walla, Washington; of Messrs. Earl Simmons, Gibson, and Charles Simpson, of Quincy, Washington; and of Messrs. A. H. East, O. B. Brown, Guy C. Browne, Drs. R. T. Congdon, and T. H. Grosvenor, all of Wenatchee, Washington. Other collections studied are those of Dr. F. C. Evertsbusch and others at Pateros, Washington, the Eells collection at Whitman College, and

the extensive material collected by Dr. F. S. Hall and others for the State Museum, at Seattle. Enthusiastic interest in the project was shown by members of the Columbia River Archeological Society and others who have done pioneer work in locating many ancient villages and burial sites and in gathering and classifying many different types

FIG. 185.—View along the Columbia River at Vantage Ferry, Grant County, Washington. Many pictographs and petroglyphs appear on the western escarpment of columnar basalt near the water's edge. The low-lying bench land to the left was the site of a large pit house village.

of archeological material. Information as to location of sites and distribution of type specimens was in every instance cheerfully given.

The next step in the survey was the plotting of an archeological map of the Columbia and tributary valleys showing known village sites and cemeteries. A check was made on data already collected, amplified in several instances by a visit to the reported location of an isolated pit house ruin, village site, or cremation burial.

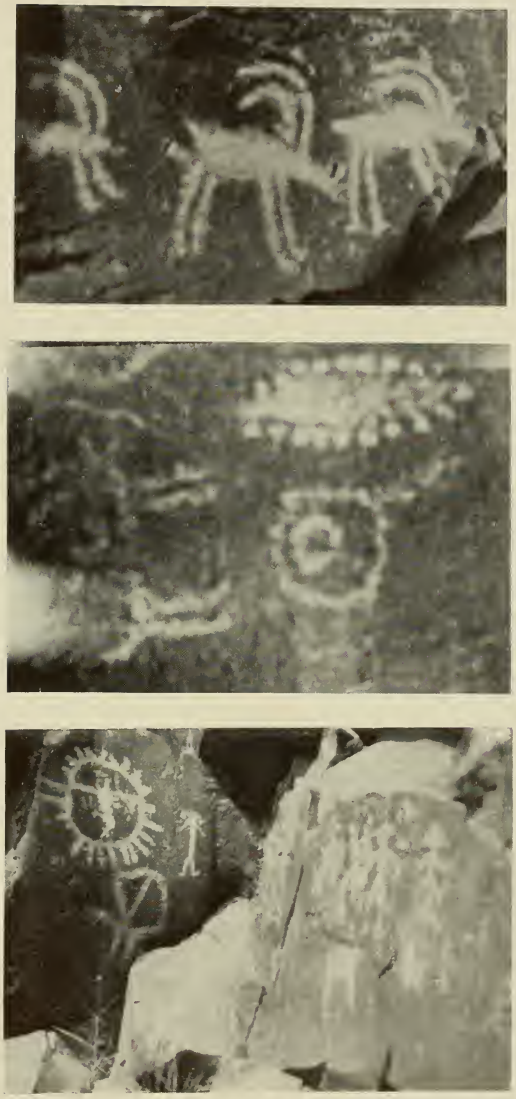


FIG. 186.—Petroglyphs pecked on the columnar basaltic rock escarpment of the Columbia River at Vantage Ferry, Beverly, and Rock Island, Washington.

FIG. 187.—Petroglyphs pecked on the columnar basaltic rock escarpment of the Columbia River at Vantage Ferry, Beverly, and Rock Island, Washington.

The necessity for obtaining an archeological map of the valley at this time becomes apparent upon noting that the Indian village site is also the most favored location chosen by the modern orchardist for his planting. The reason for this lies in the need for protection, shelter, and an adequate water supply. A young orchard can best be successfully developed on a narrow level river bench which is high enough to be secure against seasonal flood waters and near enough to the towering escarpment of the river for shelter from the winds which sweep over the plateau above. It was just this type of narrow bench land, situated above danger from floods, and close to the precipi-

FIG. 188.—Gap in the gorge of the Columbia River where the Saddle Mountain range crosses at right angles to the river at the head of Priest Rapids. On the far bank of the river at the left was located the village of Smohalla, a leader in the Ghost Dance cult. Saddle mountains separated in historic times the territory of the Shahaptian Indians from that of the Salish tribes.

tous basaltic or lava capped river escarpment which was selected by the prehistoric occupant of the Columbia valley as a location for his permanent winter home. Here, also, under the well-nigh inaccessible barrier of the cliffs the primitive village group was secure from attack by marauding hostile bands.

As the middle and upper Columbia River valley is semiarid and barren to a degree, an adequate water supply is essential. The bench land selected as a village site must be neither too high nor the banks too steep to preclude easy access to the river. On the sloping beach below the bench were obtained useful varieties of stone pebbles, float bowlders, and drift wood.

The mapping of archeological stations along the middle and upper Columbia and tributary rivers, such as the lower Yakima, Snake,

Walla Walla, Deschutes, Wenatchee, Methow, Okanogan and others began at the Dalles, in the state of Oregon, and continued to the environs of Kettle Falls, near the Canadian border. The falls and gorge of the Columbia River in the vicinity of the Dalles where the Columbia breaks through the Cascades, mark the beginning of the wooded area of the lower river which possessed an equally well marked distinct type of native culture, the Indian tribes there using principally wood in their arts and crafts, and the tribes of the middle and upper river being expert stone cutters and workers in horn and bone. Accompanied by Mr. H. T. Harding, a section of the river was covered as far north as Wenatchee. Mr. Harding's assistance was invaluable as he is intimately acquainted with the archeology of the region due to many years of experience in the field. Traces of Indian occupation are being rapidly obliterated by the plow, which is today the most productive excavator of antiquities. Where land has been brought under the plow, no record of former village sites and cemeteries is available other than that collected by members of the Columbia River Archeological Society.

Of the many sites inspected, excavation was undertaken at eight. The site yielding the largest collection of material such as ceremonial burial offerings and skeletal material was the prehistoric site at Wahluke in Grant County. There was no evidence of the burials there ever having been disturbed. Neither was there any indication of Hudson Bay Company influence in the objects recovered from the graves, such as trade beads of glass or of the shell beads which in historic times were traded to the Indians as a substitute for the *Dentalium indianorum,* or of iron tools and weapons.

The village of Wahluke is located on the east bank of the Columbia in Grant County, at a point where the river, which at this part of its course flows north, strikes a precipitous escarpment formed of yellowish gray volcanic débris and ash, known as White Bluffs. The Columbia here changes its course to a general southeasterly direction and completes the final segment of the course known as the big bend. Wahluke lies well within the territory occupied by the Shahaptian-speaking tribes within historic times, although early accounts and evidence obtained from the nature of the burial offerings indicated that in prehistoric times the entire area on the north and west bank of the Columbia as far south as the Dalles was Salish territory.

White Bluffs, which lies hard against the northern end of Wahluke, is a continuation of a range of hills known locally as Saddle Mountains from the fact that the range extending from west to east lies at right angles to the Columbia where it breaks through the narrow gorge just

below the confluence of Crab Creek, about 40 miles up the river from Wahluke. The old Indian term Wahluke is said to mean " where one can see and watch." If this is the correct meaning of the word, it would explain the term Sentinel Mountains, a name still applied to the same range. The flat east bank of the river opposite Wahluke

FIG. 189.—One of the many caves in the lava and vesiculate basalt bluffs of the Columbia River. Such caves were used as temporary habitations by hunting and fishing parties, also by bats. This cave, as may be seen, is half filled with debris composed of charred bat guano, camp refuse, such as fabrics, mats, and cooking stones, together with weapon parts and tools.

was known to the Indians as Yanuke " the place where animals come to the water and drink."

Burials at Wahluke were mostly primary and ceremonial cremation in type. Graves were placed in irregular rows along the river beach up-stream from the village proper. But one site along the river is known where a village had been built on top of a site and cemetery

FIG. 190.—A Wanapum or Columbia River Indian mother and two children in front of their tule mat covered tipi. The dog is of the type formerly kept by these Indians for the use of their shaggy coat of hair in blanket making.

FIG. 191.—Shahaptian Indian sweat house built up of tule reeds with matting of cat-tail rushes and covered over with earth. Still used by the Wanapum or Columbia River Indians. Located at the Lower Falls of the Yakima River, Benton County, Washington.

of an older date. This location, known as Simmon's graveyard is about five miles down-stream from Trinidad, the point where the Great Northern Railway crosses the Columbia. The flood waters of the river had covered the cemetery to a depth of six or more feet. A pit house village is erected over and immediately above it. At many places

FIG. 192.—Looking south from interior of Eagle House, Kasaan, across McKenzie Inlet, Kasaan Bay. Pete Williams, a Tlingit Indian belonging to Eagle clan, standing in foreground. See figs. 177-180.

along the Columbia there are similar strata of sedimentary deposits, each covering the burn and other evidence of the existence of a camp site or burial ground. These strata were formed at intervals of several years, probably generations. Temporary fishing camps which were abandoned at the close of the fishing season were left with camp débris, fragments of shell and other kitchen débris such as charred cooking stones, charcoal, and stone and bone implements. Some of these sites

are again exposed in later years when the stream forms a new channel or the flood waters erode the banks. At Pateros, the confluence of the Methow with the Columbia, seven layers of burn with intervening

FIG. 193.—Tipi used by the Wanapum or Columbia River Indians at the Lower Falls of the Yakima River, Benton County, Washington. The habitation is a temporary one and is constructed of tule reeds covered with skins and burlap. The old type of semisubterranean pit house was abandoned before the time of the Lewis and Clark expedition.

sedimentary deposits are exposed on the flanks of a little island formed on the Methow side of the channel.

Cremation graves are usually three or more feet below the surface when undisturbed. A layer of flat stones was invariably placed in oblong or circular form as a protective cover against marauding animals and erosion of the loose sand bench formation by the action of the wind. Loose sand with a slight covering of soil or sometimes dry powdery volcanic débris makes up the formation of the bench above the river bank. This was excavated with crude shovel-shaped paddles of stone, or with the hand aided by the digging stick. The body to be cremated was placed on a piece of matting of Indian hemp, tule

FIG. 194.—A prehistoric Indian grave at Wahluke, Grant County, Washington. The burial is protected with a circular ring of bowlders which have been carried up from the river beach. Among the many ceremonial burial offerings found within this grave were no objects such as glass beads or iron knives which might indicate Hudson Bay Company influence.

reeds, or cat-tail rushes. About the body, which was oriented sometimes with head up-stream, sometimes to the east, or, again apparently haphazard, were arranged the personal belongings of the dead. The pyre was built up of logs of driftwood. Many of the objects placed in the grave are merely charred; others, including the skeletal material, are completely burned or calcined. No indications of burial houses such as were erected by the tribes on the lower river were found at Wahluke or elsewhere on the middle Columbia.

In some instances the skeletons were oriented in such position as to suggest secondary burial, parts of several skeletons in such cases being

FIG. 195.—Stages in the production of a pipe. Beginning at the lower left may be seen a roughly cut and grooved section of steatite. The next step shows the tubular outline formed by crumbling and pecking; the third object is perforate and shows polishing, while the pipe at the right is complete except for the reed mouthpiece which is not shown. The steatite bowl pipe at the top right is modern and is made from a design showing influence of trade pipes. All obtained from graves at various sites along the Columbia River by Mr. A. H. East.

FIG. 196.—Types of stone pipes found in graves at various sites in the Columbia River valley, in the state of Washington. The tubular soapstone pipe at the right indicates contact with Californian tribes, while the three tubular soapstone pipes at the center are the type made by the ancient inhabitants of the Columbia and Fraser river valleys. The bowl pipe with carving of human face at the side is of the type made by the tribes of the northwest Pacific coast. The large catlinite bowl pipe with inlay of lead around the margin may have come from the Sioux or other tribes of the Plains.

jumbled all in a heap. Individual cremation burials were never secondary, the burial being effected with knees flexed and skull facing downward. Incineration was usually so complete as to prevent the securing of any one complete skeleton. Several fragments of charred skeletons including several skulls were recovered from the burn, providing sufficient material to reconstruct later at the Museum. Skulls showed in every case a frontal-occipital deformation. Skulls from graves other than at Wahluke do not always show this deformation,

FIG. 197.—Frame of Salish type of sweat house on west bank of the Columbia River six miles below Pateros.

leading to the assumption that the practice was not general. The physical type is that of the tribes which occupied the upper plateau country within historic times. Skulls found in graves accompanied by ceremonial offerings having a distinctly Hudson Bay Company aspect, such as trade beads of glass, and metal objects of copper, brass, and iron, were in every instance of the same type as those occurring in prehistoric graves.

