

SMITHSONIAN MISCELLANEOUS COLLECTIONS

VOLUME 70, NUMBER 2

EXPLORATIONS AND FIELD-WORK OF THE
SMITHSONIAN INSTITUTION
IN 1918



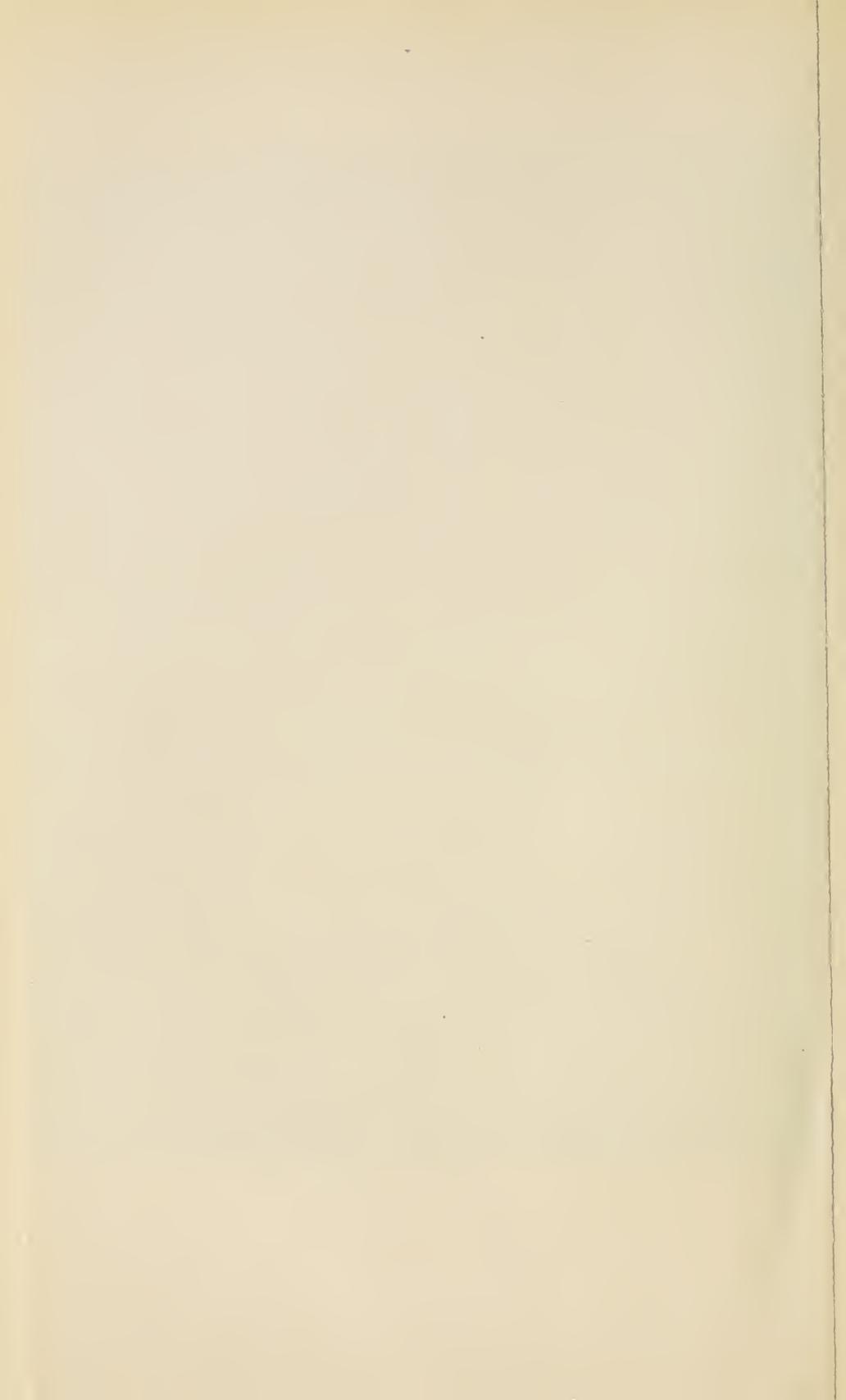
(PUBLICATION 2535)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
1919

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

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EXPLORATIONS AND FIELD-WORK OF THE SMITHSONIAN INSTITUTION IN 1918

INTRODUCTION

The more important of the explorations and researches in the field conducted or participated in by the Smithsonian Institution during the year 1918, are herein briefly described. While in many cases the work was considerably restricted by the world war, nevertheless results of importance to science were accomplished and considerable material was added to the natural history and ethnological collections in the United States National Museum. Nearly every branch of science is represented among these researches, including anthropology, ethnology, geology, botany, zoology, and astrophysics.

The work of the Smithsonian Astrophysical Observatory in measuring the amount of radiation from the sun is of increasing importance, as it is expected to make these measurements the basis of a new method of forecasting temperatures on the earth. The ethnological studies among the tribes of American Indians are of special interest as certain of these tribes are fast disappearing, in some cases only a very few persons surviving who remember the language, customs, and traditions of a once powerful people. This ethnological material is being recorded from the Indians themselves by members of the Bureau of American Ethnology and so preserved for future generations.

The brief accounts contained herein are largely written and the photographs taken by the investigators themselves.

GEOLOGICAL EXPLORATIONS IN THE CANADIAN ROCKIES

The geological explorations carried on in the Canadian Rocky Mountains by Dr. Charles D. Walcott, Secretary of the Smithsonian Institution, which have been mentioned in the Exploration Pamphlet of the Institution for the years 1916 and 1917, were continued during the field season of 1918 for the purpose of ascertaining the geological structure of the Upper Bow Valley north of Lake Louise, Alberta, and later at the head waters of the Cascade River at Sawback Lake, and also to locate any possible occurrence of unusual beds of fossils at these places.



FIG. 1. Panoramic view taken from the cliff on the east shore of Peyto Lake on the northwest side of Bow Pass, 12,000 ft. (3.6 km.) in an air line north-northwest of Lake Louise, Station on the Canadian Pacific Railway, Alberta, Canada. On the left Peyto Glacier showing its snow-field or névé, ice-foot, terminal moraine and flood plain which extends down to the lake. To the right the valley of Mistaya Creek which flows into the Saskatchewan. To the right of the valley the high ridge that terminates to the north is Mount Murchison (11,500'). Photograph by Walcott, 1918.

Passing up the Bow River from Banff there is a beautiful view from Vermilion Lakes of the western slope of Rundle Mountain near Banff (fig. 2). To the north Mount Louis in the Sawback Range thrusts its pinnacles of upturned limestones far above timber-line (fig. 3). The pinnacles when seen from the north present a bold, strong sky-line (fig. 4).

Leaving the Canadian Pacific Railway at Lake Louise Station, the Bow Valley extends to the northwest parallel to the Continental Divide which forms its southwestern side. Bow Lake at the head



FIG. 2.—Southwest slope of Rundle Mountain, looking across Vermilion Lakes, 2 miles (3.2 km.) west of Banff. The mountain is composed of sloping limestones that form bold eastward facing cliffs. Photograph by Walcott, 1918.

of the valley is a beautiful sheet of water hemmed in by bald mountain slopes and cliffs on the west and north and by the mass of Mount Hector (11,125 feet) on the east. From the west numerous glaciers drain into the lake. The first one encountered is Crowfoot (fig. 5), which flows from the great Wauputek snow-field along the Continental Divide. Some of the smaller glaciers bring down an immense amount of broken and ground up rock which forms long slopes extending nearly to the edge of the lake (figs. 6 and 7).



FIG. 3.—To the northwest of Banff, Mount Louis in the Sawback Range thrusts its pinnacles of upturned limestones far above timber line. Photograph by Walcott, 1918.



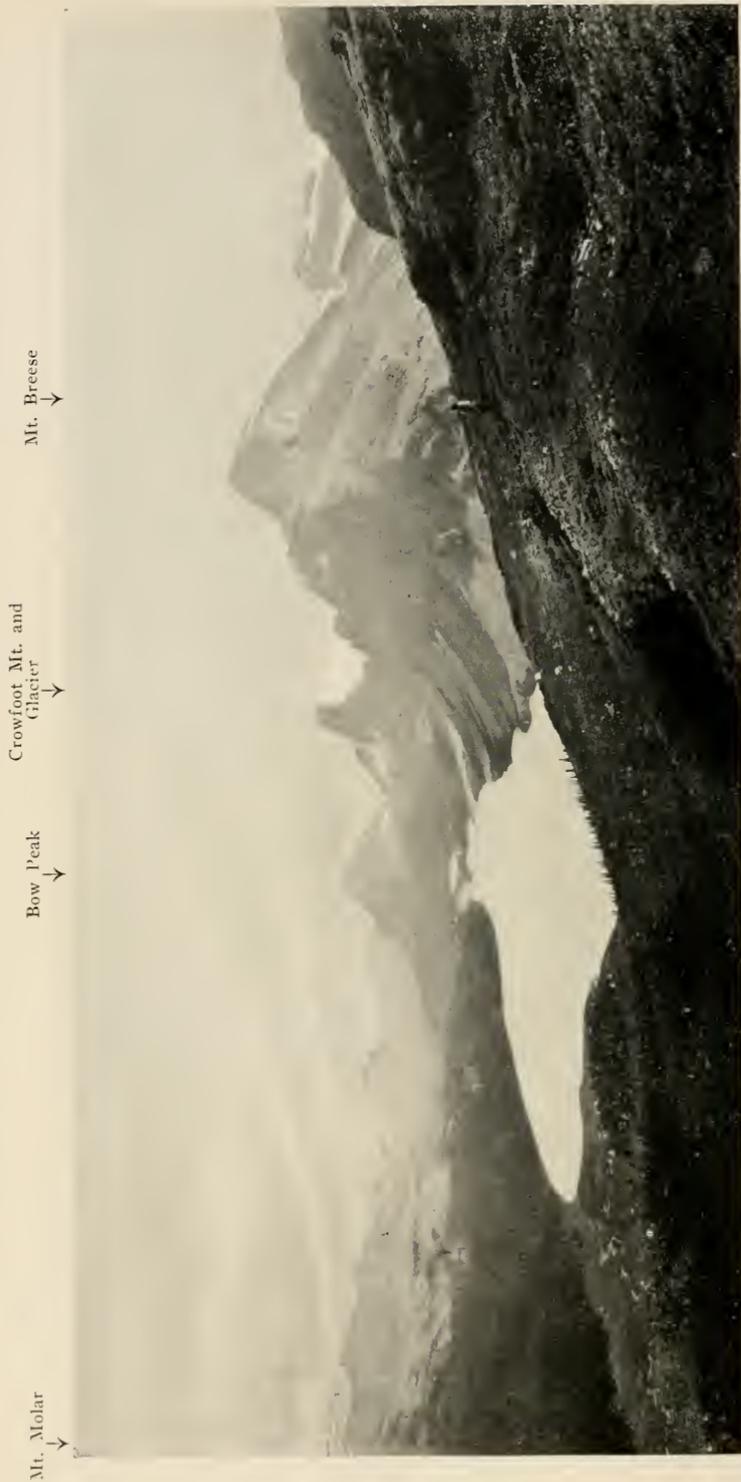
FIG. 4.—Pinnacles of Mount Louis seen from the north present a bold, strong sky-line. Photograph by Walcott, 1918.



FIG. 5.—View from the west slope of Dolomite Peak, looking westward and southward across Bow Lake, which is 19 miles (30.4 km.) north-northwest of Lake Louise. In the center Crowfoot Glacier. To the left center Crowfoot Mountain, and in the distant left Bow Peak. To the right of the Glacier Mount Breese with a small glacier on its eastern slope. Photograph by Walcott, 1918.



FIG. 6.—Small glacier in an amphitheater on the eastern slope of Mount Breese (see fig. 5) with a great talus slope that extends from the foot of the glacier nearly down to the waters of the lake. Photograph by Walcott, 1918.



Mt. Breese

Crowfoot Mt. and
Glacier

Bow Peak

Mt. Molar

FIG. 7.—Panoramic view from the northeast ridge of Mount Thomson, looking south across Bow Lake. On the right above the lake Mount Breese, and on the left of it Crowfoot Mountain with the snow field of Crowfoot Glacier. At the foot of the Lake, Bow Peak and in the distance Mount Hector. To the left Mount Molar (see fig. 8). Photograph by Walcott, 1918.

Figure 7 pictures Bow Lake as seen from the eastern slope of Mount Thomson. This view over the lake from the north shows the ridges on the right formed of Middle Cambrian limestones, while far away in the distance the snow-clad summit of Mount Hector is buried in the clouds. In figure 8 is shown a nearer view of Mount Molar, a beautiful example of horizontally bedded limestones, illustrating the manner in which the hard, evenly bedded limestones erode into domes and broad cylindrical masses.



FIG. 8.—Mount Molar (9,914'), a high mountain ridge to the east-southeast of Bow Lake. Photograph by Walcott, 1918.

There was fine trout-fishing at the lower end of Bow Lake, and we met with both deer and grizzly bear in the somewhat open valley at the head of the lake (fig. 9).

The snow-fields from which Bow Glacier flows are on the Continental Divide between the Bow Valley and the Upper Yoho Valley. The glacier flows down a gentle slope for a mile or more, and then breaks over a high cliff, as shown in figure 10. There are beautiful camping grounds on the shores of both Hector and Bow lakes, especially the latter. From one of these camps (fig. 11), geological sections were measured of the Cambrian rocks on the eastern slope of Mount Thomson.

Mt. Breese ↓
St. Nicholas Mt. ↓
Bow Glacier ↓
Portal Peak ↓
Mt. Thomson ↓



FIG. 9.—Panoramic view from the northeast end of Bow Lake. In the center Bow Glacier, and to the right Portal Peak and Mount Thomson. To the left of the glacier St. Nicholas Mountain, in the center Mount Breese. This view should be studied in connection with figure 7. Photograph by Walcott, 1918.

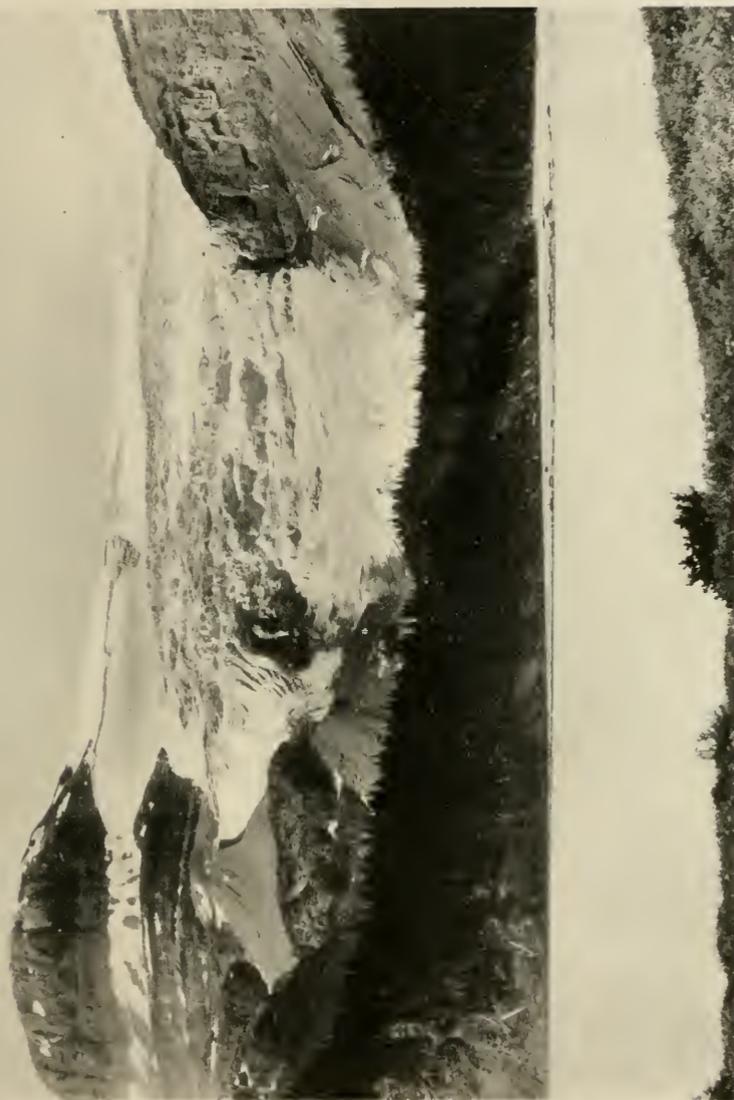


FIG. 10.—View of Bow Glacier from our camp at the head of Bow Lake. This is a beautiful illustration of a glacier cascading or falling over a high cliff. Photograph by Walcott, 1918.