Many of the objects found in the burn among the charcoal and charred bones were objects of daily use in the life of the Plateau Indian of historic times. Most of the larger pieces as bowls and pestles were intentionally broken at burial. Objects found included

basketry, matting, objects of stone, wood, bone, horn, shell, human and dog hair, and hammered nuggets of native copper. No pottery was made by the ancient occupants of the upper Columbia valley, nor were utensils or bowls of wood discovered. This seems strange when it is noted that other objects shaped from driftwood occur in the graves intact; also many ornamental objects formed from jade, dentalium, haliotis, soft slate, and lead inlay, all of which must have been brought from the Pacific coast, British Columbia, or Alaska. It would appear from this that the burials at Wahluke are of a date preceding that of the wood-working tribes of the lower Columbia.

ARCHEOLOGICAL WORK IN LOUISIANA AND MISSISSIPPI

Mr. Henry B. Collins, Jr., assistant curator of ethnology, U. S. National Museum, was engaged from the middle of April to the latter part of June in archeological field-work in Mississippi and Louisiana for the Bureau of American Ethnology. The greater part of this period was given to investigations along the Louisiana Gulf Coast, a region which was practically unknown from an archeological standpoint. This section of Louisiana is but slightly above sea level and consists for the most part of great stretches of marsh, habitable only along the narrow ridges of comparatively high land that border the many lakes and bayous. It is not a region which might be expected to have supported either a large or a very highly developed aboriginal population, and yet unmistakable evidence was found that in pre-Columbian times Indians had lived here in considerable numbers, and that some of them possessed a culture closely allied or identical in general to that found throughout the widespread mound area to the east and north.

The investigations were begun at Pointe a la Hache, on the Mississippi River about 40 miles below New Orleans. About five miles southwest of Pointe a la Hache was found an important group of mounds, nine in number, the largest of which was between 40 and 50 feet high, over a hundred feet in diameter, conical in shape, and with a flat top. The other mounds were lower but were of considerable basal diameter and were all covered with an almost impenetrable growth of palmettos, vines, briars, and other vegetation. These mounds had been built on a ridge of land at the very edge of the marsh and their location was known to only a few fishermen and trappers.

From Pointe a la Hache, Mr. Collins proceeded to Houma, in Terrebonne Parish, and examined a number of mounds and shell heaps.

Here he was fortunate in having the co-operation of Mr. Randolph A. Bazet, who is deeply interested in the local archeology and who was able to supply valuable information on the many earth mounds and shell deposits of Terrebonne Parish. Such remains were found in unexpected numbers along the lakes and bayous, ranging from comparatively small accumulations of shells mixed with charcoal, potsherds, bones and other refuse to huge deposits of the same material, or "islands" as they are locally called, sometimes a hundred yards or more wide, about 10 feet above the marsh level, and extending in some cases for a distance of almost a quarter of a mile. These Terre-

FIG. 198.—Mound on the Fairview Plantation, Berwick, La. About six feet below the surface was a thin stratum of fire-burned earth in which were found seven pits or fireplaces.

bonne Parish shell heaps, or kitchen middens, and the others throughout southern Louisiana, are composed almost entirely of the shells of a small brackish water clam, *Rangia cuneata,* which is very common in the bayous and lakes of the Gulf region. They represent merely the accumulated kitchen refuse of the Indians who once lived along these water ways. The clams were eaten, and the shells, along with other trash, were cast aside until in the course of time an extensive heap was formed.

After devoting some 10 days to the mounds and shell heaps of Terrebonne Parish, investigation was made of those to the west and north, at Gibson, Lake Palourde, Bayou l'Ours, Berwick, Charenton and Avery Island. Having examined and carried on minor excava-

tions at these localities, Mr. Collins continued westward to Pecan Island in the southern part of Vermillion Parish where he remained for three weeks.

Pecan Island, lying between White Lake and the Gulf, is a long narrow strip of land, averaging less than 200 yards in width, and extending across the marsh for fifteen miles in a general east and west direction. It is the same type of formation as Grand Chenier and other narrow parallel ridges of land found in the marsh region which have resulted from storm wave action throwing up old beach material such as sand and finely crushed shell. Pecan Island today

FIG. 199.—Mound on the property of Mr. Ulysses Veazey, Pecan Island, Vermillion Parish, La.

supports a population of some 400 people, whose only means of communication with the outside world is by the mail boat which makes the 57-mile trip from Abbeville once a week. That it was also inhabited by Indians at an early date is shown by the presence of 21 artificial mounds and considerable quantities of potsherds and other surface refuse on the island. These mounds proved to be of two distinct groups, those on the property of Mr. J. Morgan, four in number, being the larger, with an average basal diameter of over 100 feet and a height ranging from five to twenty-five feet. These four mounds were stratified, with several thick layers of crushed shell and sand (the material of which the island is largely composed) separated by thin strata of soil mixed with charcoal, animal bones and other débris.

FIG. 200.—At its eastern end Pecan Island divides into several long narrow ridges. This view shows the main ridge viewed from Cypress Point, from which it is here separated by a stretch of marsh.

FIG. 201.—Small mound surrounded by marsh at Cypress Point, on Pecan Island, La.

thus revealing successive levels of occupancy and affording a clear picture of the manner in which the mounds were constructed. The mounds of the second type, most of which were on the property of Mr. Ulysses Veazey, were unstratified. Human bones were found in two of the large Morgan mounds and in one mound on the Veazey

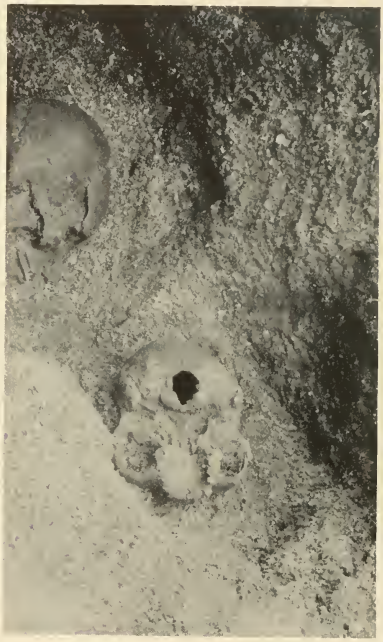


FIG. 202.—Detached skulls in Copell burial ground on Pecan Island. The bones when uncovered were soft and usually broken, but all skulls, some fifty in number, were saved and have been repaired.

place. The skulls from the former locality were all of the well-known "flat-head" type, which resulted from the practice of tightly binding the head during infancy. Skulls from the Veazey mound and those from another burial ground on the property of Mr. John Copell, which proved to belong to the same culture, were for the most part undeformed. A similar distinction was observed in the material re-

covered from these mounds, indicating that the two types represented different cultures. The objects associated with burials in the Veazey mounds and the Copell cemetery, while not especially abundant, were typical of those usually found in mounds in other parts of the country. These included chipped stone and worked bone arrowpoints; the bone end of an atlatl or "spear thrower"; beads and other ornaments of shell; large double-disk or spool shaped ear ornaments of slate covered with native sheet copper; various types of worked stone, shell and bone implements; lumps of galena; hematite; bitumen; and decorated potsherds of a characteristic type. The Morgan mounds, on the other hand, produced no such material, but the invariable flattening of the

FIG. 203.—Large kitchen-midden, or shell heap, on Chenier du Fond, south of Grand Lake, Cameron Parish, Louisiana.

skulls, the different construction of the mounds themselves, and the quite distinctive type of pottery, all point clearly to a different culture.

Pecan Island was the most western point on the Louisiana coast at which artificial mounds were found, but kitchen middens were found to continue westward and there are evidences that these extend well into Texas. After examining the aboriginal remains as far west as Grand Chenier in Cameron Parish, Mr. Collins returned eastward and began excavation of a group of three large mounds on the property of Mr. Adolph Melanson, at Gibson, in northern Terrebonne Parish. These mounds were stratified in much the same manner as the four large mounds on Pecan Island, and although a few burials were found in one of them it was obvious that all three had been erected primarily for habitation purposes.

Considering the evidence thus obtained by reconnoissance and excavation in the Louisiana Gulf Coast region, several points of interest develop. First, there is here found the most southern and western extension thus far recorded of the wide-spread and highly developed mound culture of the Mississippi Valley and Gulf States. The immediate cultural affiliations of this southern Louisiana mound area is seen to be toward the east, forming a direct connection along the Gulf Coast with Florida. The strongest evidence for this deduction is found in the pottery, certain types of which are practically identical from Florida to western Louisiana; these consist of the "checker-board" design, produced by the application of a stamp, and of enlarged rims bearing characteristic incised and punctate decoration. The exact identification of the builders of these Louisiana mounds and shell heaps will, of course, be difficult. The western part of the Louisiana coast, including Pecan Island, was inhabited in historic times by the Attacapa, a cannabalistic tribe of low culture. They could hardly have been the people responsible for either of the two Pecan Island cultures. However, they may have left behind some of the shell heaps here described, although the shell heaps cannot as a class be separated culturally from the earthen mounds. Further to the east were the Chitimacha, much more advanced than the Attacapa, and if the descendants of the prehistoric mound-building tribes of southern Louisiana are to be sought nearby, the Chitimacha might well fit into the rôle. The undoubted cultural connection with the coastal regions of Mississippi, Alabama and Florida, however, suggest the strong possibility that there may have been a direct tribal movement in one direction or the other.

The Louisiana work was completed about the middle of June, when Mr. Collins proceeded to Marion County in southern Mississippi and located seven ancient Indian village sites. From there he went to eastern Mississippi and succeeded in locating the sites of two old Choctaw villages, which were described by French and English explorers as early as 1729, but the present locations of which were unknown. These villages were Chickachae in Clarke County and Okatalaya in Newton County. The potsherds from these village sites were of the same type as those found on other historic Choctaw sites in 1925. This is a ceramic type which is restricted to comparatively recent Choctaw sites and which is quite different from the earlier mound pottery

On July 1 Mr. Collins proceeded to Philadelphia, Miss., to continue the anthropometric studies of the living Choctaw begun in the

summer of 1925. The present investigation was made possible by an appropriation from the American Association for the Advancement of Science. Seventy-two adult Choctaws of both sexes were measured, which number, together with those obtained in 1925, affords an adequate idea of the physical type of the modern Choctaw. The number of Choctaw still remaining in Mississippi is around 1,000. Unlike some other Indian tribes they are not mixing to any great extent with whites, nor have they done so for some years past. However, they are far from being full blooded as a group, due to infiltration of white and negro blood at an early date.

FIG. 204.—Group of Choctaw Indians of the Conchatta district, Newton County, Miss. Mr. T. J. Scott of the Choctaw Agency, in back row.

Among those whose interest and co-operation aided the work in Louisiana and Mississippi, particular thanks are due to Senator E. S. Broussard; Father Girault, of Pointe a la Hache, La.; Mr. R. A. Bazet and Dr. Marmande, Houma; Mr. J. A. Pharr and Mr. W. B. Reed, Morgan City; Mr. and Mrs. Sidney Bradford and Miss Sarah McIlhenny, Avery Island; Prof. C. S. Brown, University, Miss.; Mr. T. J. Scott, Philadelphia, Miss.; and Mr. Rufus Terral, Quitman, Miss.