FIG. 11.—Camp among the pines at the head of Bow Lake. This is a fine illustration of the forest growth at this altitude (6,420'). The rubber boots, landing net, and fishing rod were frequently used in the early morning and evening, as there were many trout in the nearby lake. Photograph by Walcott, 1918.

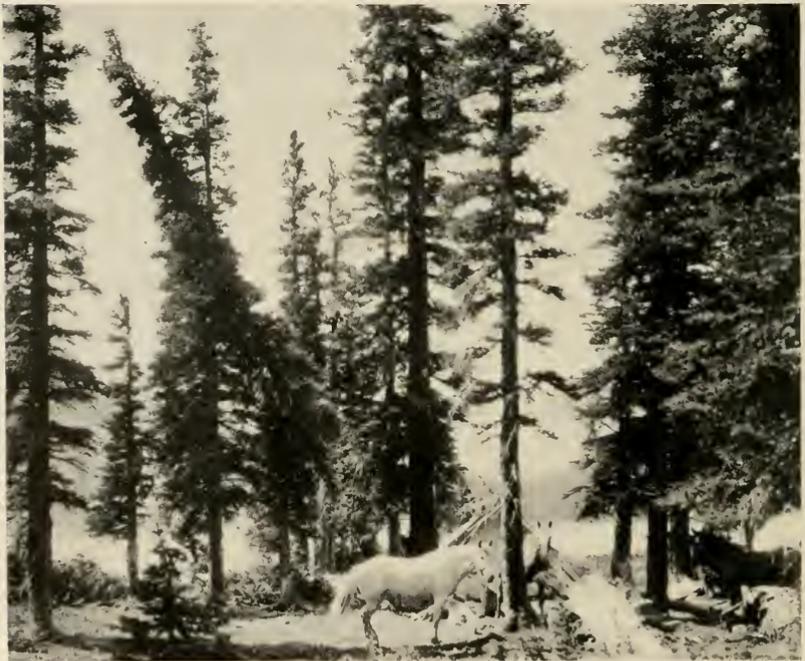


FIG. 12.—Looking through the trees at Bow Lake on a misty day when the horses were resting at camp. Photograph by Walcott, 1918.



FIG. 13.—Illustration of the average slope of the mountain ridges on the sides of Bow Valley where the slope was not broken by cliffs. It is difficult when there is much loose stone to persuade the horses that it is safe traveling, but it is necessary to take them in order to transport camera, rifle, hammers, and the rubber coats which are needed almost daily in August. Photograph by Walcott, 1918.



FIG. 14.—We were accompanied in September by Vernon Wood, forest and game warden stationed at Mount Massive in the Bow Valley. This is a photograph of him with his family and their Rocky Mountain Park cottage, which is their home during the summer and also during the long, snowy winter, as the forest warden must be on guard and attending to his duties throughout the year. Photograph by Walcott, 1918.



Fig. 15.—Peyto Glacier and Lake from the cliffs of the east shore of Peyto Lake on the northwest side of Bow Pass, 24 miles (39 km.) in an airline north-northwest of Lake Louise Station.
On the left above snow line the Continental Divide, Peyto snowfield or névé, glacier, ice-foot, terminal moraine, and flood plain. Photograph by Walcott, 1918.

Bow Pass, four miles (6.4 km.) north of the head of Bow Lake, has been eroded by glacial action into a broad, park-like area, so that the passage over into the valley of the Mistaya River of the Saskatchewan River drainage is scarcely realized until steep slopes indicate the approach toward Lake Peyto. This beautiful lake, with a glacier at its head, as shown in figure 1 (frontispiece), drains into the Mistaya River. The bold escarpment on the north side of the



FIG. 16.—Pyramid Peak reflected in pond near Mistaya River, about 17 miles (27.2 km.) north of Bow Lake. Photograph by Walcott, 1918.

lake is continued to the north down the Mistaya River to the Saskatchewan. Several sections were examined along this front, which were found to be similar to the section at the head of Bow Lake.

Peyto Glacier is a very fine illustration of a complete glacier from the gathering field of snow on the Continental Divide to the ice arch at its foot. As shown in figure 1 (frontispiece), the flood plain at the foot of the glacier extends for nearly a mile to the edge of the lake, affording a fine illustration of the manner of filling in of glacial

Mount Wilson
↓



FIG. 17.—Panoramic view looking north across head of Saskatchewan River. The valley of the North Fork is shown on the left of Mount Wilson (11,000'). The Saskatchewan is here a large and rapid stream just below the union of the north and west forks. It is wonderfully picturesque, and on the mountains to the left we saw large numbers of mountain goats, some of which we were so fortunate as to obtain a photograph of. Photograph by Walcott, 1918.

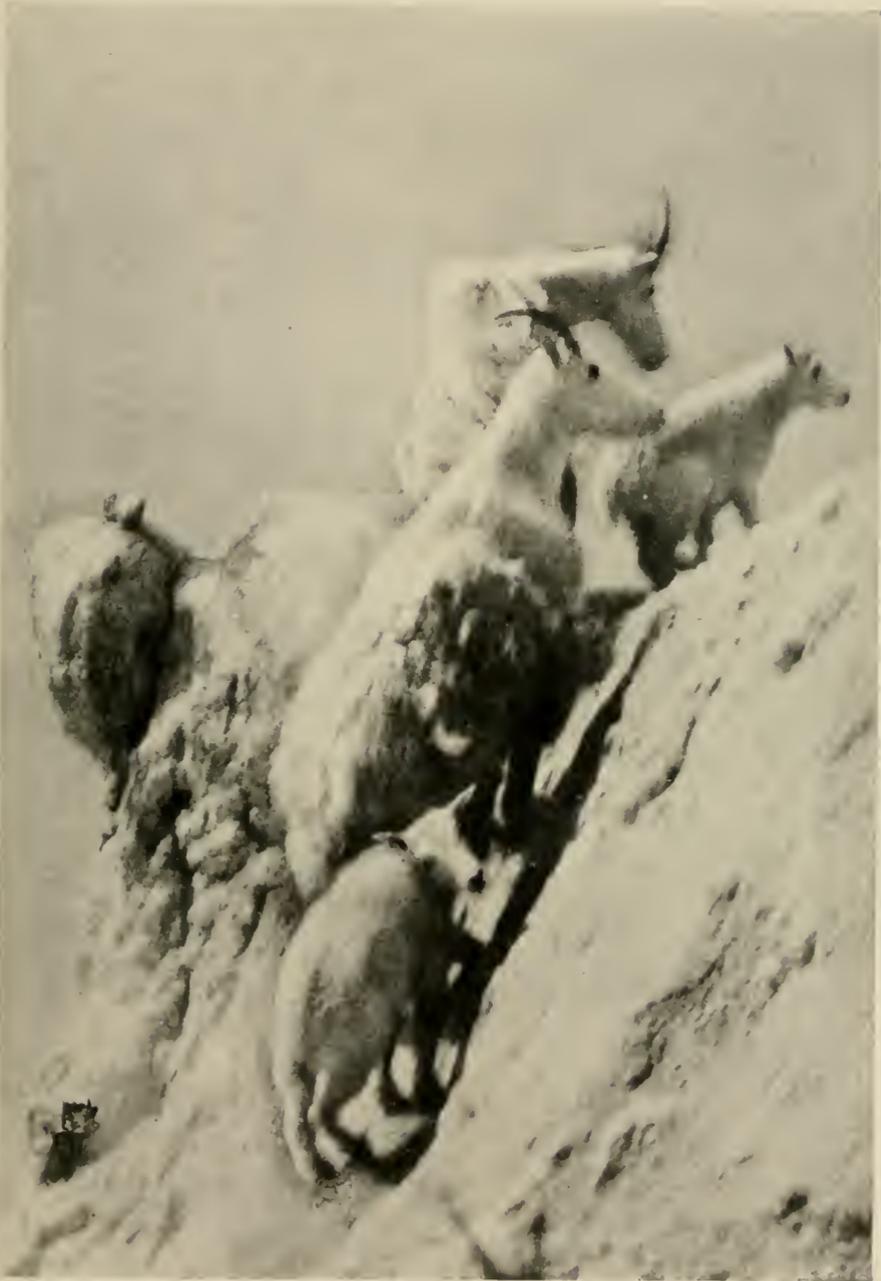


FIG. 18.—Group of mountain goats endeavoring to escape over a sharp ridge immediately in front of where Mrs. Walcott was watching for them. The one attempting to go around the point on the left is on the edge of a cliff about 50 feet above the river. The goat at the top is apparently attempting to prevent itself going over backward by throwing its head forward. Photograph by Walcott, August 5, 1918.

lakes by the rock and dirt brought down by the glacier from the higher mountain slopes. A nearer view of Peyto Glacier is given in figure 15, and figure 16 shows Pyramid Peak, one of the peaks encountered in the Mistaya River Canyon.

The broad canyon valleys that unite at the head waters of the Saskatchewan River (fig. 17) are all carved by erosion out of the same type of Cambrian rocks as those exposed in the vicinity of Bow Lake, and also in the Bow Valley south of Lake Louise Station.



FIG. 19.—Skinning out mountain sheep shot above head of Sawback Lake on September 21. Photograph by Walcott, 1918.

At the close of the season a fine pair of mountain sheep, a black bear, one mule deer, a mountain goat, and a wolverine were collected, the skins and skulls being shipped to the National Museum. At a salt-lick on the west branch of the Saskatchewan River many goats were seen. Some of them in an attempt to escape observation were forced to pass over a sharp ridge directly in front of where Mrs. Walcott was sitting, with the result that she obtained an unusual photograph of five of them (fig. 18) as they were clambering over the apex of the ridge.



FIG. 20.—Panoramic view looking across Sawback Lake eastward toward the Vermilion Range. The lake is about 16 miles (25.6 km.) in a straight line northwest of Banff, Alberta, Canada, and a favorite fishing grounds for the anglers of Banff. Photograph by Walcott, 1918.

GEOLOGICAL AND PALEONTOLOGICAL FIELD-WORK

The field-work of the Division of Geology during 1918 was limited largely to the collection of material for the school and duplicate series and for the use of the Naval Experiment Station in a newly devised apparatus recently brought into use. In connection with the latter work, the head curator made two trips, one through the principal museums of the eastern United States, and subsequently, one extending from northern Georgia through western North Carolina. In addition to the material obtained for the Navy Department, a statement of which is included in a report to the National Research



FIG. 21.—Arriving at home on the trail at eventide, and looking over the horses before turning them out for the night. This camp, below Wolverine Pass, is in one of the most interesting localities in the mountains south of Lake Louise. Photograph by Walcott, 1918.

Council, there was secured a considerable amount of bauxite, staurolite crystals, and numerous specimens of other desired materials, such as columbite, pitchblende, albite, black mica, and quartz.

Dr. Martin, assistant curator of geology, U. S. National Museum, was detailed to spend two weeks in Virginia and Maryland making collections of material to illustrate the weathering and decay of the commoner types of rocks. A sufficient quantity of each phase of the process was taken to make up 100 sets intended for distribution

primarily to such agricultural and other colleges as give instruction in rock weathering and soil formation. A series of from two to four specimens was obtained from each of the seven varieties of rocks showing the fresh and intermediate steps in the present stage of its decomposition. The types selected include granite-gneiss, diabase, gabbro, soapstone, sandstone, and limestone. The railroad cuts in the vicinity of North Garden and Chatham in Virginia, and Mount Hope and Washington Junction in Maryland, afforded, respectively, the granite-gneiss, diabase, gabbro, and sandstone, and the quarries at Alberene, Virginia, and Frederick, Maryland, yielded the soapstone and limestone. In every case the oxidation had proceeded sufficiently to result in the formation of reddish- or yellowish-brown soil, but in the case of the North Garden granite-gneiss, perfectly fresh rock could not be obtained. To supply this deficiency, a series of specimens from the granite-gneiss of the District of Columbia was included, although its weathering had not passed the stage of mechanical disintegration. Despite the fact that such materials do not readily lend themselves to exhibition purposes, several choice residual nodules of gabbro and diabase (so-called nigger heads) one to two feet in diameter were collected for Museum display.

In order to fill certain gaps in the ore and rock collections, Dr. Martin was also detailed to visit localities in Pennsylvania, New Jersey, and New York, and secure a quantity of material from each. Brandywine Summit, Pennsylvania, yielded some excellent cleavage fragments of orthoclase; Peekskill, New York, a select grade of emery rock; North River, New York, hand size pieces of abrasive garnet. From the dikes at Franklin Furnace and Beemersville, New Jersey, was secured a supply of uncommon intrusive rocks, camptonite and nepheline-syenite respectively. Both of these formations, as well as the peridotite, associated with the emery and the syenitic country rock of the garnet, were found to have suffered considerably from the action of the weather since glacial times, and appropriate specimens showing this process were collected incidentally for the study series.

During the field season of 1918, Drs. R. S. Bassler and C. E. Resser of the Division of Paleontology continued the search begun in recent years for large exhibition specimens to illustrate the various phases of structural geology and stratigraphic paleontology. Dr. Bassler

began field-work in an investigation of the Cretaceous rocks of western New Jersey, where the prime object was to secure suitable exhibits of such economically important rocks of organic origin as glauconite or green sand, and calcareous marl. The green sand area in the vicinity of Vincentown, New Jersey, afforded the best results in fossil and rock specimens for both study and exhibition. The very incoherent green sand could not be obtained in masses of a size suitable for exhibition, but by the use of shellac a large piece was hardened sufficiently to be shipped to Washington without



FIG. 22.—Marl pit at Vincentown, N. J. Photograph by Bassler.

breakage. In the marl pits unusually well-preserved fossils were found scattered through an unconsolidated sand formation. Here specimens abound literally by the millions, and large numbers were collected by passing quantities of the sand through a fine-meshed sieve, the residue in this process usually consisting of nothing but well-preserved fossils. The amount of sand sifted is shown by the excavation seen in figure 22. The undulating line marks the irregular contact or unconformity between the Cretaceous marl formation and the overlying strata of more recent age. At the point B in this photograph the fossils occurred in especial abundance,

cemented together and forming a limestone mass of such interest that several large pieces were dug out for exhibition in the Museum.

Dr. Bassler then proceeded to the Lancaster Valley of Pennsylvania where, in company with Dr. Resser, some days were spent studying the stratigraphy of the valley, and collecting minerals and fossils. Working in the region of highly metamorphosed rocks in southern Lancaster County, they were fortunate enough to secure intact the large mass of finely banded, crinkled limestone shown in figure 23, L. This illustrates, on a small scale, the folding to



FIG. 23.—Crumpled Pre-Cambrian limestone, Southern Lancaster County, Pa. Photograph by Bassler.

which the earth's crust has been subjected and forms a much needed addition to the exhibits. Proceeding to York, Pennsylvania, an effort was made to determine the stratigraphy of that area from which numerous Lower Cambrian fossils had been collected for the Museum in former years. An idea of the general structure was obtained, but the stratigraphic details were worked out by Dr. Resser on a later trip.

The east front of the Alleghany Mountains was then visited by Dr. Bassler in an effort to obtain exhibition specimens illustrating fault-

ing and its accompanying phenomena. In western Maryland a fault passing through a Silurian conglomerate was located. The conglomeratic layer itself at this place was composed of small, rounded pebbles of pure white quartz, forming an interesting educational object in itself, but along the fault zone the conglomerate had been broken into angular fragments and recemented together into a hard rock. In one case this recementation had been caused by silica and in another by iron ore. Large examples of both kinds of this fault breccia, as it is known technically, were quarried out. Fortunately,



FIG. 24.—East front of Alleghany Mountains, Western Maryland, showing fault zone at C. Photograph by Bassler.

as shown in figure 24, this fault zone (C) outcropped along a good country road, making the problem of quarrying and transportation easy.

In each of these areas photographs of the occurrence of these specimens in nature were secured so that the explanatory exhibition labels can be illustrated. The object of displaying such specimens is not simply to illustrate their geological or paleontological features, but to show in the same exhibit a portion of geological history involving at least several distinct events.

Following this Appalachian work, Dr. Bassler spent some days in central Kentucky and eastern Indiana searching for certain exhibits. In Kentucky he located a layer of limestone which had been so carved out by underground water that it could be used to illustrate the formation of a cave in miniature, and a suitable piece was quarried out. Certain fossil faunas which were much needed to complete the Museum's paleontological material from this area were also secured. The main object of the work in Indiana was to obtain a large slab of limestone composed entirely of certain characteristic brachiopods known to all beginners in paleontology, fre-



FIG. 25.—Exposure of *Olenellus* shale and *Corynexochus* limestone, north of York, Pa. Photograph by Resser.

quent requests for such exhibits having been made by students visiting the Museum. After a week of search, two large, well-preserved slabs of this kind were found, but in an area some miles from a railroad. Upon endeavoring to have them transported to a freight station it was found impossible to procure help of any kind. These two specimens were therefore buried deep enough to insure their safety until such time as they can be shipped to Washington.

Dr. Charles E. Resser spent a part of his vacation studying the detailed stratigraphy of the Lower Cambrian deposits of the Lancaster and York valleys of Pennsylvania. He found that the lowest

sedimentary rocks of the region were massive, unfossiliferous limestone probably of Pre-Cambrian age, with a great erosional unconformity at their top. Immediately following this unconformity is an arenaceous limestone several feet thick containing the *Corynexochus* fauna hitherto believed to be of Middle Cambrian age. Following this bed, in apparently normal succession, are the well-known Lower Cambrian shales containing *Olenellus* and other trilobites. In figure 25 the point of contact between the two Lower Cambrian formations is indicated at C. Collections of two faunas of Lower Cambrian age were secured during these studies.



FIG. 26.—Open iron ore pit at Cornwall, Pa. Photograph by Resser.

Dr. Resser also spent some days in collecting mineral specimens from the celebrated ore banks at Cornwall, Pennsylvania, a locality famous for its well-preserved minerals, but unfortunately poorly represented in the Museum collections. These ore banks are in the hills between Lancaster and Lebanon counties and, as they have been worked since 1853, they are now great open pits from which the minerals can be obtained. The ore is the iron oxide magnetite, formed along the lines of contact of an igneous mass intruded into Paleozoic limestone. The magnetite often occurs well crystallized, but the mineralogical interest of the locality lies in the minerals of copper, iron, and magnesium silicates which were formed with the magnetite. The photograph (fig. 26) shows the arrangement of

rocks in one of the open pits with the ore bed (O) at the bottom, above this the Early Paleozoic limestone (P), and capping the limestone, the red beds of Mesozoic age (M).

FIELD-WORK OF THE SMITHSONIAN ASTROPHYSICAL OBSERVATORY

As usual, for some years past, the Astrophysical Observatory maintained its observing station on Mount Wilson and the work was in the hands of Mr. L. B. Aldrich. As heretofore, the principal object was to follow by accurate measurements the variations in the radiation of the sun as that would be found if one were on the moon, for example, outside the earth's atmosphere. The season did not prove particularly favorable for this work on account of unusual cloudiness. Nevertheless, Mr. Aldrich made many solar-constant observations that will be unusually valuable on account of the possibility of comparing them with similar observations made in South America, which will be related below.

It happened that a station of the U. S. Aviation Service was located near Mt. Wilson, at Arcadia, and military balloons not infrequently passed up through the layer of fog which often covers the San Gabriel Valley, lying between Mount Wilson and the sea. It occurred to Mr. Aldrich to take advantage of this condition of affairs to make a measurement of the reflecting power of such a great layer of fog with a view to the applicability of such measurements to a consideration of the temperature of the planets Earth and Venus, both of which are to a large degree covered with clouds. We have at the Astrophysical Observatory an instrument called the pyranometer, devised by Messrs. Abbot and Aldrich for the purpose of measuring the heating effect of radiation received from a whole hemisphere. For example, the heat from the sun and sky combined, or from the sun alone, or from the sky alone, as it falls upon a horizontal surface may be determined by this instrument. Mr. Aldrich's plan, therefore, was to expose the pyranometer upright to the sun and sky combined, and inverted to the radiation coming up from the layer of fog. For this purpose he needed a support for the pyranometer above the fog, and such a support he thought might be furnished by a military balloon.

With the approval of General Kenley the investigation was made on a favorable day in September, when the upper and lower surfaces of the fog lay respectively about 2,800 feet and 1,000 feet above the ground. Two officers and 50 men being detailed to aid

Mr. Aldrich, one of the officers went up with the balloon, which carried the pyranometer suspended inverted underneath its basket, and exposed the apparatus repeatedly from about 7 o'clock in the morning until about 11 o'clock. The measurements were recorded by Mr. Aldrich on the ground by the aid of communicating wires carrying the currents of electricity set up by the heat of the rays received from the fog upon the instrument.

The measurements were singularly concordant and satisfactory, and gave as the mean reflecting power of the fog during the interval from 7 until 11 o'clock 78 per cent. No apparent change due to the change of the height of the sun during that time was observed. However, it is hardly questionable that if the measurements had been made nearer sunrise the reflecting power of the fog would have been



FIG. 27.—Smithsonian Observatory at Calama, Chile.

found somewhat greater. Accordingly, we must suppose that if there should be a planet completely covered with smooth clouds it would reflect upwards of 78 per cent of the solar rays otherwise available to heat its surface. In the case of the earth, the cloudiness is about 50 per cent, so that if the clouds were as smooth on their surface as the clouds observed by Mr. Aldrich, the result would be that they would reflect away about 39 per cent of the solar rays and make them ineffective to warm the earth. Taking this result in connection with the consideration of the other parts of the earth's surface, it appears that the reflecting power of the earth as a whole for solar rays of all wave lengths should be in the neighborhood of 43 per cent.

As stated above, the measurements of the solar radiation at Mount Wilson have unusual value this year on account of the simultaneous

measurements being made at Calama, Chile, under the direction of Mr. A. F. Moore, assisted by Mr. L. H. Abbot. The outfit there is the same that was used by them during the previous year at Hump Mountain, in North Carolina. The present station was chosen as the most cloudless one to be found upon the earth, and they have been able to observe about 75 per cent of the days since the 27th of July,



FIG. 28.—The Coelostat, Pyrheliometers, and Theodolite.



FIG. 29.—Part of the Spectro-Bolometer.

when the measurements began. For long periods of time, as, for example, the period from the middle of November to the middle of December, there was not a single day lost, although this required that the sky should be perfectly cloudless for about three hours, either in the early morning or the late afternoon. Notwithstanding the great number of favorable days for the observations, the records

of meteorological observations there in former years led us to hope for an even larger proportion of favorable sky conditions. However, in many parts of the world the past two years have been exceptional in their weather and it is to be expected that these exceptional conditions affected the weather of the Nitrate Desert of Chile as well. We therefore hope that in future years even better results may be obtained than now.

The purpose of the work is to follow the variations of the sun and to lay a foundation for the application of such measurements to the prediction of terrestrial temperatures. That branch of the investigation has been taken up by Dr. H. H. Clayton of the Meteorological Service of Argentina. Dr. Clayton has studied the correlations

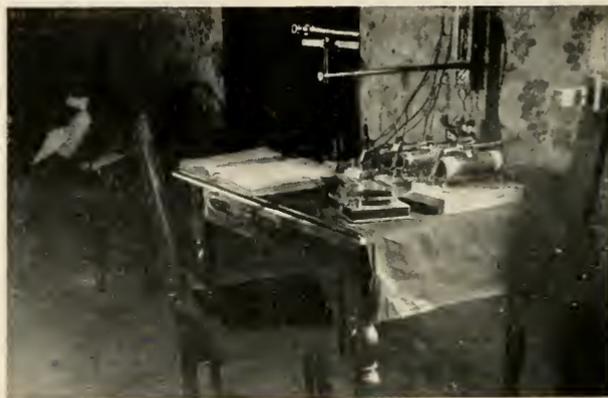


FIG. 30.—Recording Observations.

between the solar-constant results and the temperatures of Argentina and he is quite enthusiastic as to the probability that the forecasting of the weather in Argentina will be materially improved by the aid of solar-radiation measurements. If this proves to be the case, it is greatly to be hoped that means will be found to increase the number of observing stations qualified to measure solar radiation. The station occupied in Chile lies on the Loa River, also on the railroad from Antofagasta to Bolivia, about 150 miles east of Antofagasta. The altitude is 7,500 feet and the conditions about the station are entirely desert conditions, except in so far as modified by irrigation from the Loa River. The station occupied is a disused mining property of the Chile Exploration Company, which very generously allows its use for the purpose of the solar work. Every effort is being made to

secure favorable and livable conditions for the staff and for their work, and the results so far obtained seem to be very promising and to reflect great credit on the zeal and accuracy of the observers.



FIG. 31.—The Loa River near Calama.



FIG. 32.—Bank of the Loa River.

THE COLLINS-GARNER FRENCH CONGO EXPEDITION

In November, 1916, Mr. Alfred M. Collins of Philadelphia invited the Smithsonian Institution to participate in an expedition to the French Congo with the object of procuring a general collection of vertebrates and in particular a good representation of the great apes. Mr. Collins was to be chief of the expedition, while the gen-

eral management was to be placed in the hands of Mr. R. L. Garner, well known by his previous studies of chimpanzees and gorillas in the same region. Mr. Robert Aschemeier, an assistant taxidermist on the Museum force, was detailed to accompany the party. It was decided that the expedition should be known as the "COLLINS-GARNER CONGO EXPEDITION, IN THE INTERESTS OF THE SMITHSONIAN INSTITUTION."

Mr. Aschemeier and Mr. Garner sailed from New York for Bordeaux about the middle of December, 1916, Mr. Collins then expecting to follow a few months later. War conditions, however, greatly delayed the arrival of the first members of the party in Africa and have entirely prevented Mr. Collins, now Major Collins, from joining them.

After many difficulties had been overcome, largely through the extreme courtesy of the Governor General at Brazzaville, the Lieutenant Governor, and the Administrateur des Colonies at Fernan Vaz, Mr. Garner and Mr. Aschemeier finally established permanent headquarters. The following passages from a letter from Mr. Garner to Dr. Hrdlička give an idea of their surroundings:

" FERNAN VAZ, July 7, 1918.

" Our domicile is located on the edge of a vast plain, traversed here and there by belts and spurs of forest. In those plots of bush live great numbers of chimpanzees, and for the first time in my long experience among them I have seen whole families of them out on the open plain. Frequently they cross the plain from one belt of bush to another, in some places a mile or so in width and not a tree or bush in that distance to shelter them from attack. They often come within 200 to 300 yards of my house and sometimes manifest deep interest in trying to find out what this new thing is, set up in their midst. I have seen as many as four or five different groups of them in the same day, and one of these contained 11 members. One very old man has come, on two occasions, within 100 yards of me and scrutinized me very closely, while his wife (as I took his companion to be) appeared to be very uneasy and suspicious. On several occasions I have seen the young ones romping and tumbling about on the grass, chasing and scuffling with each other, exactly as you see human children do. A school of them slept, a few nights ago, within less than 100 yards of my house, in a very small clump of bush, not more than a hectare in extent, on one side of which is Lake Fernan Vaz and all around the rest of it an open plain, with the quarters of

my crewmen not more than 200 yards away on the opposite side from me and a native village in plain view 500 yards away at an angle of about 30° from the crewmen's village. I have never before seen so many chimpanzees as I find here and I have never seen them so indifferent to the presence of human beings. Even while I was building and had as many as 18 or 20 natives moving about the place those reckless apes would often cross the open plain in full view and with apparent composure.

"Mr. Aschemeier has collected well on to 2,000 specimens and nearly all of them he has killed with his own gun. Some of these specimens are exceedingly rare and valuable. When you recall the fact that he came as taxidermist of the expedition and not as *chasseur*, he was not expected to provide the specimens that he was to preserve.

"We have forwarded six consignments of specimens to the Museum and have a seventh well on the way; but we find great difficulty in getting the steamers to take them from Port Gentil (Cap Lopez), because they are all under direction of the French military authorities. Two of our last shipments were still at Port Gentil last month, where one of them has been lying since last January and all steamers declined to take it. Once both shipments were taken aboard the steamer and bill of lading signed when the captain changed his mind and sent the whole lot back on shore, with the accumulated charges of 40 francs for embarkation and debarkation.

"We have sent 12 or 13 specimens of buffalo, several specimens and species of antelope and two or three fine specimens of the "red river hog," besides a large collection of monkeys, representing six or seven species of both sexes and various ages. I think in all we have sent over 1,500 up to this time. Of course this includes birds, etc., not insects, and we have on hand a goodly number.

"Yesterday I bought a fine, fresh skin of a thing the natives call *anima*. It is something very much like the civet cat in its general appearance, but it is not of the ordinary type. I have never examined one, but I think they are more canine than feline and the natives regard them as such. At any rate, it is a fine specimen and I am taking great care to cure it in the best manner possible.

"I will call your attention to a singular fact about the monkeys and especially of the mangabeys of this region. There appears to be prevalent among them some kind of disease resembling cancer, and it is not at all unusual to see one with his nose eaten away or sometimes one side of his face, while otherwise he appears active and



FIG. 33.—Skull of West African Buffalo collected by Robert Aschemeier.

normal. An isolated case now and then might be attributed to accident or to violence; but these cases are so common as to lead to the belief that it is a disease and, so far as I have observed, it appears to be confined to this one species, with the exception of one case in which I noticed the *mustache* monkey affected by it."

Detailed work has been done in the neighborhood of this base, and several expeditions have been made away from it. Under date of September 1, 1918, Mr. Aschemeier gives the following list of the more important specimens collected: Birds, 671; small mammals, 758; monkeys, 79; gorillas, 2; chimpanzees, 8; buffalo, 14; antelope, 42; wild pig, 10.



FIG. 34.—Riding water buffaloes is the favorite pastime of Celebean children, especially small boys. During the hot part of the day the buffaloes spend most of their time in a pond or pool, with all but their heads submerged, paying little or no attention to the children that climb over them and dive from their backs.

War conditions have seriously interfered with the shipment of material to Washington. Of the lots that have been sent only three had arrived up to the end of January, 1919. These included a total of 805 specimens, all in good condition. Among the more interesting may be mentioned a gorilla, seven chimpanzees, 12 buffaloes, eight wild pigs and parts of an elephant.

EXPEDITION TO BORNEO AND CELEBES

In the report on explorations during 1916 (Smithsonian Misc. Coll., vol. 66, no. 17, pp. 29-35) an account was given of field-work

in Celebes to the end of August, 1916. Mr. Raven was then preparing to leave Menado. He arrived at Parigi on August 27 and remained in the central part of the island until March, 1918. At this time he started to return to America, but conditions of travel were so unfavorable that he did not reach San Francisco until September 20. The results of this expedition, from the beginning of field-work in January, 1916, are of great importance to the Museum. The main



FIG. 35.—*Cranorhynchus cassidix*, the large hollow casqued hornbill of Celebes inhabits the whole island excepting the high mountains and is known to the natives by names such as "boeroeng taloen," "alo," and "ngoh," the latter resembling somewhat the birds call-note.

collections include about 1,500 mammals, 2,800 birds, and an extensive series of ethnological specimens, all from regions not hitherto represented. The special value of this material from our point of view is its close relationship to the collections previously made by Dr. Abbott in the more western part of the Malay Archipelago and by Dr. Mearns and others in the Philippines.



FIG. 36.—To obviate the danger of specimens molding while in transit from the collecting ground to the Museum, it was necessary to dry them in the hot sun for a short time before they were finally packed. A boy was always detailed to guard drying specimens against domestic animals such as pigs, fowls, goats, dogs and cats.



FIG. 37.—A primitive method of plowing. The rice fields overgrown with grass, since the last harvest, are flooded and plowed by driving a herd of water buffaloes around and around until the grass is completely trampled beneath the surface of the mud.