ARCHEOLOGICAL FIELD-WORK IN ARIZONA

During the summer of 1926, from the closing days of May to the end of August, Dr. J. Walter Fewkes, Chief of the Bureau of American Ethnology, excavated and repaired a little known ruin about six

and a half miles east of Flagstaff, at the base of Elden Mesa. To this ruin he gave the name Elden Pueblo. He was assisted in this field-work by Mr. J. P. Harrington, ethnologist, and Mr. A. W. Wilding, stenographer, both of whom contributed to the success of the expedition. Valuable assistance was rendered by Mr. J. C. Clarke, Custodian of the Wupatki National Monument, and by Prof. H. S. Colton, of the University of Pennsylvania, both of whom spent much time at the ruin and aided in many ways. These gentlemen called Dr. Fewkes' attention to the clearing in the pine trees that indicated the site of a prehistoric building which had been long suspected by a few local residents. The discovery of Elden Pueblo, or rather the demonstration that the clearing indicated a pueblo site, was an important one, since it opened up an extensive area where many small ruins occur but of which practically nothing is known save obscure sites. The work at Elden Pueblo developed a new type of building characteristic of the region south of the Grand Canyon and west of the Little Colorado, extending west and south to the Lower Gila, the massive ruins of which, known as compounds, attracted attention as far back as the beginning of the seventeenth century.

This pueblo was called by Prof. Colton, Sheep Hill Ruin,[1] but has been given its present name from the mesa which towers over it on the west. The ruin is situated about 200 yards from the National Old Trails Highway, not far from where the road to Tuba City branches from the main thoroughfare. This road is a much used one along which daily, in full view of Elden Pueblo, pass many automobiles with tourists keenly interested in the scenic wonders of the country and in the attractive remains of the former inhabitants. Very few of these tourists passed without stopping to inspect the work the Bureau was doing in bringing to light this remarkable relic of the past.

The mound which covered Elden Pueblo was not very attractive as an archeological site when work began. It was devoid of trees, surrounded by a pine forest, and covered with bushes and stones. Indistinct lines of rocks were visible on the surface of the ground, but even these could not be traced many feet. No standing walls existed above ground, the rooms later excavated having been filled level to the top with fallen stones, earth and sand. The general appearance of the site before excavation is shown in figure 205. Several old residents of Flagstaff claimed they had often herded stock or sheep over

[1] In his manuscript now awaiting publication in the Bureau of American Ethnology. The name Elden Pueblo is there applied to another site.

FIG. 205.—Elden Pueblo before excavation.

FIG. 206.—West wall of Elden Pueblo after excavation. (Photograph by A. W. Wilding.)

the site but never dreamed that under the surface of the earth there existed so many walls and relics of a former pueblo. Taking as guides the few stones in line, the outside walls of the rectangular building (fig. 206) were revealed by a trench dug to the level of the foundation

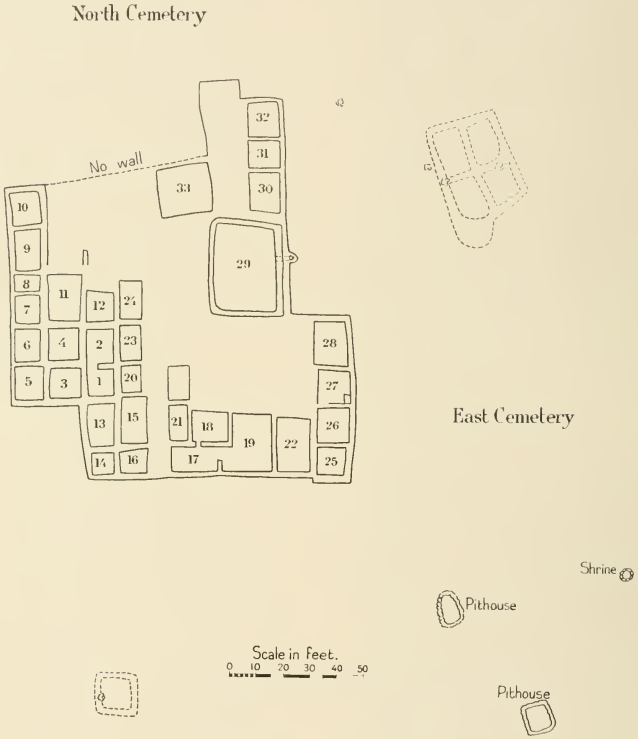


Fig. 207.—Sketch map of Elden Pueblo.

and extending entirely around the ruin. When once this bounding wall had been determined the contents of the rooms, composed of the fallen tops of walls, were dug out and the number of chambers determined. The most laborious part of this work was the removal to a distance from the ruin of the rocks and other material that filled the rooms or had accumulated outside their bounding walls.

FIG. 208.—Elden Pueblo, showing south wall and recess in the southwest corner. (Photograph by J. W. Fewkes.)

FIG. 209.—Elden Pueblo from the northwest; Sheep Hill in the distance. (Photograph by J. W. Simmons.)

Judging from the ground plan shown in the accompanying sketch (fig. 207), Elden Pueblo was a massive walled building composed of large chambers used for domiciles or granaries forming a lower story, upon which a second was built, especially evident on the western end, where, although considerably broken down, fragments of a roof rested on top of the lower rooms, with rudiments of upper walls. As will be seen by an examination of figures 206, 208, and 209, Elden Pueblo was a rectangular structure 145 by 125 feet, oriented approximately east-west. A complete wall was missing on the north side. The standing walls varied in height from about two feet at the lowest to seven feet at the highest point (fig. 210).

FIG. 210.—Recess in the exterior wall on the southwest corner, showing highest point in the wall. (Photograph by J. W. Fewkes.)

This latter occurred at the angular inset of the southwest corner, where there are indications of a shrine near a megalith forming the foundation, under which was a recess containing two or three small undecorated clay vessels and a number of rock concretions. From its position at the southwest angle of the building, facing the sunset point at the winter solstice, this shrine may be supposed to represent the winter solstice house of the sun, or the place where offerings to the sky god were placed, in the Elden Pueblo worship.

The masonry of Elden Pueblo is crude, as would be expected in a ruin of great age. Stone slabs standing on edge and megaliths occur as foundations in several places, and although here and there we find stones laid in courses, this is not a common mural characteristic. Large stones alternating with rubble thrown roughly together and exhibiting

no evidence of being shaped by human hands are most abundant. In this respect the walls are quite unlike those of the buildings situated in the Wupatki National Monument, some 25 miles away, or in the middle valley of the Little Colorado.

The secular rooms are square or rectangular in shape, but there is one room, recognized at once as different from the others in size and function, which was not secular but rather communal or ceremonial, later identified as a kiva. This kiva was indicated by a depression in the surface and as is customary was situated half underground. It lies near the northeastern corner of the pueblo, surrounded on three sides by secular rooms and by a wall only on the east. It is large and rectangular with rounded corners, a low seat or banquette extending completely around the inner wall. This banquette has no vestiges of pilasters resting on it for roof supports, the roof evidently having been held up by vertical logs set in the floor. A ventilator shaft opens into the room midway in the east wall at floor level. The vertical portion of this shaft is enclosed by stone masonry bulging from the external wall of the room. The fallen rock and adobe within this ceremonial room rendered it impossible to detect a deflector (windshield) or fire hole in the floor, and the indications are from the amount of charcoal and absence of roof beams that there had been a conflagration in this room before or after the pueblo fell into ruins. A comparison of this kiva with one partially excavated at Wupatki, and with those at Marsh Pass, Arizona, shows a great similarity. This likeness supports an Indian legend that the Marsh Pass people were the same race as the ancient Snake Clan, still represented at Walpi on the East Mesa. Very few objects of Indian manufacture were found in the rooms of Elden Pueblo, and although there were a few bowls and one or two well-preserved human skeletons, these were so few in comparison with mortuary objects from the cemeteries that a consideration of them will be left to a final report on the ruin.

There were many good metates and manos of customary pueblo shape and several stone implements, axes, mortars, spear-points, arrowheads, and the like, a consideration of which would enlarge this preliminary account too much. There should be mentioned, however, a type of paint-grinding stones similar to those from Casa Grande. A spindle whorl may be mentioned because instead of being of stone, thin and perforated like those from the pueblo ruins, it is of clay, thick, almost spherical, like Mexican spindle whorls, identical with several elsewhere figured from Casa Grande. Another form of spindle whorl has a groove around the rim, also suggesting Mexican influence.

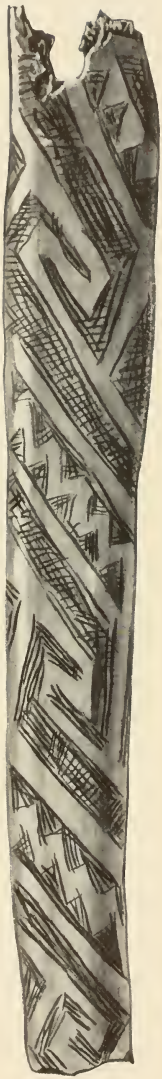


FIG. 211.—Incised deer leg bone used, with feathers attached, as a hair ornament. (Length $7\frac{1}{2}$"; width 1".)

Many bone needles were found in the rooms, a few bearing incised decorations. One bone object, figure 211, was a hairpin or ornament worn in the hair. Similar carved bones with attached feathers are still used by the Hopi and Zuñi warriors, as shown in the discussion of the possible use of one of these objects from Youngs Canyon, 12 miles from Elden Pueblo. On the cranium of one of the skeletons, figure 212, found in the Elden Pueblo cemetery there was a similar bone hairpin, still in place.

Two cemeteries were located in the work, one on the eastern, the other on the northern side of the pueblo. Many skeletons and mortuary objects were taken from these burial places. There may have been cemeteries also on the south and west sides, as a burial was found near the west wall a number of years ago when a logging road was constructed through the pine forest. Although a few "test holes" were dug on these sides, no systematic excavations were made there by the Bureau's expedition, which confined itself to the east and north cemeteries of the pueblo. These cemeteries, however, were not completely dug out on account of limitation of funds, but other interments may be brought to light by future archeologists.

There was nothing on the surface of the ground to indicate the position of skeletons in the cemeteries, but the remains of the dead were found by trenching or by probing with iron rods. The number of skeletons located was about 150, many of which were in fairly good condition, but in a much larger number the component bones were either missing or so much broken that they were of very little scientific value. After a skeleton had been located and the mortuary bowls and other objects which accompanied it had been removed with care they were replaced about the remains and a photograph made of the interment *in situ*, showing the relative position of accompanying objects (fig. 213).

There is some variety in the positions in which the dead were placed in their graves. As a rule,

however, they lay on their backs, although a few were placed on their sides; but there were no flexed burials. Some of the skeletons were a few inches under the surface, others several feet below it. The latter were accompanied by the same kinds of pottery as that accompanying the shallow burials. As a rule, to which there were exceptions, the skeletons were oriented with the head to the east. Double burials in the same grave, infant interments, and

FIG. 212.—Burial showing position of the effigy of an unknown animal at the pelvis, and carved deer tibia (shown in fig. 211) between vase and the skull. (Photograph by J. P. Harrington.)

a skeleton of a woman with skull fragments of an embryo in place were noted. In one grave was found the skull of a dog, and bones of other mammals and antelope horns occurred in several graves.

One of the most interesting graves was that which had the skeleton encased or covered by a hard crust of adobe (fig. 214), but this seems to have been the only instance of this form of burial. In no instance was the skeleton enclosed in a stone cyst as occurs so often at Wupatki. Individual stones standing on edge were sometimes found, but whether these were placed in that position for a purpose could not be deter-

mined. The dead did not appear to have had any wrappings when buried; if so, these wrappings had long since disappeared. They were accompanied by their ornaments, such as bracelets made of shell, necklaces, turquoise ear pendants, finger rings, and other adornments. Shell and stone beads of a necklace of considerable size were sifted out

FIG. 213.—Burial with vertical rock like a head-stone and various mortuary objects, including 6 shell bracelets on left forearm. (Photograph by J. W. Simmons.)

of the earth surrounding the neck of one skeleton. Several paint grinders and one or two mortars and pestles were taken from the graves, but a larger number were found on the floors of the rooms.

There were also clay images of quadrupeds and a small clay effigy of a bird (figs. 217, b, c) with outstretched wings. Miniature vessels, corrugated or painted black on white, often accompanied the dead. A particularly fine small cup of black and white ware with graceful

FIG. 214.—Burial with skeleton covered with a hard crust made of adobe, showing disposition of mortuary pottery. (Photograph by J. W. Simmons.)