FIG. 38.—In the high mountainous districts of Central Celebes are many prehistoric tombs and images of stone. This one is about five feet high and called by the natives Watoe Langko.



FIG. 39.—The Pig-Deer, or Babi-Rusa of Celebes and some of the adjacent islands to the east seems to prefer as its habitat the coastal regions.



FIG. 40.—With a proficiency born of patient practice, the Celebean native, skilfully carves, with an apparently unwieldy large knife, the sheath and handle for his side weapon.



FIG. 41.—*Squilla*, a prawn, is hunted by the people of the coast of Celebes as an article of food. After locating the animal's burrow they try to drive it out by thrusting poles down into the passage ways to which there is but one outlet. To be sure not to cut the animal off from the entrance of his burrow the probing is begun several feet away.

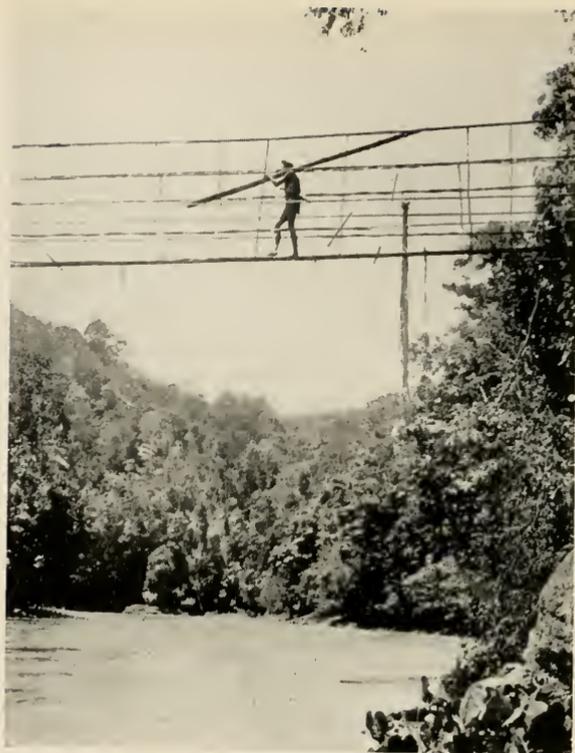


FIG. 42.—A rattan bridge over the Koro River, at Bokoe, Central Celebes.

The Koro, which is the largest river of Central Celebes, is bridged at several places by rattan hanging bridges more than two hundred feet long; this one has as its mainstay, five large rattans each about three centimeters in diameter. Other smaller rattans are arranged as a hand rail.



FIG. 43.—Madurese Prahus in the Straits of Madura, near Java. The curious sail is made from the fiber of the banana tree, loosely woven but nevertheless quite durable.

MARINE BIOLOGICAL STUDIES IN CALIFORNIA

Under the auspices of the United States Bureau of Fisheries, Waldo L. Schmitt, of the Division of Marine Invertebrates, U. S. National Museum, spent the months of August, September, and October in California engaged in a study of the life history of the West Coast spiny lobster, *Panulirus interruptus* (Randall).

The greater part of the time, by courtesy of the Scripps Institution for Biological Research, was spent at their laboratories at La Jolla, examining their extensive plankton collections for the larval stages of the "lobster." Considerable material, chiefly of the younger stages, was obtained here, including many specimens of the post-embryonic stage, hatched by Mr. P. S. Barnhart, curator of the institution's museum, in one of their large aquarium tanks. And further, the assistance extended by the director, Dr. Ritter, enabled Mr. Schmitt to conduct a two-day dredging and tow-netting trip both outside and inside of the extensive kelp-beds lying between La Jolla and Point Loma.

An examination was also made of the collections of the University of California at Berkeley, Stanford University at Palo Alto, the University of Southern California at Los Angeles, Pomona College at Claremont, the Venice Marine Biological Station (of the University of Southern California) at Venice, the Laguna Marine Laboratory (of Pomona College) at Laguna Beach, and the Museum of the San Diego Natural History Society at San Diego, and some pertinent material obtained.

But by far the richest samples of spiny lobster larvæ were returned through the activities and generous co-operation of the California State Fish and Game Commission. These collections were secured by means of a small otter trawl with a spread of about 20 feet, operated from their patrol-boat, the "Albacore," and contained many phyllosomes of large size as well as a number of pueruli. The latter represent the stage intermediate between the phyllosome, the form in which the "lobster" is hatched from the egg, and the definitive form of the adult.

An interesting feature brought out by the collections made by the State Fish and Game Commission was the great off-shore range of the phyllosomes and the depth at which some of them were obtained—as much as 150 miles off shore, and to a maximum depth of 75 fathoms. A phyllosome taken at that depth, some 16 miles off Los Coronados Islands, is shown in figure 44.

Certain incidental shore and tidepool collections were made while at La Jolla.

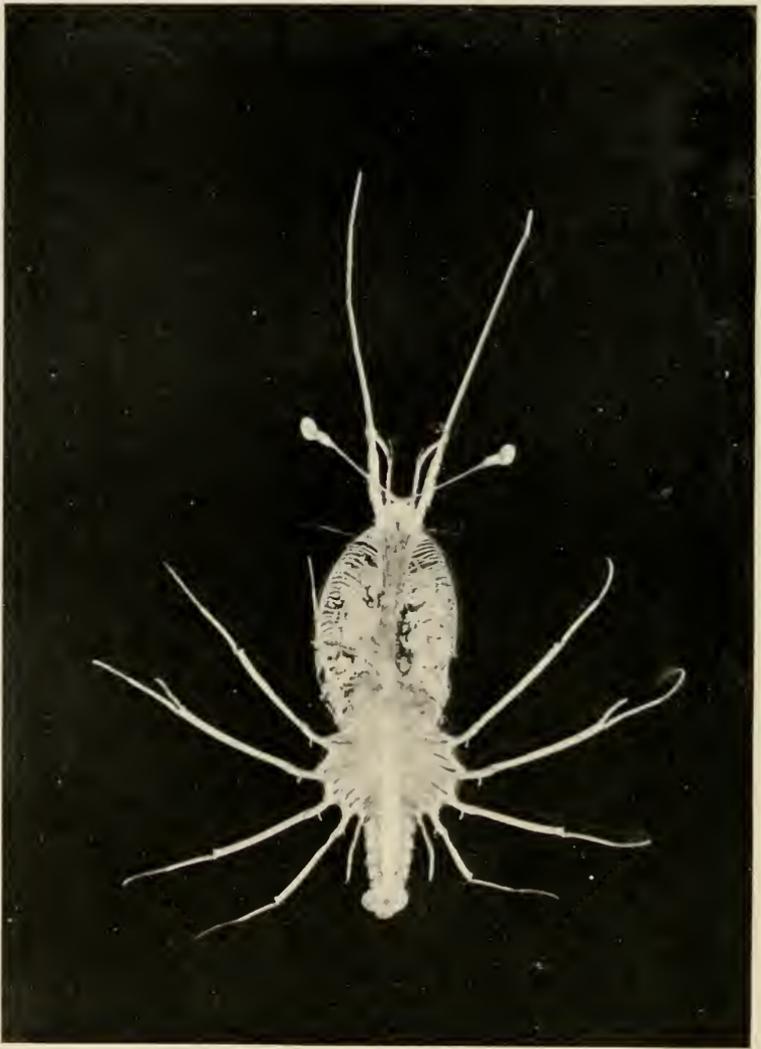


FIG. 44.—Large phyllosome of the California spiny lobster, *Panulirus interruptus* (Randall).

BOTANICAL EXPLORATION IN ECUADOR

During the year a plan for a co-operative investigation of the flora of northern South America was organized by the United States National Museum, the New York Botanical Garden, and the Gray Herbarium of Harvard University. It is believed that this investigation will greatly enrich our botanical collections and furnish information regarding economic plants which will be of much value to the horticultural and agricultural interests of this country.



FIG. 45.—A view in the upper valley of the Chanchan River. The mountain mass in the center is called the Devil's Nose. Photograph by George Rose.

The first field expedition under this co-operative plan was undertaken by Dr. J. N. Rose, associate curator in the United States National Museum. He was also materially aided by the Bureau of Plant Industry of the United States Department of Agriculture. Dr. Rose, accompanied by George Rose, left Washington July 22, and returned December 4, 1918. In addition to his visit to Ecuador he made short stops at Cuba, Panama, and Haiti, collecting a few plants at each place.



FIG. 46.—A view of Chimborazo, taken at an altitude of about 12,000 feet.
Photograph by George Rose.



FIG. 47.—A view of the Chanchan Valley looking west from Huigra. Photo-
graph by George Rose.

Three months were devoted to work in Ecuador and very large collections were made, including about 6,000 botanical specimens, 100 jars of fruits, seeds, and plant products preserved in formalin. Several hundred packets of seeds, a number of wood specimens,



FIG. 48.—Giant cactus plant, apparently undescribed, which is very common in the Chanchan Valley. Photograph by George Rose.

samples of cinchona-bark and small collections of fishes, frogs, shells, and other zoological material were obtained. George Rose, who went as photographer, made about 260 negatives of landscapes and plant subjects.



FIG. 49.—A species of *Furcraea* from which is obtained one of the most useful fibers in Ecuador. It is called caboya. Photograph by George Rose.



FIG. 50.—Residence of the general-manager of the Guayaquil and Quito Railway Company at Huigra. Photograph by George Rose.

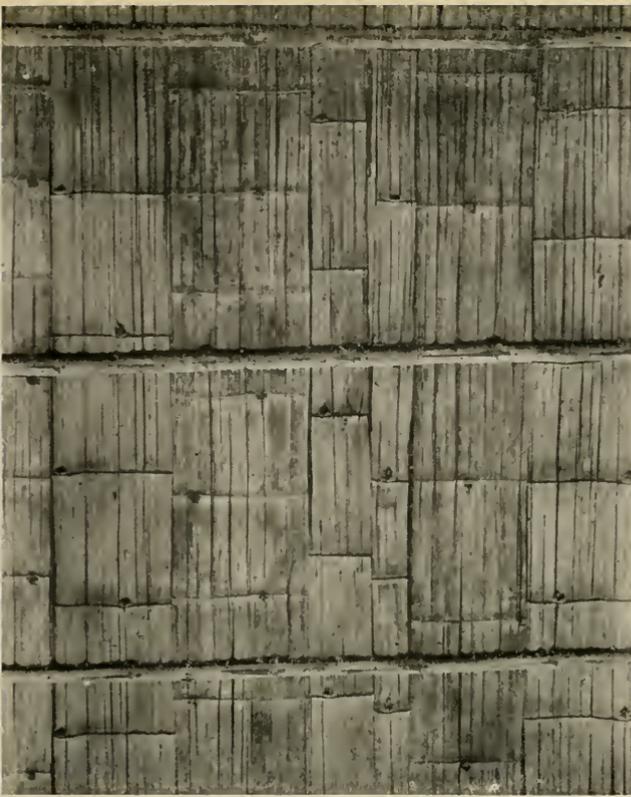


FIG. 51.—Detail of bamboo boards. This giant bamboo is much used in the construction of houses and fences in the low country along the coast of Ecuador. Photograph by George Rose.



FIG. 52.—A view of the Quinta Normal at Ambato, the first Agricultural Experiment Station to be established in Ecuador. Augusto N. Martínez is director. Abelardo Pachano, Professor of Agronomy, was educated at Cornell University. Photograph by George Rose.



FIG. 53.—American Hospital at Portovelo. This hospital belongs to the South American Development Company and is in charge of an American doctor. Much is being done here to relieve the condition of the poor in southern Ecuador. Photograph by George Rose.



FIG. 54.—Market view. The bowl contains wild blueberries (*Vaccinium mortinia*). Photograph by George Rose.



FIG. 55.—Types of Cañar Indians. Photograph by George Rose.



FIG. 56.—Market view, showing the ocha (*Oxalis tuberosa*) a well-known root crop of the high Andes. Photograph by George Rose.

Two sections were made from the coast across the western range of the Andes to the interior Andean Valley: one in the south from Santa Rosa to Loja and the other near the center of the country from Guayaquil to Riobamba. A longitudinal section was made down the Andean Valley from San Antonio to Loja. This last section was over the route followed by Alexander von Humboldt at the beginning of the eighteenth century. Many of the plants collected by him on this memorable journey were recollected.

Figures 45 to 56 show the nature of the country, some unusual types of vegetation, the class of buildings, market scenes, and native inhabitants.

BOTANICAL FIELD-WORK IN THE SOUTHWESTERN UNITED STATES

During the month of August, 1918, Mr. A. S. Hitchcock, systematic agrostologist of the Department of Agriculture and custodian of the section of grasses of the Division of Plants in the U. S. National Museum, visited Arkansas, Oklahoma, Texas, and Colorado for the purpose of studying the grasses. In Arkansas, Oklahoma, and eastern Texas the season was unusually dry and hot. As the grasses were in an unfavorable condition for study little time was spent in these states. Collections were made at Fayetteville and Pine Bluff in Arkansas, Stillwater in Oklahoma, and Fort Worth in northeastern Texas. At Amarillo in northwestern Texas the season was more favorable and the grasses were in good condition for study.

Amarillo is situated in the midst of a plain and the flora is characteristic of much of the Great Plains region of the western parts of Texas and Kansas, and of the eastern parts of New Mexico and Colorado. Grasses form the dominant vegetation, and the collection here represented 30 species. Buffalo grass (*Bulbilis dactyloides*) forms patches of sod, but most of the species are bunch grasses and do not form a continuous covering to the soil. The most common are the grama grasses (*Bouteloua hirsuta* and *B. gracilis*) and the needle grasses (*Aristida longiseta*, *A. purpurca*, and *A. wrightii*). An interesting species (*Eragrostis barrelieri*) was found here in small quantity, evidently being a newcomer. The species is a native of southern Europe and appeared a few years ago in southern Texas, the first collection being made in 1894 by A. A. Heller at Kerrville. In 1897 J. G. Smith collected it at the same place and also at Llano.

In 1902 Professor Tracy found it at Abilene. In 1910 the writer collected the species in several localities (Big Spring, Kerrville, Brownsville, San Antonio, Kenedy) and observed it to be a common weed in lawns and along streets. In time the species will probably spread over a much wider area.

Several days were spent in the vicinity of Long's Peak, Colorado, the headquarters being Long's Peak Inn. This is reached by rail from Denver through Boulder to Ward and by stage northward to Estes Park, Long's Peak Inn being one of several hotels in the park. The hotel is at an altitude of about 9,000 feet. To the east are two peaks, the Twin Sisters, rising to a height of about 11,500 feet. Long's Peak lies a little south of west, in an air line about four and



FIG. 57.—A view of Long's Peak from the summit of Twin Sisters. Long's Peak is the central dome, the summit of which is 14,255 feet. Chasm Lake lies at the base of the cliff below the snow bank.

one-half miles, its summit reaching an altitude of 14,255 feet, over 100 feet higher than Pike's Peak, the best known of Colorado's mountains. A short distance to the northwest is Estes Cone, a symmetrical, isolated peak about 11,000 feet high.

One trip was made to the summit of Twin Sisters and another to the summit of Long's Peak. The second trip was made in company with Titus Ulke and Mr. Babcock, the latter a forest ranger kindly placed at our service by the superintendent of the park. Mr. Babcock had ascended the peak many times, having acted as a guide to tourists. His efficient aid was greatly appreciated.

The party set out in the morning for Timber Line Cabin (11,000 feet) and spent the afternoon in observations at Chasm Lake and

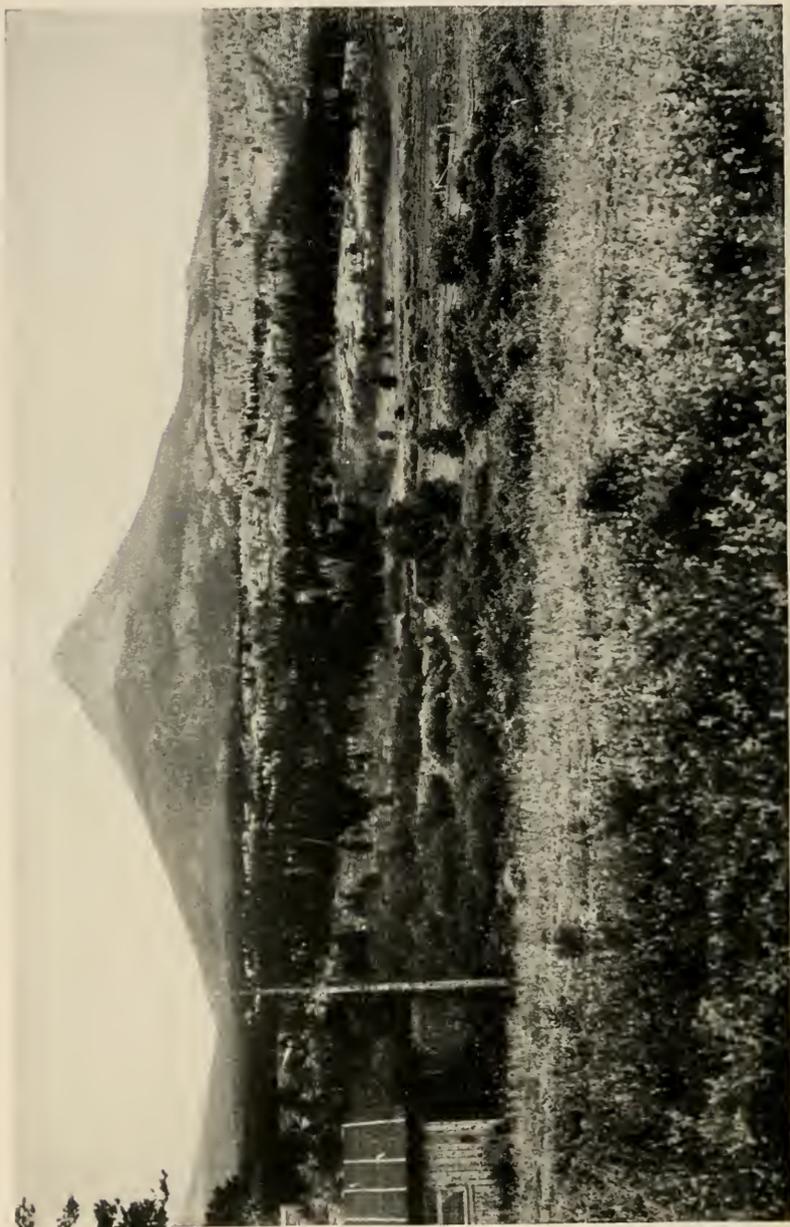


FIG. 58.—Estes Cone as seen from Long's Peak Inn. This regular peak is about 11,000 feet high. The shrubs in the foreground are alders along a stream; the conical trees are Engelmann spruce; the more irregular dark trees are lodgepole pine.

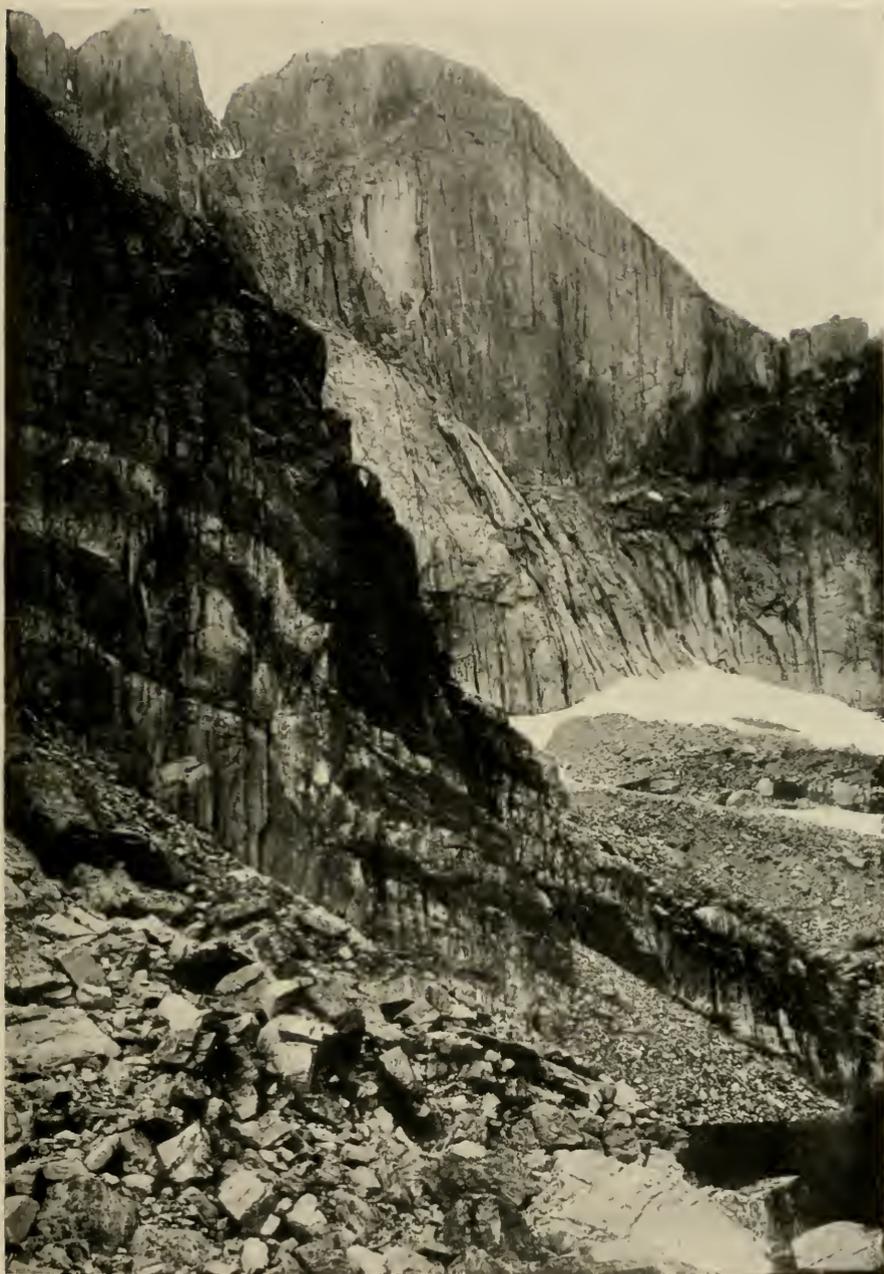


FIG. 59.—The summit of Long's Peak from Chasm Lake. A part of the lake is shown at the lower right-hand corner. The rounded dome in the center is the summit. The precipice is about 2,000 feet high.

vicinity. Chasm Lake lies at the foot of the east face of Long's Peak, which rises above it, a sheer precipice of over 2,000 feet. A beautiful and well-marked lateral moraine leads away to the east of the lake. On the morning of the second day the ascent of the peak was commenced and the summit was reached about noon. Fortunately the weather was clear and the whole surrounding country lay in plain view for many miles, even Pike's Peak being distinguishable, nearly 100 miles to the south.

The timber-line is at approximately 11,000 feet. In this vicinity the trees are stunted by the force of the winds and can develop only



FIG. 60.—A heavy rock near Chasm Lake, probably transported by glacial action and left supported by four small stones.

in the lee of rocks and hillocks. It is not uncommon to find a dense growth of pine or spruce reaching up to the level of a protecting ledge, but prevented by the force of the wind from extending above this level.

The forest on the slopes of the mountain consists mainly of four species, the aspen, the Englemann spruce, and two kinds of pine. The aspen (*Populus tremuloides*) is a deciduous tree with smooth light green or nearly white bark, found up to about 10,000 feet. The Englemann spruce (*Picea engelmanni*), a beautiful conifer with a tapering top, is common over all the upper stretches of the mountains. The lodgepole pine (*Pinus contorta*) is the common pine



FIG. 61.—Engelmann spruce (*Picea engelmanni*), a beautiful pyramidal tree, forming the bulk of the forest in this region.

around Long's Peak Inn and the lower slopes of the mountains. At the higher altitudes the limber pine (*Pinus flexilis*) is frequent. This species is recognized by its very elastic "limber" branchlets which bend without breaking.

The herbaceous plants with showy flowers, the real "flowers" of the tourist, are abundant and attractive. One of the most conspicuous plants is the green gentian (*Frasera speciosa*), not so much for the flowers as for its stately appearance. It grows to the height of 2 to 4 feet, a single erect stem with numerous leaves and masses of green flowers from their axils. There are several



FIG. 62.—A young growth of lodgepole pine (*Pinus contorta*), the common pine of Estes Park. Altitude 9,000 feet. One peak of Twin Sisters rising at the right.

species of gentian, some rare, some abundant, all much sought by tourists. The lupine (*Lupinus decumbens*), with racemes of blue flowers, the harebell (*Campanula rotundifolia*), with delicate stems and large blue bell-shaped flowers, and several species of daisies (*Erigeron*) are among the more showy of the late summer flowers.

Above timber-line are the alpine meadows, boggy areas supporting a growth of grasses and sedges with other plants intermixed. There are no trees, but shrubs extend upward in the protected valleys or depressions. The pine and spruce are found in the form of "krumholz," stunted growths in the lee of rocks, as described in a preceding



FIG. 63.—A single tree of lodgepole pine (*Pinus contorta*), aspens in the background.

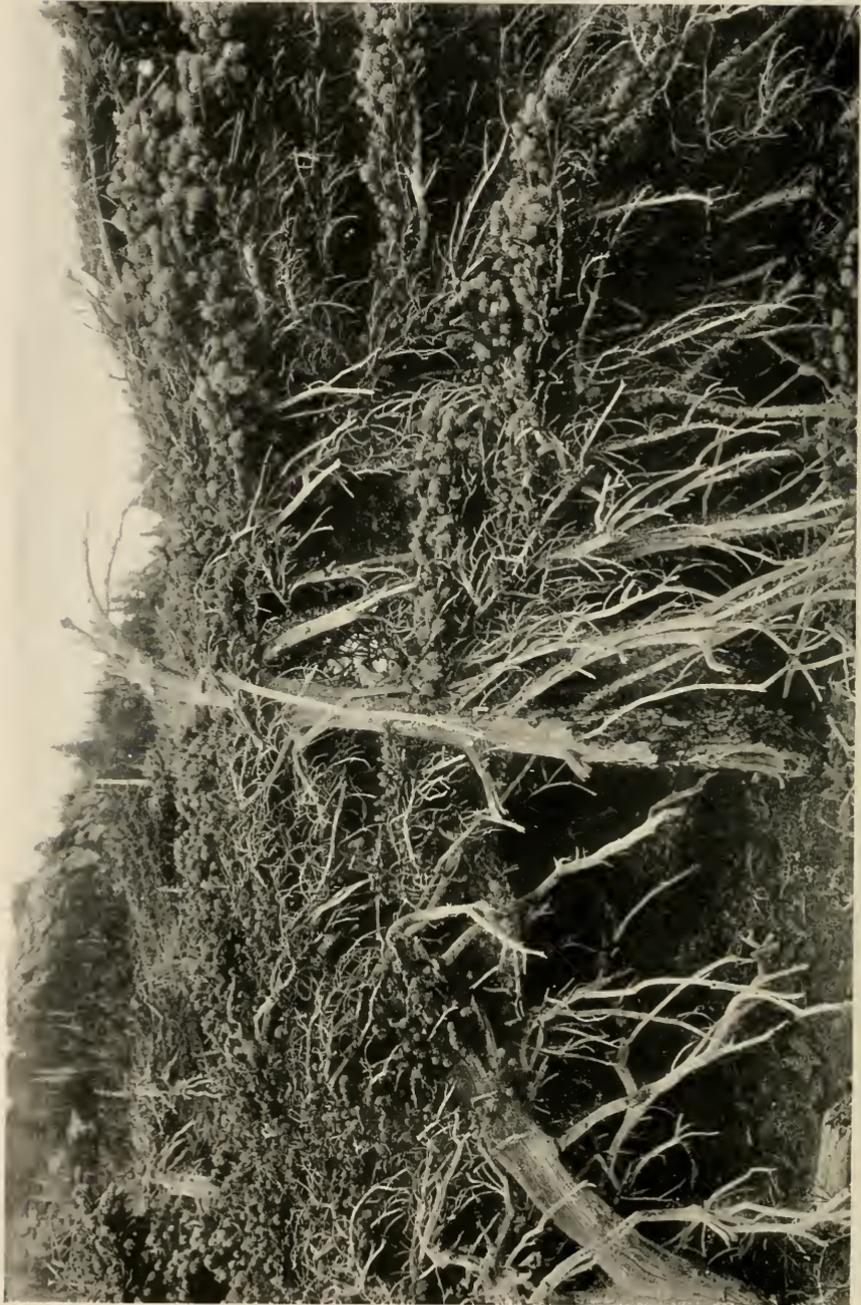


FIG. 64.—A stunted pine (*Pinus flexilis*) near Timber Line Cabin. The tree, now many years old, is sheltered from the severe winds behind a rock, but above the level of this it cannot extend. A stunted growth of this kind is known to the ecologist as krummholz.

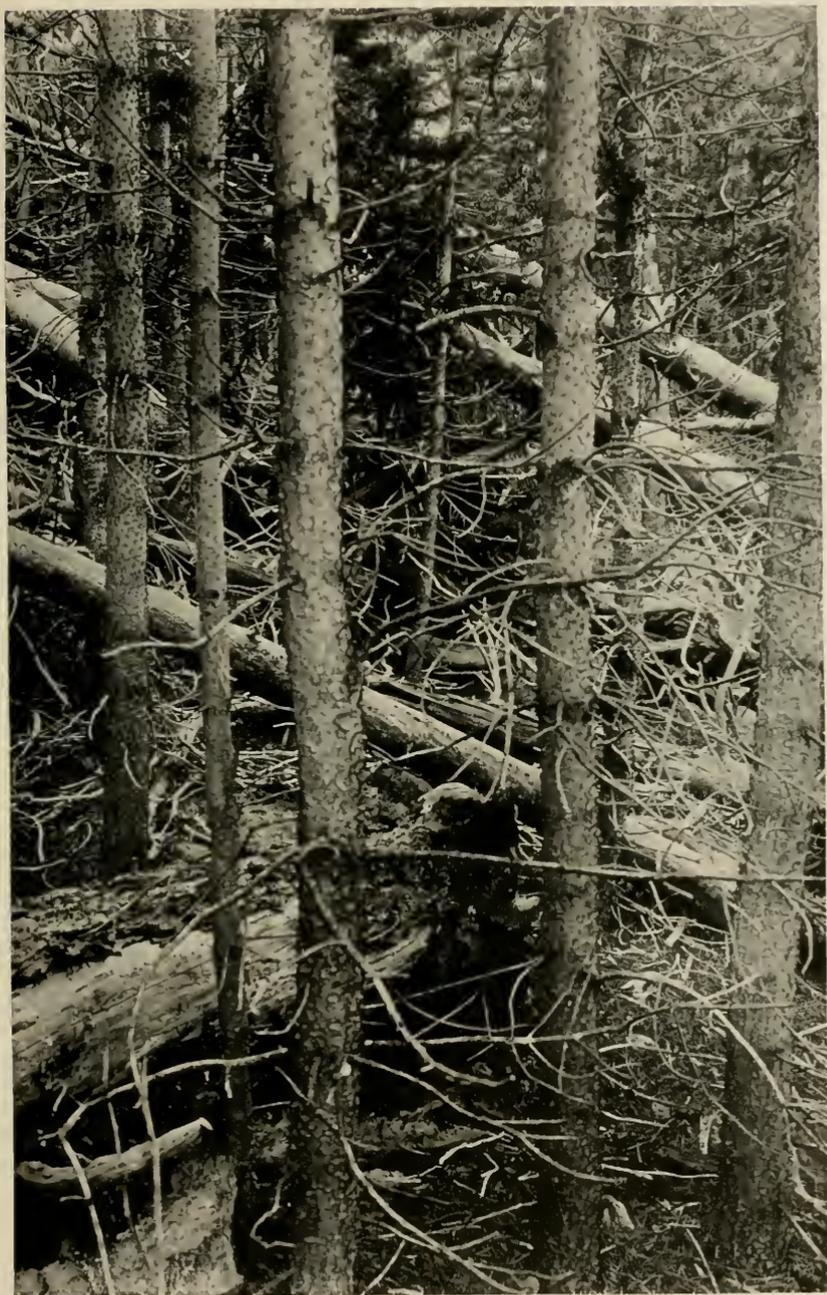


FIG. 65.—Down timber, the bane of the explorer. This is the result of high winds and forms an intricate mass of interwoven trunks very discouraging to the naturalist who may depart from the trail.

paragraph. Two species of alpine shrubs are common, mountain birch (*Betula glandulosa*) and a small willow (*Salix brachycarpa*). These last two form extensive areas of dense low growth, in many of the depressions from 10,000 to 12,000 feet. A common plant of the alpine meadows is the bistort (*Bistorta bistortoides*), with oval heads of white flowers. Probably the most beautiful of the mountain flowers is the columbine (*Aquilegia coerulea*), with large blue



FIG. 66.—The columbine (*Aquilegia coerulea*), one of Colorado's most beautiful wild flowers. The large flowers are blue or lavender. The state flower of Colorado.

flowers, which is found through a wide altitudinal range, in the forested zone, and on the alpine slopes to 12,000 feet.