FIG. 215.—Burial shown in figure 214 with crust of adobe removed. (Photograph by J. W. Simmons.)

neck and handle (fig. 217, a) lay over the breast of a priest. This vessel probably once contained medicine water.

By far the most numerous mortuary objects obtained in the Elden Pueblo graves were pottery vessels or utensils made of burnt clay. Each skeleton was accompanied by several pieces of pottery, differing in form, color, and other features, but all characteristic of the ruin. Among the objects represented were ollas, vases, bowls, jugs, dippers, ladles, effigy jars and other forms. Some of these are painted, others are plain pieces without decorations, but there were no specimens of true glazed ware, leading to the conclusion that, in common with the

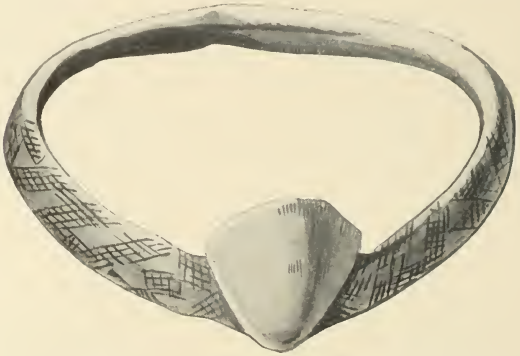


FIG. 216.—Bracelet made of Pacific Coast clam shell (*Pectunculus*), similar to those on the left forearm of fig. 213. (Diam. $3\frac{3}{8}$".)

San Juan region, glazing of ceramics had not yet come into vogue at Elden Pueblo when it was in its prime.

As a rule Elden Pueblo pottery is not of the finest texture—some specimens are very coarse—nor are the decorations carefully made, although variegated. The fact that a relatively large number of pots and bowls were small naturally attracted attention. As several appear too minute for utensils it has been suggested that some of them were specially made as mortuary vessels. None of the vessels was punctured or "killed" before burial, and only one specimen had a "life-line" or break in the surrounding bands.

The corrugated and coiled ware largely represented at Elden Pueblo appears to be contemporaneous with the black and white specimens which are equally abundant. The latter are coarser than

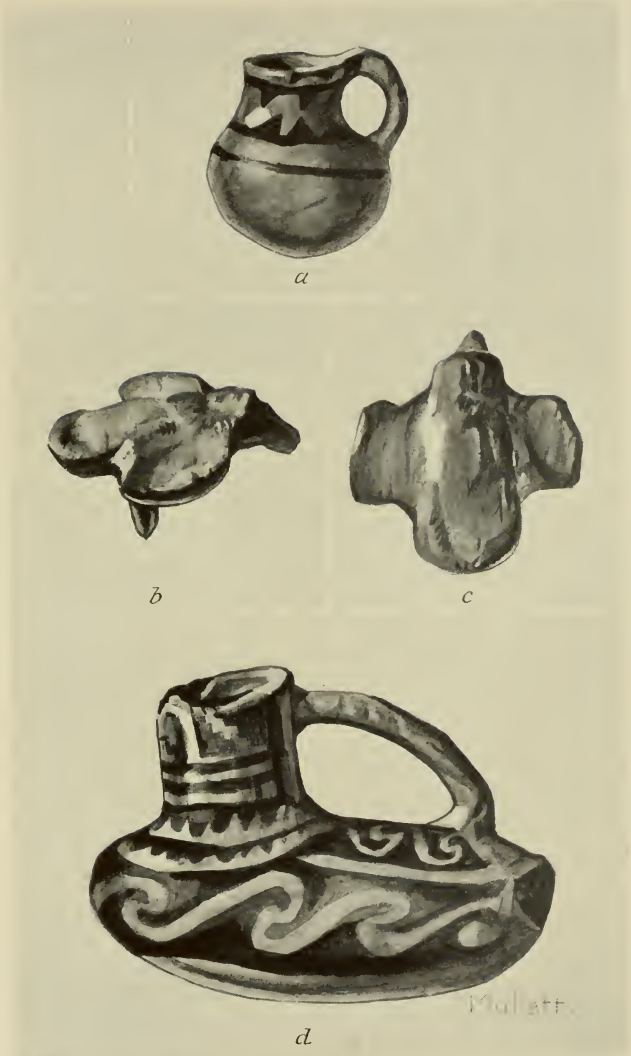


Fig. 217.—Small pottery objects and clay image of a bird. *a*, Medicine cup from breast of a skeleton; *b*, *c*, Lateral and dorsal view of a bird fetish; *d*, Medicine vessel.

a, Largest diam., $1\frac{3}{8}$″; height $1\frac{1}{2}$″. *b*, *c*, Length $1\frac{7}{8}$″; width $1\frac{3}{4}$″. *d*, Length $3\frac{1}{2}$″; height $2\frac{1}{4}$″.

a

b

FIG. 218.—*a*, Smooth red vase with blackened interior; *b*, red food bowl with lustrous black interior.
a, Diam. 6″; height 5¼″. *b*, Diam. 6½″; height 3″.

those from Mesa Verde and show an imperfect technique, nor are they as boldly drawn and cleverly combined. They show a close resemblance to the black and white ware of the Marsh Pass ruins and those identified as belonging to the San Juan culture. There is no external ornamentation on the black and white food bowls, but jugs and other forms of the same ware show elaborate external decoration.

A prevalent type of pottery obtained in the Elden Pueblo cemetery has a bright red color on the exterior and lustrous black on the interior (fig. 218). Some of these specimens have their outer surface corrugated, but the black interior surface occurs both in many of those which are corrugated and others whose outer surface is smooth. This ware, whether bowls, jars, or vases, is characteristic, and may be known as the Flagstaff ware; although widely distributed all over the Southwest, it is especially abundant in localities where Gila Valley ware prevails. The black color on the inner surface of the jar or bowl was formed in the same way as at the modern Santa Clara pueblo, where it is produced by the action of smoke from a smothered fire. Various substances may be used to create this smoke. The Hopi often use for that purpose a thin piece of corn bread, called paper bread, but other substances are likewise employed. A similar method of using smoke to impart this black color was employed by the ancient Greeks and Egyptians.

The forms of the red pottery here described as Flagstaff type are food bowls, vases, jugs, ladles, ollas, and the like. The several jugs and bowls, some smooth, others with corrugated exterior and lustrous interior surface, would indicate that these two groups were contemporary. Both, however, are supposed to antedate what is called the black on white pottery, which type is decorated and by far the most attractive of all the archaic ware from Elden Pueblo. The designs on this ware are conventionalized figures painted on a white ground.

In order to simplify a study of the variety of pottery found at Elden Pueblo these artifacts are here divided into six groups, classified as follows: 1. Rude and undecorated, with no evidence of coil; 2. Corrugated and coiled; 3. Mat red ware; 4. Smooth red ware; 5. Polychrome; and 6. Black on white, or white on black, decorated with geometrical designs.

1. *Rude, undecorated, and uncoiled.*—The few objects referred to this type of pottery are very coarse and show no indications that they were made by coiling. They seem to have been fashioned by the hands, working a lump of clay and possibly smoothing it by the aid of a stone or some other implement. Finger prints and other markings occur on the surface of these vessels. They show no at-

tempts at painting a glaze decoration and their shapes recall the very crude products of workmen who were unskilled in the work. Among the varieties of this form may be mentioned small crucible-shaped receptacles, like children's playthings, larger bowls, ollas, cooking pots, vessels with grooved handles like gourd ladles, and others. Images of animals, birds, quadrupeds, and even human effigies were pressed into shape from balls of clay.

FIG. 219.—Red corrugated vessel. Diam. $5\frac{1}{2}''$; height $4\frac{1}{2}''$.

2. Corrugated and coiled ware.—Elden pottery of this group is very characteristic and is easily distinguished from the corrugated and coiled ware of other pueblos by its red color. We sometimes find examples, mostly bowls, vases and jugs, of gray color with black lustrous interiors, the corrugations being quadrilateral in shape, smooth on the surface, indentations shallow. The quadrangles are arranged in regular rows (fig. 219). Variants of this regular corrugation are many, the differences being mainly in form and relative size but the corrugations are so regular that some form of angular instrument must have been used in making them. There are also specimens of coiled ware in which the corrugations are very small, closely

crowded and apparently made with a stone, a piece of wood, or some pointed implement. The coiling often appears broadly separated by parallel grooves. Vessels made of corrugated ware have not as a rule thin walls like those characteristic of the San Juan, especially Mesa Verde cliff dwellings, and lack appended scrolls.

3. Mat red ware.—There are two types of red ware, both of which may be called abundant. The most common red ware has a bright burnished red color, generally more or less blackened in burning, with a lustrous black color on the interior. It takes the form of globular bowls, flat open food bowls, ladles with short handles, and jugs. The most abundant red ware specimens are globular jars. Some of the red food bowls have the opening pear-shaped, resembling a form of ladle. The lips of red jugs are outcurved and the neck is compressed, generally short. One of the most highly decorated examples of red ware with dull black decoration on the interior (fig. 222, a) has also on the outside white figures representing a circle of human hands or animal paws, which is rare among food bowls from Elden Pueblo. The designs on this bowl recall those on a vessel formerly used in the snake washing of the Hopi snake priests.

4. Smooth red ware.—The most unusual type of pottery and therefore the most instructive is the smooth red ware, commonly without decoration exteriorly but often blackened on the inside. This ware occurs sporadically in the pueblo region but is well known from the ruins in southern Arizona and is most abundant among modern Pima, Kwahadt, and Papago. The smooth red ware of Papago is generally decorated with geometrical patterns in black. Several specimens of both the smooth red ware and the corrugated have their interiors a lustrous black color, but with no designs. The white or gray ware bears black decorations.

We have this same condition of corrugated ware with inner surface black in the cemeteries of Pipe Shrine House on the Mesa Verde, a specimen of which has been figured elsewhere. The smooth red ware which is so abundant at Elden Pueblo is very rare in the Rio Grande and exceptional in the Little Colorado. The decorated red ware of Elden Pueblo is like the ornamented red ware at Homolobi and Chevlon, pueblos near Winslow, and is abundant in the ruins at Tuba City and on the road to Marsh Pass.

5. Polychrome ware.—Polychrome ware is very rare at Elden Pueblo, only a few sherds and but one or two small food bowls having been found in the collection from this ruin. This is astonishing when we bear in mind that collections made at Wupatki and Marsh Pass contain many specimens of this ware. As a general rule, polychrome

a

b

FIG. 220.—Two specimens of black and white ware. *a*, jug; *b*, canteen with glossy black and white decoration.
a, Diam. 5″; height 4½″. *b*, Diam 6″; height 5¼″.

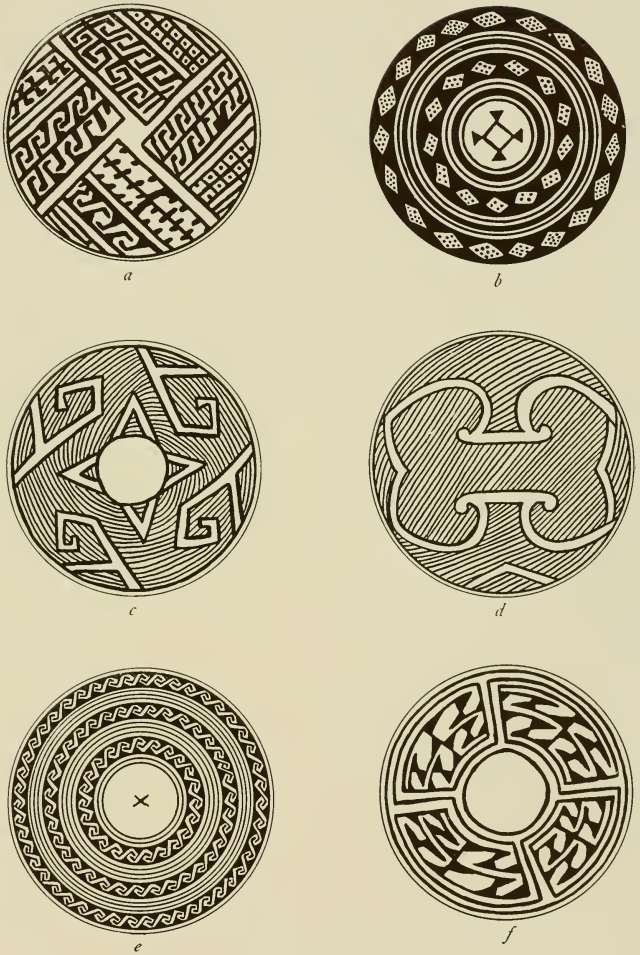
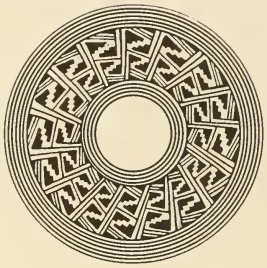


FIG. 221.—Inside decoration of six food bowls of black and white ware showing variety of the geometrical decorations.
a, Diam. $4\frac{1}{2}$″; height 2″. *b*, Diam. $9\frac{1}{4}$″; height $4\frac{3}{4}$″. *c*, Diam. $5\frac{1}{2}$″; height 3″. *d*, Diam. $7\frac{3}{4}$″; height $4\frac{1}{4}$″. *e*, Diam. 6″; height 3″. *f*, Diam. $5\frac{1}{2}$″ x 5″; height 3″; handle $6\frac{1}{2}$″.