The chief object of the visit to Long's Peak was the study of the grasses, especially the species growing above timber-line. It is only by a study of the species of mountain bluegrasses (*Poa*) *in situ*, that one can determine whether the different forms belong to a single variable species or represent distinct species. Twenty-one species of grasses were obtained, the common or well-known species not being collected.



FIG. 67.—Green gentian (*Frasera speciosa*), a stately plant about four feet high. Common from 7,000 to 10,000 feet.

ANTHROPOLOGICAL SURVEY OF THE SOUTHWESTERN COAST
OF FLORIDA

In November, 1918, Dr. Aleš Hrdlička supplemented his former work in Florida by a four weeks' exploration of the little known region of the Ten Thousand Islands. The objects of this journey, which was carried out under the auspices of the Bureau of American Ethnology, were to trace the anthropological type of the former aboriginal population along this unknown remainder of the western coast of the peninsula, and to study such Seminole Indians as could be found roaming among the islands.

The results will be published more fully later. They are briefly as follows: The region of the coast south of Key Marco, which was



FIG. 68.—The Mangrove Swamps.

supposed to be of no great account as far as aboriginal remains were concerned, was found to be full of sites, shell heaps, platforms, and mounds, with canals and other evidences of former Indian occupation, the remains covering in individual instances 20, 30, and even 80 acres of ground. Only the southernmost parts of the coast are poor in such remains. And all of this is still intact so far as scientific exploration is concerned.

It was determined that these remains are throughout of the same class, though differing in very interesting details, and the conclusion seems justified that they represent the same culture and people, identifiable with those farther north, up to and beyond Charlotte Harbor. A part of these people were known historically as the Caloosas, and have left their name in that of the Caloosahatchee



FIG. 69.—A Mound in the Jungle, Florida.



FIG. 70.—Shell Heaps, Allen River, Florida.

River. They were, according to such evidence as we possess (crania, etc.), a homogeneous stock, physically related to the type of the eastern Algonquins. The round-headed people of farther up the coast and the St. John's River were evidently wholly absent in this region.

Of the Seminoles, four individuals were met with among the islands, of whom two were full-bloods. One of these latter submitted to measurements. These Indians roam over most of the Everglade



FIG. 71.—A Seminole Hut, Florida.

part of southern Florida as well as among the myriad of keys off the coast. They are partly "civilized," but prefer to be left alone. They are considerably mixed with whites and slightly also with negroes, but this mixture does not seem to be recent. They have few if any steady all-the-year-around habitations and lead a more or less nomadic life, moving from place to place in quest of food or for other reasons. They can be met with occasionally, individually or in parties, from Palm Beach on the east coast to Fort Myers on the west, and from Lake Okechobee to the southern extremity of the peninsula.



FIG. 72.—Seminoles in Boats.



FIG. 73.—Seminole Types.

ANTHROPOLOGICAL WORK IN PERU AND BOLIVIA

In October, 1917, Mr. Philip Ainsworth Means, honorary collaborator in American archeology, U. S. National Museum, reached Peru to do archeological work. A short time was first spent in the vicinity of Lima, during which were studied several ruins about the capital, under guidance of Drs. José de la Riva-Aguero and Julio C. Tello. Two of the least known places visited were Maranga and Pando. They are very close together and are about 6 miles northwest of Lima. In its prime, Maranga (see fig. 76) had four fine terraces with a spacious terreplein at the top. At the bottom, the pyramid is



FIG. 74.—The raised end of the chief room in the small palace at Pando. Note the attractive arabesque patterns in the stucco which covers the walls.

about 450 feet square and the summit terreplein is about 250 feet by 350. The material of construction is adobe. This pyramid is probably of Inca construction; it is much like the Inca built Temple of the Sun at Pachacamac and has yielded many Inca artifacts.

Lying somewhat north and northwest of Maranga are the ruins of Pando. These cover an immense amount of ground and consist of several pyramids even larger than Maranga, but not so well preserved. The old city at this place was enclosed in a massive wall with easily defended gateways. These latter were narrow, and, at either side, sunk in the thickness of the wall there was a raised platform or niche where possibly a guard could stand and effectually oppose ingress.

At the western side of Pando there are the remains of a fine though small palace or temple. Although it is only about 85 feet square, this little building is remarkable on account of the attractive arabesque patterns made in the stucco coating of the walls. (See fig. 74.) The western end of the main room was provided with a platform raised some 3 feet above the rest of the floor. Behind this there was a passage (fig. 75) which led to other apartments. It is not now possible to know exactly what sort of roof there was, for the wind has eroded the tops of the walls and signs of roof beams or joists are no longer visible. The present inhabitants of this



FIG. 75.—Corridor of the small palace at Pando. A dwelling of present inhabitants in the background of the picture.

ruin are a wretched Indian family who live in the crude shelter made of burlap and old gasoline cans seen in figure 75.

From Lima Mr. Means went to Arequipa and La Paz and while at the latter place he visited Tiahuanaco. There are, besides, several related sites in the region, notably Pumapuncu Llojeyaya and Viacha, which are almost unknown. The chief collections studied at La Paz were those of Messrs. Federico Diaz de Medina, Agustín de Rada, Arturo Posnansky, and that of the Museo Nacional (directed by Sr. Jáuregui.)

From Bolivia, Mr. Means went to Piura in northern Peru. There he hoped to find much archeological material, but various sorts of grave plunderers had preceded him, and archeological sites are apparently few. The collections of Dr. Víctor Eguiguren (of Piura) and of D. Luis Elías y Elías (of Morropón) were examined.

On returning to Lima, Mr. Means made other trips to various sites in that neighborhood, which is undoubtedly still one of the richest in South America, from the archeological standpoint. He also examined the collections owned by Drs. Javier Prado y Ugarteche and Julio C. Tello.



FIG. 76.—The pyramid or *huaca* of Maranga about six miles northeast of Lima. The view was taken from the northwest of the pyramid.

ARCHEOLOGICAL FIELD-WORK IN SOUTHWESTERN COLORADO AND UTAH

The chief of the Bureau of American Ethnology, Dr. J. Walter Fewkes, spent a month in field-work in southwestern Colorado and the adjoining State, Utah, directing his attention to the structure of the remarkable towers and castles to which attention was called in an account of his work last season. The purpose of this visit was to enlarge our knowledge of the forms and characteristics of these buildings and their relation to similar structures on the Mesa Verde National Park.

One of the important results of the field-work of 1918 was the discovery of two hitherto unknown towers in McLean Basin, near Ruin Canyon, about 35 miles from Dolores, Colorado. The exceptional feature of these towers is their situation on the diagonal corners of a rectangular ruin. One of these towers (fig. 78) is circular, the other (fig. 79) D-shaped; both are constructed of good masonry and stand about 15 feet high. Their relation to the fallen

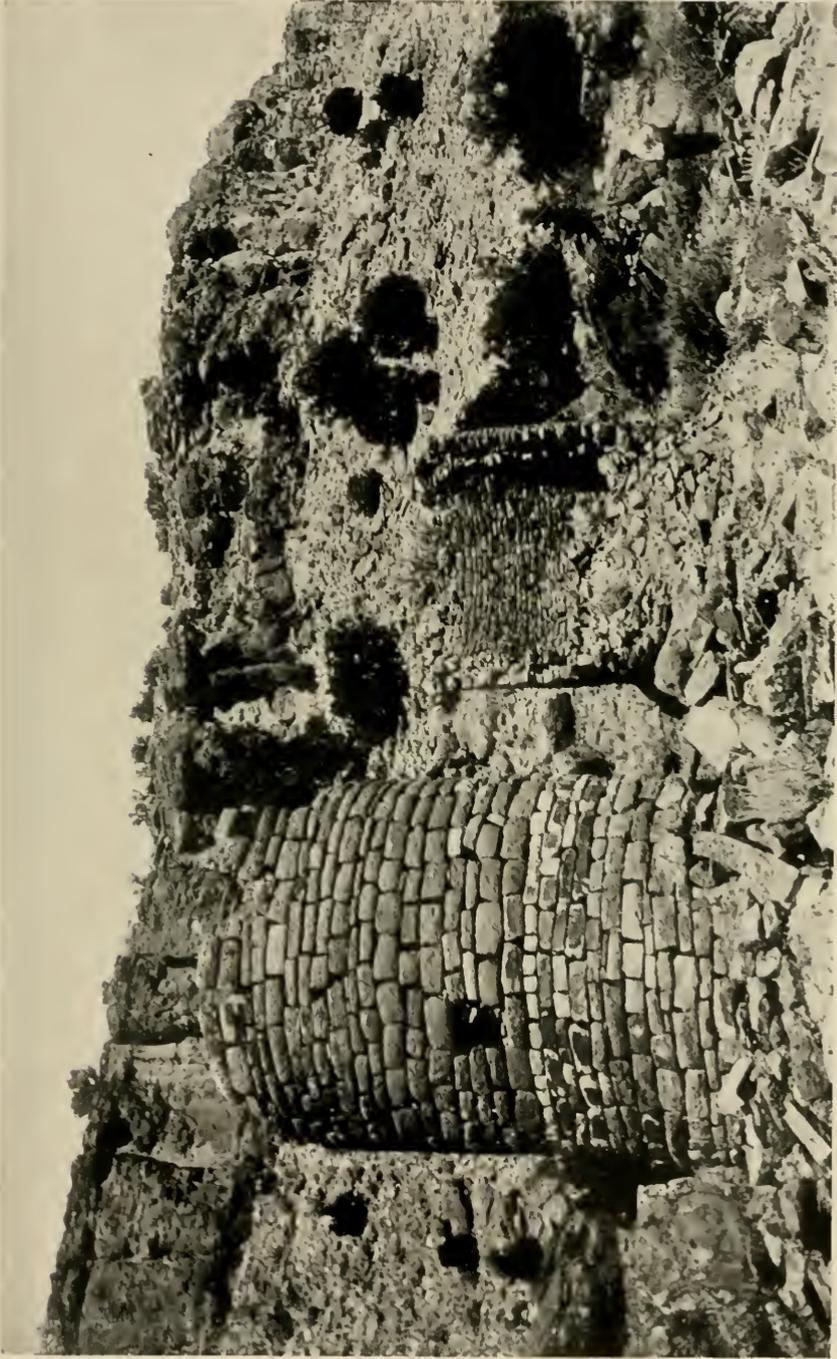


FIG. 77.—Circular and D-Shaped Towers in McLean Basin Ruin. Photograph by J. Walter Fewkes.

walls of the remainder of the ruin is shown in the view of a model (fig. 80).

Dr. Fewkes likewise examined three towers in Mancos Canyon, one of which (fig. 81), called Holmes Tower from its discoverer, has been known for 40 years. This tower has the same general form as those on the Mesa Verde.



FIG. 78.—Circular tower, McLean Basin, Utah. Photograph by T. G. Lemmon.

The additional data collected during the past season indicate that the towers and great houses of the McElmo region may have served, among other purposes, as granaries for storage of food. All have certain features in common with Sun Temple, on the Mesa Verde, although architecturally they are much simpler. A tower in Sand Canyon (fig. 82) resembles those in the McElmo Canyon.

Sand Canyon, one of the northern tributaries of the McElmo, contains several prehistoric buildings which have not hitherto been described, but offer possibilities for future research. Among these are well-made cliff-houses, one of the best preserved of which is shown in figure 83. There is another house (fig. 84) in a ceremonial cave, consisting of a single circular kiva of the Mesa Verde type



FIG. 79.—D-shaped tower, McLean Basin, Utah. Photograph by J. Walter Fewkes.

surrounded by rectangular rooms, occupying the whole floor of the cavern. This building is a unique example of a pueblo of the single unit type situated in a cave. A remarkable feature is the existence of walls of a more modern kiva built inside those of an older chamber, resembling in this respect one of the kivas of Spruce Tree House, on the Mesa Verde National Park. Another unusual ruin in Sand



FIG. 80.—Model of Towers in McLean Basin, Utah.



FIG. 81.—Holmes Tower, Mancos Canyon, Colorado.
Photograph by T. G. Lemmon.

Canyon is a wooden scaffold in a cave like that of Scaffold House in the Navajo National Monument.

There are several other cliff-houses in Sand Canyon all of which resemble in the structural features of their kivas those of Mesa Verde and Chelly Canyon, but differ from those of the Upper Gila and Salt rivers.

The group called cliff-dwellings, from the fact that they occur in caves or cliffs, was formerly universally recognized as a division in



FIG. 82.—Sand Canyon Tower, Colorado. Photograph by T. G. Lemmon.

a classification of southwestern ruins. It is evident from enlarged knowledge of the architectural forms of these buildings that the only difference between the so-called cliff-dwellings and others found in the open is their site; structurally they are identical and were evidently constructed by the same people. Some cliff-dwellers were related to the Pueblos, but all cliff-dwellings were not built by people



FIG. 83.—Cliff dwelling, Sand Canyon, Colorado. Photograph by T. G. Lemmon.



FIG. 84.—Ceremonial cave, Sand Canyon, Colorado. Photograph by T. G. Lemmon.



FIG. 85.—Fish Creek Canyon, Apache Trail, Arizona. Photograph by Mark Daniels.



FIG. 86.—Cliff dwelling, Pueblo Canyon, Sierra Ancha, Apache Trail, Arizona. Photograph by Mark Daniels.



FIG. 87.—Cliff dwelling, Cherry Creek, Sierra Ancha, Apache Trail, Arizona. Photograph by Mark Daniels.

of exactly the same mode of life as Pueblos. For instance, the cliff-dwellings of the Verde Valley, a tributary of the Salt River in southern Arizona, are different structurally from those of the San Juan Basin in Colorado and Utah. Some of these aberrant cliff-houses, thus far little known, but pleading for investigation, are situated in Tonto Basin near the Apache trail, Arizona. The character of the environment in this region appears in the view up Fish Creek (fig. 85), a rugged canyon, the mouth of which is visible to travelers on the road to Roosevelt Dam.



FIG. 88.—Interior cliff dwelling, Cherry Creek, Sierra Ancha, Apache Trail, Arizona. Photograph by Mark Daniels.

By courtesy of Mr. Mark Daniels, photographs showing cliff-dwellings of the Sierra Ancha Mountains in southern Arizona are here reproduced (figs. 86 to 87). Although these buildings are situated in cliffs they have only a distant likeness structurally to those of the Mesa Verde National Park in southwestern Colorado. The principal difference from the latter is the absence of circular ceremonial rooms or kivas. They may be said to represent the cliff-dwelling phase of a house building culture that reached its highest development in so-called compounds near the Gila which are unlike

pueblos. They are villages typical of the plains of southern Arizona built in caves of a mountain environment. Their masonry is comparatively poor, with a tendency to the horizontal, but has component stones arranged in irregular courses, the mason relying more on natural cleavage than artificial pecking or dressing. Plastering still remains on the outer surfaces in several cases. In one of these the roof is in place and well preserved, as shown in figure 88. A remarkable pictograph from this region is shown in figure 89.