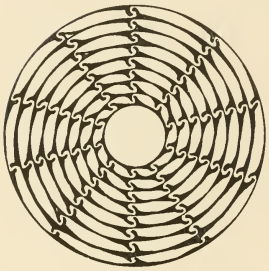


FIG. 222.—Decorations on the interior of food bowls. *a*, interior of dull red ware bowl; *b*, exterior of same bowl; *c-f*, interior decoration of black and white bowls.

a, *b*, Diam. 11½″; height 5″. *c*, Diam. 6¾″; height 4″. *d*, Diam. 7″; height 3¾″. *e*, Diam. 5¼″; height 2½″. *f*, Diam. 6½″; height 4″.


a


b


c


d


e


f

FIG. 223.—Characteristic designs on the interior of black and white food bowls.

a, Diam. 10¼″; height 6″. *b*, Diam. 8½″; height 5″. *c*, Diam. 8¾″; height 3¾″. *d*, Diam. 8½″ x 7⅞″; height 5″. *e*, Diam 8″; height 4½″. *f*, Diam. 3½″; height 2¼″.

ware in the last mentioned localities has the same geometrical symbols as the Elden Pueblo black on white ware.

6. *Black and white ware.*—The common decorated pottery at Elden Pueblo is the well-known black on white. In many instances the

FIG. 224.—Ladle of black and white ware. Bowl, $3\frac{3}{4}''$ x $4\frac{1}{4}''$; handle, $4\frac{1}{4}''$.

figures, which are here always geometrical, are white in color on a black base, but generally the reverse is the case, *i. e.,* the design is in black on a white base. The former may be called "negative." The distribution of the white and black commonly leads to patches or bands of checkerboard areas or mosaic patterns well illustrated in pottery

from the middle Little Colorado valley. While the black decoration on white is mainly geometric, some of the designs are very intricate and beautiful. No realistic and few conventionalized figures appear. Decoration appears on the inside of food bowls and ladles (figs. 221 to 224), but are confined to the outside of vases (fig. 225), ollas, jars, and seed bowls. Many of the designs are modifications of the swastika or of the friendship sign. There are no ornamental figures on the outside of bowls and generally no broken lines. The

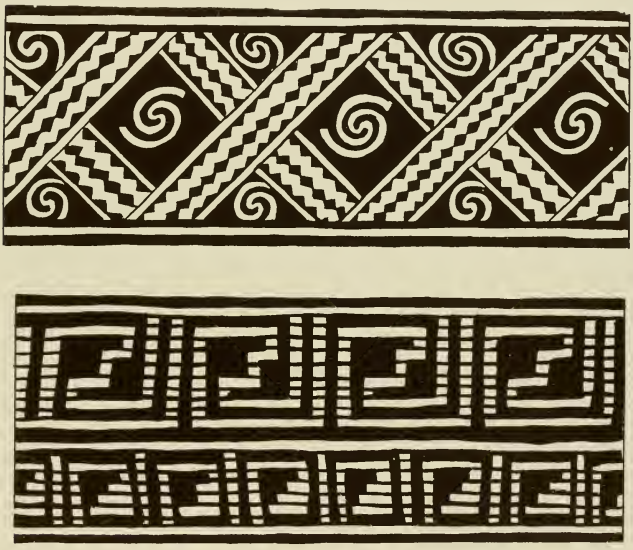


FIG. 225.—Decorations on two black and white vases.

bowls are hemispherical in shape, generally thick walled with square, round, or outcurved lips. In the last-mentioned, the outcurved inner rim when broad enough is decorated with simple designs differing from those of the body of the bowl.

The globular vessels of black and white ware called seed bowls are represented in the collection by several specimens, all highly decorated with scroll, frets, and other designs. These seed bowls are sometimes designated as globular vessels. They do not always contain seeds, for two specimens of red ware are filled with red and green pigments.

One of the most exceptional forms of Elden Pueblo pottery is an effigy vessel here placed under the black on white ware and shown in figure 226. This specimen was found upon the pelvis of what appeared to be a priest, as shown in figure 212. It is a most remarkable piece of prehistoric pottery, especially when it is borne in mind that it is made of archaic black and white ware and must therefore be very old. Its purpose is unknown, but it may have been a receptacle for medicine liquid employed in ancient rites and ceremonies. It was evidently

FIG. 226.—Vessel of black and white ware in the form of an unknown animal probably used in carrying medicine or sacred meal in ceremonies. Length $8\frac{1}{2}$", height $6\frac{3}{4}$".

carried by a cord forming a handle attached to a perforated ridge between the stumps of horns or ears and to a similar ridge at the posterior end of the back.

It is not possible to identify what animal this effigy was intended to represent but it was a quadruped with divided hoofs at the extremities of short and stumpy legs, three of which are partially broken. The mouth is wide open and the head bears between the eyes and near the two ears the broken remnants of two horns. The body is almost globular in shape and is covered with designs in which sun emblems predominate. The designs repeat several times a circle with short

extensions from the periphery. The circle among the Pueblo people symbolizes several supernatural conceptions in the Hopi art, among which are sun or sky god and earth, but whether the effigy jar represents either of these or some other conception is not evident.

The form of this effigy is not unlike an inferior specimen from the cemetery of Pipe Shrine House, Mesa Verde National Park, Colorado.[1]

The mortuary pottery from Elden Pueblo is allied in several features to that found in the great cliff ruins of the Navajo National Monument and also to that from the Marsh Pass, northern Arizona. It has some points of resemblance to that of an archaic prepueblo of the Mesa Verde culture that antedated the cliff dwellings of the Mesa Verde, as shown by specimens collected by the Bureau from the cemeteries at Far View Tower and at Pipe Shrine House of the Mummy Lake Group. It likewise crops out elsewhere at most unexpected localities in the Southwest, as in ruins in the Walpi Wash and Jeddito Valley. Dr. Walter Hough has called attention to the similarity of pottery from McDonald Canyon, 22 miles south of Holbrook, to that from Elden Pueblo. It would seem to characterize the oldest culture of the central Little Colorado valley as well as that from the San Juan.

In conclusion, it should be pointed out that although many important contributions have been made in recent times to our knowledge of pueblo pottery and its distribution in prehistoric times, these conclusions are tentative, as there remain many unexplored areas in our Southwest, the pottery of which is unknown. One of these is the region west of the Little Colorado and south of the Grand Canyon, as far west as California and southwest to the Gila Valley. Elden Pueblo lies in the geographical center or heart of this extensive area, of which archeologically and ceramically we knew next to nothing up to the past summer. It is a type ruin strategically placed, adding new facts bearing on several problems of the prehistoric Southwest.

The likeness of Elden Pueblo architecture and ceramics to the oldest ruins in Arizona is very pronounced. It has many points of resemblance to the ruins in the Gila basin, apparently connecting them with the pueblos of the San Juan. The relative age of Gila compounds and San Juan pueblos is a problem we are as yet unable to satisfactorily solve. We now greatly need more information on the region between Elden Pueblo and the mouth of the Gila in order to show intimate connections between compounds and pueblos, but in this re-

[1] Smithsonian Misc. Coll., Vol. 74, No. 5, Fig. 107c.

gion we evidently have a meeting place of the types of prehistoric cultures in the northern and southern parts of Arizona.

RECORDING OF HOPI INDIAN MUSIC

At the request of the Starr Piano Co. of Richmond, Ind., Dr. J. Walter Fewkes superintended the recording of eleven Katcina songs of the Hopi Indians. Permission was received from the Office of Indian Affairs to take four Indians from their reservation to the Grand Canyon, where the recording was done. The singers represented the older generation and remembered Dr. Fewkes from the time of his studies among their tribe 30 years ago. The age of the singers insured the genuineness of the songs, many of the words of which are archaic and cannot be translated.

Dr. Fewkes noted with much interest the improvements that have been made in recording apparatus since his pioneer efforts along this line over 30 years ago. The Indians displayed no hesitancy in singing into the microphone and seemed quite pleased on hearing the result.

The original master records will eventually be deposited with the Smithsonian together with a set of the reproductions.

ARCHEOLOGICAL AND ETHNOLOGICAL RESEARCHES IN CALIFORNIA

The beginning of the year found Mr. J. P. Harrington, ethnologist, engaged in the work of following up what information is still available on the culture and archeology of the Mission Indians of southern California. Work was continued at ruined village sites in the Santa Ines, Ojai, and Simi valleys, and important discoveries were made revealing an earlier and a later coast Indian culture. The archeological sites of the region are being built over at an alarming rate, due to the settling up of the country by Americans, and thus are being lost forever to scientific investigation. The numerous pictographs, legendary stones, and place names were also thoroughly investigated. The rancheria of Misyahu in the Cañada de las Uvas was traced with more than usual success, although it seems that the cemetery has been washed away by the arroyo. The village consisted of 30 or more dome-shaped huts, from 12 to 20 feet in diameter, clustered irregularly on and about a great rocky hill, also of dome shape. Most of the hut circles can still be traced, but little was found under the surface of the floors. The near-by village of Sikutip had an entirely different arrangement, standing on the floor of a meadow beside a little swampy patch of ground that must have supplied the Indians with drinking water. Four large springs with pictographs traced on their rocky walls were located in the vicinity.

FIG. 227.—Housepit at Misyahu.

FIG. 228.—Indian fortification parapet at Santa Maria ranch.

FIG. 229.—Indian sign post.

FIG. 230.—Site of Simomo ranchería.

The country in Indian times was literally populated with " petrified " " first people," who lived at the beginning of the world and were transformed to stone for one reason or another, as special legends tell. There is a rocky pinnacle on a hilltop which used to be a person and evidently still has some life in it, for it is said to change its position at times, being seen by the Indians now erect, now tilted, now reclined. Two more petrified people shot arrows at each other across a canyon, with the result that one of the rocks is badly shattered. Another rock has horns. Even a whole house is petrified; a ghastly magical woodrat described as being some two feet in length is said to live in a rock

FIG. 231.—The old and the new: sheet iron stovepipes emerging from Hopi kivas. (Photograph by J. P. Harrington.)

that looks exactly like a primitive Indian wigwam. Another rock is the home of a magical beaver. Still another rock is a warclub left by the first people. Up another boulder two petrified rattlesnakes are crawling, seen as streaks in the formation of the rock.

The first people also left their barefooted or sandaled tracks. A good photograph was obtained of one of these footprints. It is a perfect human footprint, fourteen inches long. The god who made this print was heading toward the ocean.

The Indians also had the custom of placing a small rock on top of a boulder to mark the trails. One would go along the trail looking for these guides, which are always seen bobbing up ahead in conspicuous places. It is denied that Indians put all of them there; it is

said that some of them were there always, even in the time of the first people. They were the Indian sign posts.

At Simomo the cemetery was located. The great shell refuse mound of this rancheria shines white and makes the site conspicuous at a distance. The houses were on this mound and as the mound grew,

FIG. 232.—Kutqa, Chief of the Walpi Indians, who sang at the Grand Canyon. (Photograph by J. P. Harrington.)

by fresh accumulations of débris, the whole village gradually rose in elevation as the centuries passed. The spring was at the foot of the slope and had a strong flow of excellent water; it is now used as a watering place for cattle. No material of very early date was recovered from the reconnaissance of the Simomo site. At Shisholop site, the shell content of the mound was found to be unusually large and few artifacts were found in it. The shell species contained in these mounds are practically all identified as modern.

At the close of the California work, in May, Mr. Harrington was detailed to visit Walpi, Arizona, for the purpose of bringing a party of Hopi Indians to the Grand Canyon, where records were made of their songs. The Indians whose services were secured were Kutqa, Chief of Walpi Pueblo; Hunawö, head snake chief; Hungi, a leader in the snake ceremonies; and Kakapti, one of the best singers of the tribe. At the Grand Canyon they met their old friend, Dr. Fewkes, and proceeded to give their best renditions of Katcina songs to the strange machine invented by the white man to preserve these priceless songs of the remote Indian past. The Grand Canyon is a sacred place of Hopi mythology, and their visit to it took on almost a religious aspect. Songs were obtained of a dozen different kinds of Katcinas, which may be described as ancestral spirits. On the trip through the Hopi country native place names were gathered from the four aged men.

During the middle of the summer, Mr. Harrington assisted the Chief of the Bureau in the excavation of Elden Pueblo, Arizona. During the excavations, visits were received from a number of Hopi Indians and information of unique character was recorded from some of them. None of the visitors, however, was able to furnish the old Indian name of Elden Pueblo, although they gave without hesitation the name of the near-by Elden Mesa. But they were unanimous in thinking that the Elden inhabitants were ancestors of the Hopi. Practically all the artifacts taken from the ruin could be named in Indian and intelligently discussed by the Hopi.

ETHNOLOGICAL STUDIES AMONG THE IROQUOIS INDIANS

Mr. J. N. B. Hewitt, ethnologist, Bureau of American Ethnology, spent the period from May 25 to June 29, 1926, among the Iroquois Indians living on their reserves in the vicinity of Brantford, Ontario, and at Caughnawaga near Montreal, Quebec, Canada.

While on the Grand River Grant to the Six Nations, near Brantford, Ontario, Mr. Hewitt resumed his intensive researches relating to the content and analytic interpretation of the Onondaga, the Mohawk, and the Cayuga native texts recorded by him in former years, relating to the several institutions of the Federal League of the Five (latterly Six) Iroquois tribes, including the contents and the structure of the noble Chants and Rituals of the impressive Federal Council of Condolence for deceased Chiefs and the Installation of their successors.

With the aid of Chief John Buck, an Onondaga-Tutelo mixed-blood, as an Onondaga informant and interpreter, and Chief (retired)

Alexander G. Smith, a Mohawk speaker and informant, Mr. Hewitt obtained a fine Mohawk version and literal translation of the remarkable Requickening Address of this famous Council.

The psychological insight of the framers of this wonderful ritualistic address is without question unsurpassed in any other composition of its kind in any other literature of the world. Its primary purpose is to thwart the ultimate aim of Death—the ultimate destruction

FIG. 233.—Mr. Joshua Buck, (obiit 1923), Onondaga-Tutelo, Iroquoian stock, ritualist and native physician.

of all living—and to restore the mental equipoise of one who has been stricken with inconsolable grief through the loss of a kinsman or kinswoman, or a beloved ruler, a chief, by the ruthless hand of Death. One so stricken gives vent to extravagant expressions of grief and sorrow, lasting weeks, and months and even years, by self-torture and self-humiliation, by foregoing food and drink to the verge of starvation, by denying himself the ordinary comforts and needs of life, and even by sitting among the ashes of the hearth and casting the ashes and coals over his head and person, thus filling in time the eyes, the

ears and the throat with them, in such manner that the environing world of persons and things are no longer objects of sense; and the vitality becomes so reduced in time that the sufferer may well be regarded as moribund. To redeem a grief-tormented sufferer from such a state of collapse is the set task of the Requickening Address.

About the year 1570 of the Christian Era, five linguistically cognate Iroquois tribes, occupying at that time chiefly the central and the eastern portions of the present State of New York, united in establishing the historically well-known League or Confederation of the Iroquois for the avowed purpose of securing Health and Peace, Justice and Righteousness, Order and the Force of Personality (Orenda), as the bases of a beneficent Commonwealth of peoples.

The tribes entering into this organic unity were the Mohawk, the Seneca, the Onondaga, the Oneida, and the Cayuga. At that time these tribes were also united in a more or less close compact with the noted Neutral Nation of the Iroquoian linguistic stock, another federation of tribes, which in the person of the famous Chieftainess, Djigonsa'sen (the Wildcat), took an active part in the conferences and the deliberations resulting in the establishment of the League of the Five Iroquois Tribes and also of the other compact with the Neutral Nation. But for some reason, yet unknown, this alliance was not wrought into a permanent organic institution, and so, in the structure of the Iroquois League as known to us, there appears no concrete indication of this former important alliance; not even nominal recognition of the Neutral Nation exists. There are, however, some essential features of the structure of the Iroquois League which a uniform tradition ascribes to the helpful work of this broadminded stateswoman and Chieftainess of the Neutral Nation.

Political and religious organizations of the Iroquoian peoples function only through the interaction of two important complementary principles which are embodied in definitely organized groups of persons. This is true of the tribal and of the federal organizations. These two principles are the male and the female functions.

The unit of the tribal organization is the clan. The smallest number of clans in any tribe is three. The Mohawk and the Oneida each have this number. And in either tribe the three clans are grouped in two complementary units, the one representing the Male or Father Principle, and the other, the Female or Mother Principle. Each of these units is usually called a Phratry or a Sisterhood of Clans. The nine clans among the Seneca, the Onondaga and the Cayuga are, in like manner, respectively grouped into two complementary units composed

of four and five clans each, the one unit embodying the Male, and the other, the Female Principle.

The highest unit of organization of the federal League of the Iroquois was the Sisterhood or Phratry of Tribes. Two Sisterhoods of Tribes composed the League. The five tribes mentioned above composed these Sisterhoods; in the one were three tribes, namely the

FIG. 234.—Chief (*Merit*) John "Smoke" Johnson, Mohawk, Iroquoian stock, annalist and ritualist.

Mohawk, the Seneca and the Onondaga, in the other were two tribes, namely, the Oneida and the Cayuga; the first Phratry embodied the Father or Male Principle, and the second the Mother or Female Principle.

Viewed from the federal standpoint, what affects the integrity or the welfare of a clan of a tribe affects in like manner the entire Sisterhood or Phratry of Tribes to which that tribe belongs. So the death of a Chief of a clan of a tribe makes mourners of the entire

Phratry to which such tribe belongs, and this fact automatically makes the complementary Phratry Redeemers or Restorers. The mourners are described as *Those whose minds are prostrate,* and the Redeemers as *Those whose minds are virgin* or *unaffected,* and so in a position to restore to full life those who mourn.

In all formal public assemblies or councils, the Phratry of Tribes representing the Father or the Male Principle occupies a side of the real, or the imaginary, fire opposite to that occupied by the Phratry of Tribes representing the mother or female principle.

In formal public assemblies the Male or Father side of the tribe or of the League is addressed as a single personality by the pronoun, "thou," and by the terms, "My Father," "My Father's Brothers," "You, Three Brothers." The Female or Mother side of the tribe or of the league is also addressed as a single personality by the pronoun, "thou," and by the terms, "My Offspring" or "My Children," 'My Weanling," and "You, Two (latterly Four) Brothers." These examples apply specifically to the League institutions. It is these figurative appellations which are employed in the Rituals and Chants and Addresses of the Council of Condolence and Installation. To understand these dramatized lyric compositions the terms in the foregoing examples must be kept carefully in mind.

These brief interpretative comments will enable one the better to grasp the significance of the contents of the Requickening Address in question. This formal lyric address is composed of 15 themes or burdens of hurts to life learned from human experience, and the asserted healing of each hurt by the use of the appropriate remedial means by the ritually prescribed agent, the Celebrant.

Each of these Themes or Burdens is set forth through a formula common to all, with one or two exceptions. First, a specific type of hurt arising from grief at the loss by death of kindred is made; then, this type of hurt is directly asserted as affecting the mourner present; and, lastly, the Celebrant executes the symbolic act which at once heals the hurt or removes its cause.

From one to four strings of wampum about four inches long (the proportion of white to purple beads varying with the theme), accompany each of these Themes or Burdens when they are in use, and they are hung upon a horizontal pole immediately in front of the celebrant Orator. As he ends the recital of a Theme he sends by the hand of his assistant the accompanying wampum string or strings to the opposite or mourning side of the Council Fire, where they are hung on another horizontal pole in front of the Speaker for that side.

The Council of Condolence and Installation requires that if the Father Phratry or Sisterhood of Tribes is the mourner then the Mother Phratry must become the unaffected one, and vice versa. It is the duty of the *unaffected* Phratry to act as the Celebrant of the Rites of the Council of Condolence and Installation.

In this remarkable Council five Rituals are employed, and four of these Rituals, when in use, are divided into two portions in such wise that there necessarily results a perplexing interlocking of one Ritual with another. This curious fact, for which the present writer has so far found no satisfactory explanation, has never yet appeared in print, in so far as the writer's knowledge goes.

The Requickening Address opens its first theme with a frank recognition of the Creator and Source of Life and with an expression of solidarity with him.

Specific names are applied to these Themes or Burdens of the Hurts of Life. In their order these Themes are as follows:

I. Tears. II. One's Ears. III. One's Throat. These three constitute the First Section of the Address, and they are used at the "Edge of the Forest," where the Fire of the Welcoming is kindled, and where the mourners first meet their *unaffected* guests, and they intone the Chant of Welcome. But the final Section of twelve Themes of the Requickening Address is not used until the other set Rituals but one have been recited and answered by the mourners, and is virtually the closing Ritual of the Council.

The intent of the Themes of the first Section is to restore to their normal condition the sight, the hearing, and the vocal organs of a grief-stricken mourner such as is mentioned previously in this paper. After this ceremonial cleansing and revivifying, he is prepared to meet the Condolers in the Principal Place of Assembly. Now he can see, he can hear, and he can talk.

The names of the Themes of the final Section are as follows:

IV. "Within the Breast (or Body)." The shock of deep grief has displaced the internal organs and they are awry, inducing much reduced vitality, with impending dissolution.

But the Celebrant gives a draught of the Waters of Pity, pressed from many words of sympathy expressed, to the sufferer, and as these waters reach the parts affected they quickly replace the disturbed organs and normal vitality is restored.

V. "The Trail of Blood from the Death Mat." "Verily, thou dost writhe in the midst of blood."

But the Celebrant does "wipe away the blood-stream from thy mat," using the "soft skin of the spotted fawn," so "that when thou wilt return to thy mat, it will be in the fullness of peace, and it will be spread out in contentment."

VI. "The Thick Darkness of Night" covers one. "Now thou dost not know the Light of Day upon the earth."

But the Celebrant comforts the mourning one, saying, "We cause it to be Daylight again for thee . . . . the daylight will be fine, shining in perfect peace, and thou wilt again look upon the handiwork of the Perfector of our Faculties . . . . spread out richly upon the earth."

VII. "The Sky is Lost" to the mourner. "Now, the Sky is completely lost to thy mind. Thou knowest nothing of what is taking place in the Sky."

But the Celebrant comforts with the words, "We cause the Sky again to be fine for thee; it will be beautiful, and thou wilt think contentedly as thou wilt again look upon the Sky."

VIII. "The Sun is Lost" to the mourner. "Such a person knows nothing about the Sun in its movements, nothing of its drawing nearer and nearer to him."

FIG. 235.—Chief Abram Charles, Cayuga, Iroquoian stock, annalist and ritualist.