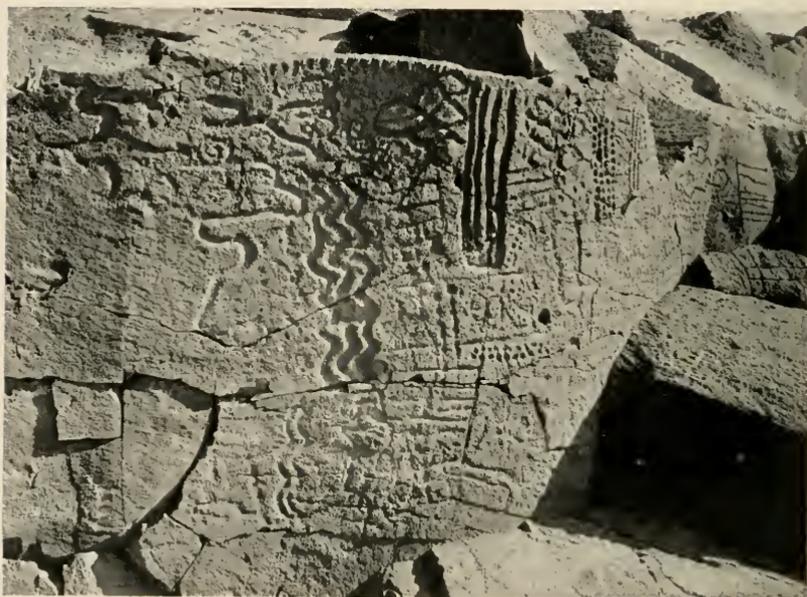


FIG. 89.—Indian inscriptions, Cherry Creek, Sierra Ancha, Apache Trail, Arizona. Photograph by Mark Daniels.

Among many instructive sites of ruins in the Hovenweep district is the bluff where the Yellow Jacket Canyon enters the McElmo. On top of this high promontory there are enclosures built of megaliths set on edge, apparently of the same cyclopean type of construction that characterizes larger buildings described by Jackson on Montezuma Mesa, Utah. We are evidently here on the dividing line, geographically, between the region of stone slab houses and the horizontal masonry of the Pueblo culture, such as is found on the McElmo. They are believed to represent an archaic masonry older than the kiva type of Mesa Verde.

It was found that the artificial heaps of stones in the Montezuma Valley and the mesa north of the McElmo are arranged in clusters forming villages like the Mummy Lake Group on the Mesa Verde. All component mounds of a group are the remains of buildings constructed on the same general plan, their size depending on the number of component unit types or kivas. The characteristic form of a unit type with four kivas is shown in Far View House, illustrated in the account of field-work for 1916. There is every reason to suppose that a like clustering of small pueblos into villages occurs on the Mesa Verde, throughout Montezuma Valley, and on the summits of the mesa north of the McElmo.



FIG. 90.—Mound on Santa Fé Ranch, near Topila, Vera Cruz. Courtesy of Drs. Adrian, Staub, and Mr. Muir.

Chronologically arranged, the classification of ancient habitations in the McElmo, adopted as a result of recent field-work, is as follows: (1) Single houses with walls constructed of rude cyclopean masonry, stone slabs or megaliths set on end. (2) Villages in cliffs or in the open, composed of units of the same structure in clusters or consolidated, each unit being composed of a characteristic circular kiva with vaulted roof embedded in rectangular rooms. Towers and great houses, either isolated or united, are sometimes found in this group, which is a prehistoric type, now extinct, the highest attained by the Pueblos. (3) The mixed type of architecture, found in modern pueblos, has no embedded circular kivas, and marks an epoch of decline in house building largely due to admixture or influence of other tribes.

Aztec Spring Ruin in the Montezuma Valley will probably, in the future, become of considerable popular interest, as the owner, Mr. Van Kleeck, of Denver, has generously offered the site to the Public Parks Service for permanent care by the United States Gov-



FIG. 91.—Side view of painted clay drinking vessel with hollow handle. Tempoal, Vera Cruz. Courtesy of Drs. Adrian, Staub, and Mr. Muir.

ernment. In order to be in a position to give expert advice on the desirability of accepting this generous offer, Dr. Fewkes revisited Aztec Spring Ruin and reports that it is not only one of the largest and most typical prehistoric villages of the Montezuma Valley, but also recommends that it be excavated and repaired.

ANTIQUITIES OF THE GULF COAST OF MEXICO

Several years ago (1904-1905) Dr. Fewkes made a preliminary trip to the Mexican states, Vera Cruz and Tamaulipas, for the purpose of tracing the relationship of the Totonac and Huastec Indians along the Gulf coast to the mound builders in the United States, or



FIG. 92.—Front view of painted clay drinking vessel with hollow handle. Tempoal, Vera Cruz. Courtesy of Drs. Adrian, Staub, and Mr. Muir.

across the Gulf of Mexico to the prehistoric inhabitants of Porto Rico and Cuba or other adjacent Antilles. A fair beginning was then made in this direction and the results were published in the Twenty-fifth Annual Report of the Bureau of American Ethnology. He has again taken up the problem, and through the kindness of friends has collected additional data bearing on these questions.



FIG. 93.—Clay heads, Tampico, Mexico, U. S. National Museum. The two outer heads in the middle row are from San Juan Teotihuacan, Valley of Mexico. Photograph by De Lancey Gill.

The general appearance of ruined buildings or mounds, locally called "caves" (fig. 90), situated along the Panuco River, Mexico, recalls that of Louisiana mounds, but unlike them, as a rule, they were faced with stone work, absent in all the mounds of the Mississippi Valley. On top of the Mexican mounds there stood a stone superstructure or temple, but the mounds show no indication of walls within, as is the case with artificial stone heaps in Colorado,



FIG. 94.—Stone slab from the Cerro Cebadilla, U. S. National Museum. Courtesy of Drs. Adrian, Staub, and Mr. Muir.

Utah, Arizona, and New Mexico. These remains and pottery objects (figs. 91, 92) found near them are ascribed to the ancient Huastec Indians.

The figurines (fig. 93) made of burnt clay that have been exhumed from these mounds recall in a distant way the clay heads found in the Antilles, but more closely resemble those of the mainland. The ancient pottery of the inhabitants of the valley of the Panuco is allied

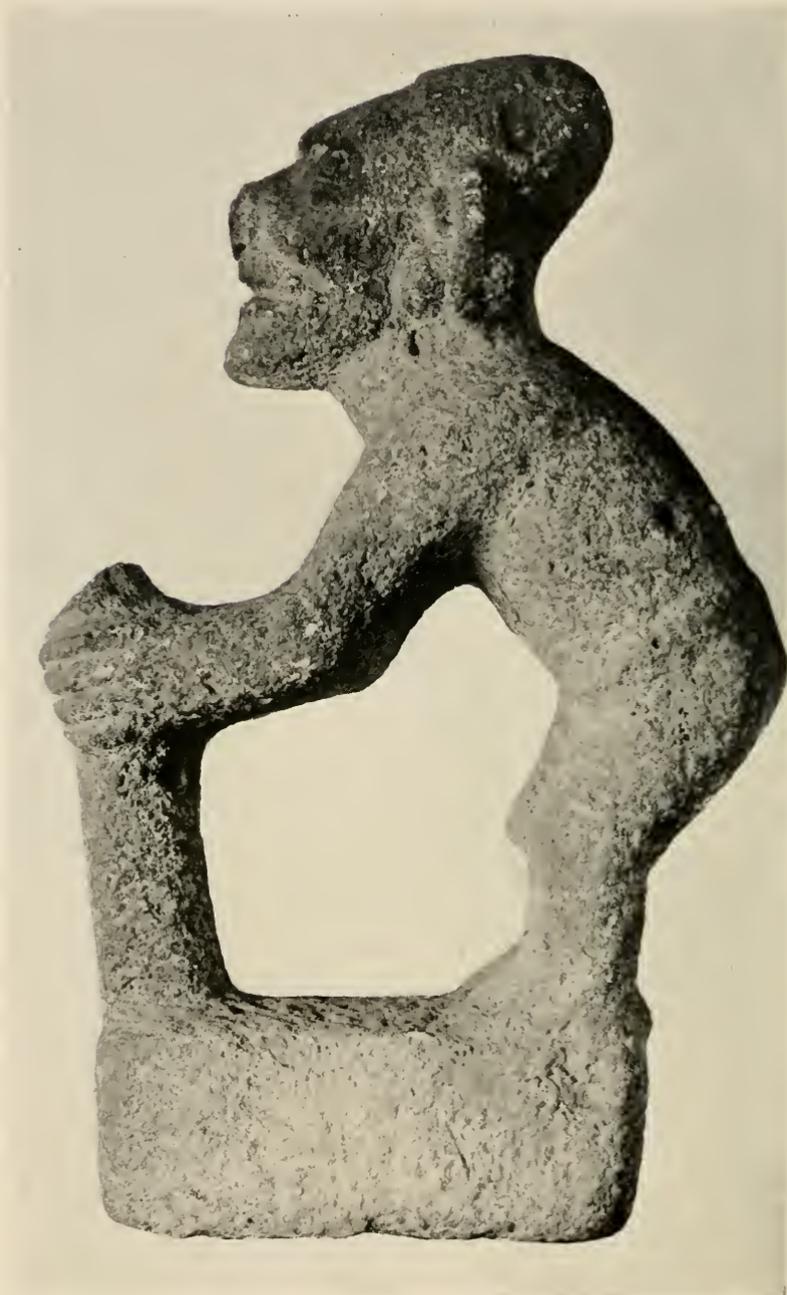


FIG. 95.—Stone Idol, Panuco, U. S. National Museum. Photograph by De Lancey Gill.



FIG. 96.—Stone Idol, Tampico, U. S. National Museum. Photograph by De Lancey Gill.

to the archaic ware of the Valley of Mexico. Burnt-clay heads from the Huastec region distinctly resemble archaic heads from the Valley of Mexico, two of which, from San Juan Teotihuacan, are here figured (fig. 93).

A flat stone slab (fig. 94) from Cerro de Cebadilla in the Panuco region, now in the U. S. National Museum, was part of the facing of one of these cuves, or possibly one of the bounding stones of a ball court used by the Huastecs, and recalls prehistoric Porto Rican remains called *juegos de bola*. The stone idols from the Huastec



FIG. 97.—Stone Idol, Jopoy, Tamaulipas, U. S. National Museum. Photograph by De Lancey Gill.

region are characteristic, as seen in the hitherto undescribed specimens (figs. 95, 96, 97). The representation of a conical hat found on one specimen (fig. 98) would seem to indicate the same god as that figured and identified by Sahagun as Quetzalcoatl, the Plumed Serpent. The art shown by figure 100 recalls that on stone collars and three-pointed stones, but the enigmatical objects from Haiti and Porto Rico are not found in North, Central, or South America. Possibly the stone collars of the Antilles may be idols embodying the insular conception of a being corresponding to the Bird Snake Dragon of the Mayas.



FIG. 98.—Idol with pointed cap, Panuco, U. S. National Museum. Photograph by Delancey Gill.

One of the figures (fig. 99) shows a circular stone object from a Huastec ruin near Topila on which is depicted a cross used in "patolli," a favorite game among the Mexicans.

One of the most striking of the stone images from this region is owned in Guerrero, San Luis Potosi, by General Larraga, and was found in Consuelo. The remarkable thing about this idol is the imitation of tattooing on the body, right leg, and wrists (fig. 101). On the back is a representation of a human figure, the head of which is in high relief.



FIG. 99.—Stone slab at Mata de Palanchó, near Topila, Vera Cruz, Mexico. Courtesy of Drs. Adrian, Staub, and Mr. Muir.

We have thus far little information on the antiquities of the region that lies between the most northern of the Huastec ruins and Louisiana across the Mexican state of Tamaulipas, and Texas. The modern Huastecs speak a language that shows relation to the Maya stock, but they never attained a high degree of architecture nor developed a complicated hieroglyphic calendar system comparable with that of their southern relatives. None of the prehistoric objects from other localities on the Gulf coast of Mexico are more closely related to those of the Greater Antilles than the stone and ceramic specimens of the Huastec, but the prehistoric culture of Porto Rico-Haiti was indigenous and characteristic.

Through the courtesy of Mr. J. M. Muir, Dr. H. Adrian, and Dr. Staub, who have generously furnished him with photographs,



FIG. 100.—Stone idol, Tampico, U. S. National Museum. Photograph by De Lancey Gill.



Left side

Right side

Back

FIG. 101.—Stone idol with incised decorations from Consuelo, San Luis Potosi. Courtesy of Drs. Adrian, Staub, and Mr. Muir.

notes and maps, Dr. Fewkes has in preparation an extensive memoir on the antiquities of the oil fields of Mexico, which will supplement and in some respects enlarge our knowledge of the archeology of that region.

ARCHEOLOGICAL EXPLORATION IN ARIZONA

The exploration in Arizona under the auspices of the bureau, by Dr. Walter Hough, curator of the Division of Ethnology, U. S. National Museum, was productive of interesting observations on

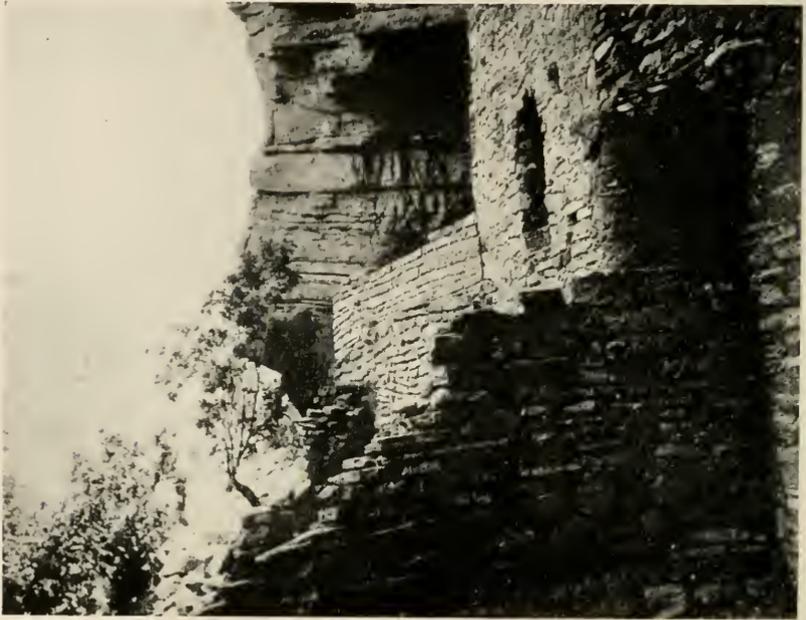


FIG. 102.—Cliff House, Oak Creek (White Mt., Apache Reserve).

prehistoric ruins, many of which are undescribed. Owing to the scarcity of labor on account of the draft the exploration was confined to a reconnoissance of the ruins in the vast region lying west of Fort Apache and including the Tonto Basin Forest. The work covered a portion of this area and required 500 miles of travel by various means of locomotion. Much of the country traversed is very difficult, being broken by deep canyons eroded in the slopes of the great Mogollon escarpment, known locally as the "rim" or "mountain," a tremendous geographic feature of dominant importance, in which the rivers of southern Arizona take their rise.



FIG. 103.—White Mountain Apache House.



FIG. 104.—Great Kiva, near Fort Apache, Arizona.

At intervals along the trail through this country of majestic picturesqueness are ancient ruins of considerable size and hidden in the canyon walls are cliff-houses (fig. 102), showing that in ancient times the environment furnished sustenance for an aboriginal population. Entering Tonto Basin the landscape assumes a wilder aspect, the region becoming drier and exhibiting a great variety of cacti and thorny growths among bristling rocks. North of the Sierra Ancha the country opens out into park-like stretches, in which the towns



FIG. 105.—White Mountain Apache, Oak Creek, Arizona.

of Young and Payson are located. As the character of the geography changes gradually from Fort Apache to Payson in the Tonto, it is seen that the ruins represent a gradual diminution of culture, those of the northern Tonto Basin being ruder in art than those to the east. The latter are generally of large compact pueblos, the art affiliations of which, judging from the pottery, are with those of the north in the basin of the Little Colorado, but plainly showing a rather high development. As the exploration proceeded west it was found that coincidences of southern culture appeared, while in the northern portion of the Tonto Basin the culture appears to affiliate entirely with the lower Gila and west of that river.