But the Celebrant comfortingly says, "We now replace the Sun in the Sky for thee . . . . and when the time for the dawning of a new day comes thou wilt see the Sun perfectly when it will rise . . . . thy eyes will rest upon it as it draws nearer and nearer to thee . . . . When the Sun will place itself in mid-sky, then around thy body rays of sunlight will abundantly surround thee."

IX. "At the Grave—the Heap of Upturned Clay." The shock of grief "thrusts a person aside to the place where arises the mound of earth which covers the one in whom one's mind confided and received support. . . . . Unhappily one thinks, for one's mind lies there beside the grave of uptorn earth. There it is shaken and rolled about on the ground. . . . . It knows nothing else."

But, the Celebrant in comforting terms says: "We now level the uptorn earth over the place where rests the one thou didst trust for words of wisdom. . . . . A fine slab of wood do We, the Three Brothers, place over these; and gathered moss and grasses plucked up; for verily, there are two things which are done by the Day and also by the Night; the one is that, should it so be, that should the Day put forth fierce rays of sunlight, they shall not, therefore, pierce through to him; the other is, that should it so be, that driving rains fall heavily upon them by night, these too shall not go through to where he lies—though nothing save the bones be visible there. So then there will his bones lie peacefully. . . . . So that even for one little day thou shouldst think your thoughts in contentment."

X. "Twenty (Strings of Wampum) are the Penalty for it" (Homicide).

But the Celebrant comforts with these words among others: "Do thou know it. . . . . My Offspring (*i. e.*, the Mother Side) . . . . that now, we, Three Brothers take that up now, and that, let them say it, 'Now, we wrap up thy bones, one and all (as a protection), fixing the penalty of twenty (strings of wampum) on them (for any hurt done them).'"

XI. "The Fire of the Home, Around Which the People are wont to go to and fro."

"Our grandsires, now dead, whom our minds trusted implicitly, decreed, because they failed to perceive the lineaments of its Face, the Face indeed, of that Being that abuses us ceaselessly by day and by night, of that Being of Darkness, crouching hard by the barklodges, goes about with uplifted bludgeon—with its couched weapon at the very top of our heads—eagerly muttering its fell purpose, saying, 'I, I it is, who will destroy all things,' they decreed, I say, that they would name it the Great Destroyer, the Being Without a Face, the Being Malefic in Itself—Death. So, putting forth its sinister power in thy booth of bark, it struck down one therein on whom thou didst depend confidently for words of wisdom and for kindly service, and there is therein now a vacant mat. By this blow It scattered widely the fire-brands of thy fire, and in mocking derision the Great Destroyer has stamped out thy fire."

But the Celebrant orator utters these words of cheer and comfort: "So now, do thou know it, my Offspring, that we, the Three Brothers, having perfected our preparations, say, 'Now, we gather together again the scattered fire-brands of thy home fire, and so indeed, we rekindle thy fire for thee; and the smoke thereof shall rise again; that smoke shall be fine, and it shall even pierce the sky (smoke=the activities of life). . . . . Now, indeed, we raise thee again to full stature.'"

XII. "Woman."

"Now, another thing. It is that wherein the Perfector of our Faculties who dwelleth in the sky, established it, in that He desired that He should have assistants above and even down to the earth; that some shall devote their care to the matters which pertain to the earth 'I have ordained,' He says, 'one and all.' It is that, in fact, that He, therefore, caused the person of our Mother—the Woman—to be of noble worth. He designed that She shall be entrusted with the duties pertaining to the birth and the nurture of mankind, and that She shall circle around the fire in preparing,—that she shall care for,—that by which life is sustained.

"And that, too, is a calamity, that, it may be, the Great Destroyer will make a swift stroke there in the ranks of our mothers, felling one there. The evil

is that a long line of (unborn) persons will be blotted out, in the many-fold lines of grandchildren who would have come from her loins. . . . . Now, furthermore, the minds of all those who still remain have fallen and are prostrate."

The Celebrant orator says: "So now, furthermore, the Three Brothers, having perfected their preparations, let them now say, "now, then, we raise up your minds again and cheer and comfort them. This, indeed, shall come to pass; and you shall now again devote yourselves to your several cares and duties."

FIG. 236.—Onondaga woman and infant on cradle-board. Syracuse, N. Y.

XIII. "Hoyā'ne'r: the Federal Chief."

"They whom our minds highly respected made a decree. They strictly forbade what they denominated 'tossing it over the shoulder.'"

The Celebrant continues: "Now, Sayā'ne'r (thou, Federal Chief), we, Three Brothers, having perfected their preparations say to thee: 'Do thou, listening, hear full well what is said to thee by thy Niece (our Mothers) and by thy Nephew (the Men) of thy Clan. The reason that this must be is that to them also has been given mind—the ability to judge right things.'" (Here follow the details of several admonitions to the Federal Chief for derelictions in official duties by the Mothers, and then by the Mothers and the Men of the Clan). The Celebrant continues: "That too is another grave matter, shouldst

thou toss over they shoulder the admonition of justice and right conduct by which all the people live. Should this come to pass, then know that the time is near when the feet of thy people shall hang over the abyss of the sundered earth (of impending ruin). Should this misfortune take place there is no One under heaven who is able to draw them out of it save One, the Creator of our bodies, who has the power to do this and to aid all in distress."

XIV. "The Loss of Reason—Suicide."

"Our grandsires made another decree forbidding another thing, and that is, that the mind should not be permitted to lose its reason by nursing the memory of deep sorrow. . . . .

"That verily is a grave matter when the mind loses its reason because a grievous loss has befallen a person; for, it is well-known that there grow things on the earth, over which the other things of the earth have no power, but which have the power to end the days of a human being, should there be any weakening of the mind."

The Celebrant admonishes: "Should this come to pass, it will be a source of death to the people. So, for this reason, we, Three Brothers, forbid this thing to you, so that now you can again think in contentment."

XV. "The Ever-burning Signal Torch" And "The Short Purple Wampum String of Notification."

"When our grandsires, now long dead, conjoined their affairs they made a decree, saying: 'Here we place two rods horizontally side by side, and held fast by them fix the Ever-burning Torch.'

"And here, over the small horizontal pole of partition where it pierces the bark-wall we suspend a Pouch of the Skin of Dji'nho^{n}'do'hyĕ^{n}''ă', of indifferent fur, in which we put the Short Purple Wampum String of Notification.

"And we, so many as our Council Fires number, have an equal right to these two objects. And they shall be of essential use wherever a grevious thing (=death) has taken place, or where instant peril, menacing death to one and all, is seen creeping like a serpent close at hand.

"It matters not on which side of our Council Fire (the Father Side or the Mother Side) the evil will be, these two things shall be vitally important.

"In either case, the one whose mind is *unaffected* (ago'nigo^{n}'ga''te') shall grasp the Ever-Burning torch from its holders and also unhang the Pouch of the Skin of Dji'nho^{n}'do'hyĕ^{n}''ă' containing the Short Purple Wampum String of Notification, and he shall at once start going through the Lodge of the League so that the message he bears shall quickly be carried through the entire Lodge and all the Council Fires be made acquainted with it. . . . . His going shall be done in such manner that there shall be no traces—no 'forms'—of lying down along the path. . . . .

"So, now, verily, with respect to thee, thy Ever-burning Torch is removed from its place and thy Pouch with the Short Purple Wampum String of Notification is unhung for thee, all this because of the grievous calamity which has befallen thee."

The Celebrant orator comforts with the following:

"Now, we, Three Brothers, again suspend the Pouch of the Skin of Dji'nho^{n}'do'hyĕ^{n}''ă', of indifferent fur, over the Small Horizontal Pole where it pierces the Bark-wall of the Lodge, containing the Short Purple Wampum String of Notification which we have replaced and we also set back the Ever-

Burning Torch between the Two Horizontal Poles—these things to which we, so many as our Council Fires number, have an equal right.

"For, it may be that thou thyself will see close at hand the nameless Being of our destruction then verily thou shalt go at once and taking the Ever-burning Torch and the Pouch with the Short Purple Wampum String of Notification, and thou must go quickly along through the Lodge of the League so that in the shortest time possible all shall be notified.

"So, that verily will make it possible that thy two nephew-niece groups of kindred, and thy grandchildren as well, may live and think in contentment. So that, therefore, for one little day, you my weanlings severally may live pleasantly in the days that are coming.

"So, perhaps thus, let the Three Brothers do, so-called ever since they perfected their affairs. So, now then, do thou my weanling know that these are the sum of our words. Now then we kneel before you (thee) reverently. And now we will know presumably that the full number of our words have been realized in deed. We have now completely set your affairs in order again.

"Thus, then, did they whom we greatly revered do when they united their affairs; they made a decree, saying, 'It matters not on which side of the Council Fire which is between us the need be, it shall be possible that they shall again set his face fronting the people, that they shall again raise him up (requicken him), that they shall again name his name, and that then also he shall again stand upright before the people. In this we are following the ceremonial path. So, now furthermore, let them say, 'Do thou now point out to us the one who shall be again a colaborer with us.'

"Now, my weanling, do thou know that we, Three Brothers, have completed the Ceremony.

"And, now then, that which (short purple wampum string) notified us is on its way back to thee.

"Know thou, then, that now soon thy Father's kinsmen will arise to leave for home, and that there, then, at the edge of the forest will they lay their backs."

FIELD STUDIES OF INDIAN MUSIC

In July, 1926, Miss Frances Densmore, collaborator of the Bureau of American Ethnology, went to Neah Bay, Washington, to continue her study of Makah music. Neah Bay is situated on the Strait of Juan de Fuca, near the end of Cape Flattery. Encircled by the Olympic Mountains, it can be reached only by water, and during the winter months it is practically shut off from communication with the outside world. In this isolation the older Indians have kept their former beliefs and traditions with remarkable clearness, though they are anxious to be "civilized" and adopt the best of the white man's ways. Many years ago the Spaniards visited Neah Bay and the location of their fort is near the village. Traces of Spanish ancestry are seen in some of the Indians and occasional songs bear a resemblance to those recorded on the Mexican border. The intermarriage of the

Makah has been chiefly with the Clayoquot on the west coast of Vancouver Island and with the Quileute who are their nearest neighbors on the Pacific coast. Songs of these tribes were recorded as well as those of the Makah, the entire number of songs obtained being 146. The classes of songs comprise those of war, treating the sick, dances, legends, and songs for children. Eight Clayoquot songs for subduing the waves were recorded, as well as songs for fair weather and a plentiful supply of herring. Two aged people, one a Clayoquot and the other a Makah, said they had never heard of anger on the part of any "spirit," nor of any attempt to "propitiate the spirits." The words of the songs addressed to the breakers were said to "make them ashamed." These songs were sung during a storm, one containing the words:

Your teeth that are trying to get these people are long and homely.

Another song contained the words, "Please be still, you have treated us so badly." Another, sung in rough weather, had the words, "What beautiful weather this is! It is as calm as when the dogfish are moving in." The informant said, "Even when we were in the highest breakers, if we sang these songs it seemed as though very soon the water was smoother."

Although the caste system was rigidly maintained among the Makah, it is interesting to note that songs learned from slaves were recorded and that a slave was allowed to sing a song of his own country at the Klokali. A song received from a shell was recorded, as well as songs concerning the crab, chipmunk, shark, and whale.

The Klokali received special attention. This was an important gathering in the old time and terminated with dances imitating the actions of animals; it was understood, however, that the dancers represented the human beings who were the *ancestors* of the various animals and did not represent the animals themselves. Songs with representations of the wolf, deer, blackfish, and the wild white geese were recorded. One of the most important dances was that representing the elk, a dance which had no songs, the pounding on sticks and drum being the only accompaniment.

A remarkable opportunity for seeing native pageantry and hearing Indian songs occurred on Makah Day and at the rehearsals for that event. The dancing on this annual occasion is intended chiefly to transmit to the younger generation a knowledge of the old beliefs which are dramatized and presented by trained performers. Each dance has its costume and other paraphernalia. Spears decorated with hemlock were carried in the war dance, elk antlers by the elk dancers, and robes of

FIG. 237.—James Hunter in dance costume. (Photograph by Miss Densmore.)

FIG. 238.—Charles Swan in dance costume. (Photograph by Miss Densmore.)

bear skin were worn in the "brown bear dance." The thunderbird dancers were followed by women who represented the lightning, known as the "belt of the thunderbird." The whale dancer carried green boughs on his back representing the dead bodies which, according to an old legend, were carried by a man preparing himself to be a whaler. Head-dresses of wood, cedar bark, and feathers were worn,

FIG. 239.—Mrs. Parker. (Photograph by Miss Densmore.)

some being decorated with shells. The legends connected with the dances, as well as their songs, were obtained. James Hunter (fig. 237) in a dance position wears a head-dress representing a duck, and Charles Swan (fig. 238) wears a similar ornament representing a wolf. Many Quileute and Indians from Vancouver Island attended this gathering, and, after the dramatic dances were concluded, each group sang its own songs, making it possible to compare the songs and manner of rendition from these widely separated localities.

The photographs at Neah Bay consisted of 12 portraits, numerous landscape and dance pictures, and a series of 20 posed pictures showing the successive postures in various dances. The 27 specimens obtained included a very old rattle used by a successful whaler, a war knife of whale bone, and a war club of the same material with feathers on the handle "to break the force of the blow" to the arm

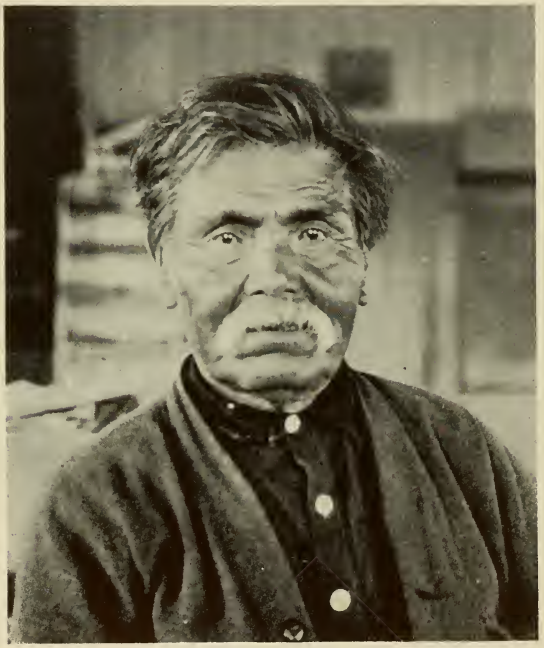


FIG. 240.—Albert Irving. (Photograph by Miss Densmore.)

that wielded it. Other specimens were a braided rope of whale sinew and a portion of a whale vertebra used for smoothing the bottom of war and whaling canoes. Old halibut hooks of elk bone were obtained, also an old adze with blade of elk bone, this being the type of implement used in felling trees before the Makah had metal axes. The collection included a small reed instrument commonly called a whistle which, when blown, was concealed in the mouth of a thunder-

bird dancer, and another wind instrument the sound of which was said to "come through the seams" where the halves of the wooden tube were joined together. An interesting specimen is a "baby-carrier" woven of cedar bark and used only during the first four days of a child's life. In this carrier is placed a doll with pads of cedar bark around its face as formerly used to flatten the forehead and shape the cheeks and chin. A very old wooden cradle used for infants above the age of four days was also obtained.

FIG. 241.—Mrs. Sophie Wilson. (Photograph by Miss Densmore.)

The collecting of plants comprised 58 pressed specimens with descriptions of their economic uses. A majority of these were medicinal, including the entire set of remedies inherited by Mrs. Parker (fig. 239). Her children do not regard the old ways and this knowledge of plants would have perished with her.

The study of general customs included a detailed account of the making of the native canoe (dug-out), the preparation of native dyes, and a description of the whale hunt and its weapons, valuable information on the latter subject being given by Albert Irving (fig. 240).

Numerous legends concerning the mythical hero called Hirokwati were also recorded, with their songs.

On August 24, Miss Densmore arrived at Chilliwack, British Columbia, to record songs among the Indians gathered at the hop-fields where they were employed as pickers. These Indians were more than 1,000 in number. During the next two weeks she obtained more than 120 songs, 28 of which were recorded by old medicine men who use them at the present time in treating the sick. The 20 Indians who recorded songs were from 16 localities distributed over a territory extending about 400 miles north and south and about 150

FIG. 242.—Indians playing Slahal game at Chilliwack, B. C. (Photograph by Miss Densmore.)

miles east and west. Some live in mountain regions whence they go to the railroad on pack horses, while others were from remote settlements on islands or along the Pacific Coast. Among these localities were Cooper Island, Church House, Powell River, Metlakatla, Port Simpson, the Nass, Skeena, Thompson and Fraser rivers; and the west coast of Vancouver Island. Mrs. Sophie Wilson, a singer from Church House on Butte Inlet, is shown in figure 241. Among the interesting songs is one said to have been sung by a seal, another song is about a mountain goat, and another is the song of a doctor who talked with a whale and received from it the power to heal the sick.

An interesting event of each Sunday at the hop-pickers' camp was the playing of the Slahal game, its songs accompanied by pounding

on drums and planks. The playing of this game around a huge bonfire at night was a spectacular sight. In figure 242 the leader of one side has the "bones" in his hand and is preparing to give them to a member of his side for hiding. The songs occur while the location of the marked bone is being guessed by the opponents.

The material gathered at Chilliwack affords a remarkable means for comparison among the tribes represented, as well as with songs of tribes previously studied.

Among the important results of this year's work is the obtaining of data on the manner of composing songs by Indians, as distinct from the "receiving of songs in dreams." It appears that the composition of songs was assisted by walking or by the motion of a swing. Two persons sometimes collaborated in the composition of songs. Such persons were interviewed and their songs were recorded.

ARCHEOLOGICAL WORK IN LOUISIANA

Mr. Gerard Fowke, special archeologist, conducted important fieldwork on Indian mounds near Marksville, Louisiana.

It is a matter of actual knowledge that the Natchez Indians built many large mounds along the bluffs bordering the Mississippi on the east, and that this practice continued, though perhaps in a diminishing degree, until the period of French occupation of the territory. But it is not of record that this tribe, or a colony from it, moved permanently to the west of the river until within historic times.

Also, it is now an established fact that the small mounds so numerous over much of Texas, Louisiana and Arkansas, extending in great numbers down the Red River to Alexandria and, sparsely, even beyond that point, are the work of the Caddoans. The latter tribes, as far as we know, did not erect the quadrilateral or flat-topped mounds such as are prevalent to the eastward. This leaves unexplained as yet the comparatively few such structures found along the Red River, always near the stream, reaching up the valley nearly or quite to Texarkana. These may be due to Natchez, or others, who once lived here for a time but left no further traces.

Between the known territory of the Natchez and that of the Caddoans, that is, between the Mississippi and the vicinity of Alexandria, La., is a strip of country which, so far as its ancient remains suggest, did not belong to either of these people, and yet there is some resemblance to both. Whether these works indicate mingling of the two, or an overlapping of boundary lines at different periods, or whether there may have been another people in between them who borrowed somewhat from the customs of both, is not determined.

The low lands subject to overflow from the two rivers are, of course, extremely fertile, but as a rule the soil on the uplands is not productive, is so flat as to be swampy much of the time where not artificially drained, and apparently is not of a nature to invite a primitive people whose sustenance must depend in large measure on agriculture. That there were, nevertheless, settlements of Indians here and there is shown by the tumuli, sometimes more than twenty feet deep; but these are few and far between, and point only to small settlements with much open territory between them. It was a matter

FIG. 243.—Marksville. Trench partly excavated, Mound 4.

of some surprise, then, to find, a mile east of Marksville, a group of earthworks of such extent and character that they would be noticeable even in a region where similar structures are abundant, in Ohio or Georgia, for example. They extend for more than a mile along a bayou known as "Old River," which opens at either end into Red River, and, as its name indicates, is recognized by the present population as having once been the channel followed by that stream. There is little doubt that it flowed here at the time these earthworks were constructed, although at present it is several miles away. This fact, however, has no bearing on the age of the remains; such changes are frequent and extensive.

Most of the works are on the upland, close to the river bluff. Beginning at the south there is first a square, flat-topped mound eighteen feet high, covering a fourth of an acre; the sides are still so steep as to be difficult of ascent. It stands close to a tributary bayou beyond which, toward the south, no mound or other structure exists within three or four miles. Next in order is a nearly circular inclosure measuring somewhat more than three hundred feet across. This has a flat side bordering a moat lying along the outer margin of an embankment which is in the form of a rude semi-circle with each

FIG. 244.—Marksville. Mound 8, showing structure.

end at the top of the bluff; in fact, it seems that part of it has fallen with the caving of the bank. The length of this embankment is thirty-three hundred feet. Inside of it are two flat-topped mounds, each with its highest point thirteen feet above the surrounding surface. One of them covers about three acres, the other being somewhat smaller. It would seem that they were once quadrangular, but their outlines are so altered by cultivation and erosion that this is not certain. There were also within the enclosure a low mound eighty or ninety feet across, one somewhat smaller, and a conical mound twenty feet high.

Beyond this is another enclosure five hundred feet long, forming a fourth of a circle, one end on the river bluff, the other end at the bank of a ravine. Both ends are shortened by the banks caving in. There is a wide, deep moat at the outer side. The space enclosed is about four acres. Within the wall is a flat-topped mound six feet high and one hundred feet across.

Between these two embankments are lodge sites; low, circular embankments with a shallow exterior ditch from which the earth was taken to build them. These do not seem to be a part of the main works, but to pertain to a different period or a different people.

FIG. 245.—Mound inside of enclosure. Marksville.

Over a space of nearly a fourth of a mile to the east of the last mentioned enclosure no structures were erected; beyond this area, close to the margin of the bluff, are six mounds of the so-called "conical" form. Finally, in the bottom, on land subject to overflow, are four large quadrangular, flat-topped mounds from three to thirteen feet high, and three small, low, ordinary mounds, all enclosing a rectangular space of two acres. The three small mounds are on the edge of a slough.

It was a natural supposition that such conditions would be favorable for research, that works of such magnitude would repay investigation.

Six of the mounds were carefully excavated to an extent that disclosed all they had to reveal. Two, the smallest of those opened,

FIG. 246.—Pipe and vase found in Mound 4.

FIG. 247.—Left to right: Vase from Mound 4, vase from Mound 8, and plummet from Mound 10.

were simply piles of earth, containing nothing whatever to signify the reason for their existence. Had it not been for some charcoal, worked flint, and broken pottery, they might have been deemed natural formations. Two others were merely foundations for houses, but each showed plainly that at least two, perhaps three, houses had been erected on the same site, the later ones on new foundations above the old.

The last two mounds, one fifteen feet, the other twenty feet high, were tumuli. In the first a number of bodies had been placed either on the natural surface or in shallow graves, and the mound erected over them, apparently as a continuous operation. There was no evidence of a burial in the body of the structure.

The largest mound was quite different in its arrangement. There were no skeletons at the bottom, the first step having been to build up a platform of earth to an elevation of eighteen or twenty inches. On this a number of bodies had been placed, how many could not be even guessed, as all the bones were completely decayed and had no more consistency than wet chalk or ashes. They entirely covered a space several feet across. The mound had then been carried up over them to a height of about fifteen feet. Scattered through the earth for this entire distance were traces of burials, made as the work progressed, so the construction must have been intermittent or desultory, although there was no stratification or other marks to demonstrate this. Finally, the tumulus in this stage was finished.

Later, though it was impossible to estimate how much time may have elapsed, two large graves were dug in the top of the mound, several bodies placed in each, the graves filled, and the mound then added to until it was five feet higher, with a proportional increase in diameter. But the addition was largely on one side. The point beneath the apex as it was first built, was several feet away from the corresponding point in the mound as completed.

No implements or manufactured objects of any character of stone, shell, or bone were found in any of the mounds. There was some pottery—not much—and that crude, and except for two pots, neither of which is of two ounces capacity, all of it was broken. With a few skeletons were fragments of pots which had been entire when deposited, but had been broken from pressure. Some of them had decorations of incised or impressed lines and figures. A study of these, and comparison with other pottery in the southern territory, may furnish a clue as to the tribal affiliations of these Mound Builders, but unless so, there seems little hope of discovering their identity.