The art of the cliff-houses does not appear to correspond with that of the neighboring open-air pueblos so far as pottery and some other things are concerned. It is probable that the cliff-house sites in this region represent the habitations of a small house people. It is also possible that there were spread over the Pueblo region tribes that never formed the habit of coalescing into compact pueblos. Much that has been discovered substantiates this theory.

A rather unusual evidence of the age of a pueblo was furnished by a juniper 126 inches in circumference growing in the house mass of a ruin near Blue House Mountain in the western portion of the Apache Reservation.

Near Fort Apache a ruin was observed which had as a prominent feature a rectangular depression 45 by 51 feet square and at present 5 feet deep and occupied by three large pine trees (fig. 104). This great construction is believed to be a kiva and is evidently like those described on the Blue River and Upper San Francisco at Luna, New Mexico.

In connection with the Apache Indians with whom Dr. Hough was thrown in contact during this exploration, it may be said that notable changes have taken place among them since 1901, when he visited them. There is little except their habitations (fig. 103) to connect them with their former life, all traces of native costume, etc., having disappeared. The Apaches are on the whole prosperous and contented and have an intelligent appreciation of their duties to the United States (fig. 104).

ARCHEOLOGICAL RECONNOISSANCE OF NORTHWESTERN ARIZONA

Late in April, 1918, provision was made by the Bureau of American Ethnology for a brief archeologic reconnoissance of that little known section of Arizona lying north of the Colorado River, and Mr. Neil M. Judd, of U. S. National Museum, was detailed for the purpose.

From Kanab, Utah, Mr. Judd proceeded with pack mules on a route lying southeastward over the northern portion of the Kaibab National Forest to House Rock Valley, thence southward across North, South, and Saddle canyons to the Walhalla Plateau, known locally as "Greenland." He examined a large number of low mounds bordering the rim of this promontory or scattered over its timbered ridges.

House remains were plentiful along the road and the narrow trails. They began with those previously noted in Johnson Run¹ and included the small exposed ruins near Cape Royal and Cape Final, overlooking the Grand Canyon. The remains are those, usually, of one-, two-, or three-room structures; their walls are of irregular and entirely unworked blocks of limestone, sandstone, or chert, depending upon the character of the material nearest the site occupied. Such blocks were picked up by the ancients from the surface of the ground and apparently were laid in large quantities



FIG. 106.—Open ruin on the brow of a low hill about 7 miles south of the new corrals, House Rock Valley.

of mud; numerous small fragments were added as a support for the mortar and as a partial protection against the action of the elements. The small number of sizable building stones on some sites, in proportion to the quantities of lesser pieces, suggests that certain houses may have been constructed chiefly of mud, although real adobe is not to be found in the region. In several of these it is obvious that the walls included but one or two courses of rock—there are no remaining traces of others. In many instances the stones at the bottom of the wall were placed on edge, their upper, unworked surfaces probably supporting rough masonry or rubble.

Potsherds collected near the ruins indicate that the development of the ceramic art among these ancient people was not far behind that

¹ Smithsonian Misc. Coll., vol. 66, No. 3, p. 70.

of the prehistoric Pueblos of the San Juan drainage and neighboring sections of the southwest. Shards ornamented with black geometric designs seem to predominate, but there are also numerous fragments of black-on-red and the customary plain and corrugated ware. Those which are decorated exhibit no marked variations from shards of similar design found upon ruins in better known localities and tend to substantiate the belief that a definite cultural relationship existed between the prehistoric peoples on either side of the Colorado River.

A small group of ruins distinctly different in type from those observed on the Walhalla Plateau was noted near Two-Mile Spring,



FIG. 107.—Sandstone slab making the walls of a small circular ruin near Two-Mile Spring, House Rock Valley.

in upper House Rock Valley. The structures are all circular, or nearly so, and measure from 4 to 10 feet in diameter; their standing walls are of dressed sandstone slabs, set on end and usually close together. No trace of plaster is to be found in any of the rooms and nothing remains of the masonry which unquestionably surmounted the upright stones. Where exposed, the floors are covered with burned earth and ashes and mixed with these are chunks of roofing clay still bearing impressions of willows, grass, etc. All of the structures are circular—no evidence of a former rectangular dwelling was noted in their immediate vicinity. Prehistoric remains similar to these have been observed, also, to the east of the Colorado River, between Grand Gulch and Chinlee Valley, in the San Juan drainage. As yet their original appearance and use seems to have been incompletely determined.



FIG. 108.—Looking across the Grand Canyon from ruins near the head of Clear Creek, Walhalla Plateau.



FIG. 109.—Cliff village in lower Saddle Canyon, with the Rio Colorado in the distance.

Many mullers and metates lay promiscuously about, and two of the latter were pitted on the grinding surface, showing secondary use as mortars. Flint chips and projectiles seemed unusually numerous, but potsherds, although of the customary types found on "Greenland," were surprisingly few in number.

Cliff-houses are not so plentiful as might be expected in the breaks bordering the Wallhalla Plateau and these are, almost without exception, small single-room storage cists built by the inhabitants of the open houses among the pines and back some distance from the rim. Many of these cists have been occupied recently as shelters by white hunters—the smoke stains on the cave roof will not be confused with those left by aborigines. Dwellings protected by shallow caves are not unknown, however, and, although small, they add much to the picturesqueness of the country and to the less easily understood ruins of the mesa tops. Cliff-dwellings not visited during the recent reconnoissance are reported along the trailless ledges far below the floor of "Greenland"; others are known to exist in the "sand hills" and the red ledges of Pahreah Plateau. The difficulty of studying these remains is greatly enhanced by the infrequent sources of water supply and lack of forage for saddle and pack animals. As in other sections of the Southwest, the prehistoric dwellings are not always to be found in the vicinity of existing springs or water pockets.

ARCHEOLOGICAL STUDIES IN CENTRAL MISSOURI

Mr. Gerard Fowke, a collaborator of the bureau, made a reconnoissance in the Ozark region of south central Missouri. The purpose of the work was to locate and examine, as far as was feasible, all archeological remains, but with particular reference to caverns which afford evidence of having been used as places of shelter in prehistoric times. As the area in question includes the principal cave region lying east of the divide which separates these streams from the drainage basin of White River in the southwestern part of the State, a careful investigation was desirable.

It appears that Phelps and Pulaski Counties were centers of aboriginal population. There are many caverns, large and small, a majority of them showing abundant evidence of their former occupancy. Potsherds, broken animal bones, mortar stones, flint chips and spalls, broken implements of stone, bone perforators, and especially mussel shells, may be found under the present floors of the caves, and excavation shows them to continue to a considerable depth, usually to the bottom of the fine, loose, cave earth which rests

upon the original clay or rock bottom. In many of the caves, however, this bottom cannot be reached, as water interferes with the digging, but ashes abound to whatever depth excavated. In a cave on Gourd Creek, 12 miles southwest of Rolla, this material formed a mass, almost solid, to a depth of 7 feet or more, and even then its limit was not reached; but no greater depth can be reached until a ditch is dug to the outside of sufficient depth to drain off the water which has accumulated from interior drainage. Goat Bluff Cave, facing the Gasconade near the line between Phelps and Pulaski Counties, 4 miles west of Arlington, shows a similar condition. Many of the caverns have a large amount of talus and other débris about the opening which sometimes makes entrance difficult; others have earth floors which are many feet in depth, with no refuse material near the present surface, although it extends down the slope on the outside. While the larger caverns would have sheltered more persons and consequently may yield a larger number of artifacts, it is not to be expected that traces of very ancient residence will be found in them in the same abundance as in smaller caves. A cave with a narrow entrance to the interior could be more readily defended by its inmates than one where the passageway is larger and the interior more accessible. It would therefore be natural to conclude that a smaller cave would be inhabited longer than a larger one, and so contain more ancient remains.

Passing in any direction from these two counties, caverns continue, though they gradually diminish in number, and while many of these are suitable for shelters or permanent homes, fewer of them have the usual indications of occupancy. With the changing elevation of the cave-bearing strata, due to the dip of the formations, a smaller number of them are as well adapted for shelters. It seems useless to investigate anything beyond the limits reached in these researches.

In addition to the residential caverns along all the streams in these two central counties there are numerous village sites on the level bottom lands. Flint implements and chips are very abundant; pottery fragments less common except in a few places where it would appear that vessels have been manufactured; axes or hatchets are rather rare; other objects, such as mortars and pestles, have not been reported, probably because they are overlooked in the search for "arrows"—a general term, including all edged or pointed flints—which are very plentiful, though usually not smoothly finished. Several large mussel shells, found in the caves, are perforated for attachment to a handle, for use as hoes.

Very few of the caverns visited along the upper Current and upper Meramec Rivers are adapted for shelters, being damp or with small openings which shut off light from the interior: or difficult to reach; or at a distance from water. This is also true of the caverns along the lower Osage and lower Gasconade. The best field for research, however, is situated in Phelps and Pulaski Counties, where scores of caverns not only promise good material, but also are of sufficient depth to have stratification containing the handiwork of successive populations.

No aboriginal burial places have been discovered in level bottom lands, though many must certainly exist, when consideration is given to the evidences of numerous villages and long periods of occupation.

Cairns are found on nearly every ridge, especially on points which overlook streams or valleys. Nearly all were the ordinary conical or dome shape, formed by throwing stones over a grave, and are not at all distinctive, resembling in this respect similar burial places in various parts of the country. Two types, modifications of a single plan, were discovered, however, which have not been observed elsewhere. The graves in these are indicated by stone walls forming an enclosure as nearly square as the skill of the builders would permit. In one form, only a single row of flat stones was laid, and the grave, including a narrow space around the outside of the wall, was covered with stones, so that the pile outwardly resembled the ordinary cairn. In the other form this wall is carried up several rows, making a structure like a cellar wall or the foundation of a house. The space within this was filled with stones thrown in loosely, but none were placed against the outside. This latter type differs from the earth-covered stone vaults along the Missouri River where the inside of the vault is laid up as evenly as possible, no attention being paid to the outside; whereas, in the former, this feature is reversed.

FIELD-WORK AMONG THE KIOWA

From July to October inclusive, Mr. James Mooney, ethnologist, continued his field investigations of the Peyote cult and Kiowa heraldry among the Kiowa and associated tribes of Oklahoma.

The heraldry investigation relates particularly to the confederated Kiowa and Kiowa Apache, and involves a study of the origin, history, decoration, myths, and ceremonial regulations in connection with the shields and heraldic tipis formerly existing in the two tribes (there being approximately 250 shields and 50 decorated tipis), with incidental attention to the tribal systems of genealogy, heredity, and medicine, together with the warrior organization and



FIG. 110.—Tenikwa, Chief Priest, Native Peyote Religion, Comanche Tribe.



FIG. 111.—The Peyote (*Lophophora williamsii*): whole plants, green top, and dried "buttons." About one-half actual size.

shield songs. A complete series of miniature models of the shields and tipis concerned, prepared by the best artists of the two tribes under dictation of the former owners or their representatives, forms an interesting Museum exhibit in connection with a report now in preparation which will contain all the information now in hand, including an indefinite number of tabu regulations, and a number of shield songs in keeping of individuals.



FIG. 112.—The Cow-shield (inside cover) formerly carried by Tsentainti, "White Horse," Kiowa raider, with cow-horn headdress, bridle, pendant and pouch.

The Peyote study involves some 20 distinct tribes in Oklahoma, as well as others in various Western States, together with the majority of the tribes of the upland regions and central Mexico as far south as the City of Mexico.

The peyote is a small cactus which is used medicinally for the relief of various ailments and sacramentally in connection with a

native religion. Its use in both connections among the tribes of Mexico was noted by the earliest Spanish writers after the Conquest and by such later investigators as Lumholtz and Fuchs. It was noted in Texas as early as 1760.

In continuation of his study begun years ago, before the Peyote religion had reached its present high development or territorial extension, Mr. Mooney, on invitation of the tribes, transmitted by delegates from the Councils, made observation of the ceremony and of the medical use of the plant, and had filled out a number of individual questionnaires relating to the same subject, among the Kiowa, Comanche, Apache, Caddo, Cheyenne, and Arapaho, being everywhere received with the most generous hospitality and given every opportunity for observation and investigation, by reason of his long-standing friendship with the tribes and his known interest in the subject.

FIELD-WORK AMONG THE IROQUOIS

Mr. J. N. B. Hewitt, ethnologist, of the Bureau of American Ethnology, resumed his work in Ontario, Canada, on the textual and literary criticism of the many texts which he had previously recorded relating to the establishment of the Federation or League of the Five Tribes (or Nations) of the Iroquois, and especially to the organic institutions of this league. By the accession of the Tuscarora in 1722 these Indians became the Six Nations of the Iroquois.

The larger and more detailed part of these texts was dictated by his late friend, the blind Seneca federal chief, John Arthur Gibson, one of the best-informed ritualists and expounders of the principles and the institutions of the so-called League of the Iroquois; the remainder, consisting of differing versions of the matter just mentioned and also of much additional and supplemental material in the form of texts, was recorded from the dictation of other competent informants, among whom may be mentioned the late Onondaga federal chief, John Buck, who was at the time of his death the federal Fire-Keeper; the present Cayuga federal chief emeritus, Abram Charles; and Chief Prophet Joshua Buck, all versed in the varying traditions of the motives and plans of the founders of the League or Federation and the decrees and ordinances promulgated by them for its establishment.

Since nearly all the traditions recorded in these texts were transmitted by memory for about 350 years it was inevitable that some of the essentially important details of the structure of the league and of its organic institutions should not have been remembered with the same fidelity by different persons, and so differences of opinion and marked variation in statement are not infrequently encountered concerning the same subject-matter. The problem for

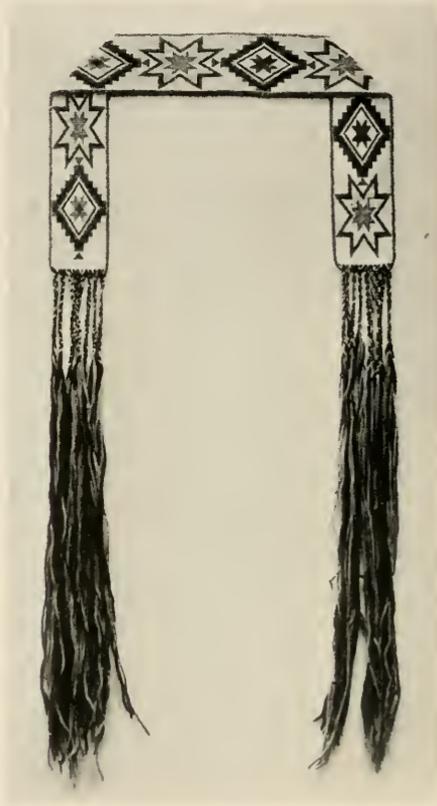


FIG. 113.—Baby Cradle Sash (Chippewa).

the student, then, is to determine by a sufficiently broad survey of differing traditions what the most probable facts were upon which these conflicting views and statements were originally based. The motives of the founders are not at all times remembered. As the institutions of the league are slowly becoming obsolete in the face of assimilated European culture and civilization this reconstructive work is one of great difficulty.

The diction is largely that of the forum. The notional terms employed are those of statecraft and ritualism—the language of statesmen and stateswomen and prophets of that earlier time, who even then had measurably clear visions of institutions of to-day.



FIG. 114.—Red-faced mask of a Wind God. A deity of Disease and the East.



FIG. 115.—Black-faced mask of a Wind God. A deity of Disease and the West.

such as the recall, the initiative, the referendum, woman suffrage limited to mothers for the election of nominees to chiefships, and a colonial policy. It may be added here that the men had no voice in the nomination of chiefs.

Certain words occurring in Iroquois texts show that the laws and the rules of procedure among the Five Iroquois Tribes were not the decrees of an autocrat or tyrant, but rather were the formulated wisdom of a body of peers, who owed their official positions to the suffrages of those who owned the titles to them, and that the form of government was a limited democracy, or, strictly speaking, a limited gynecocracy.

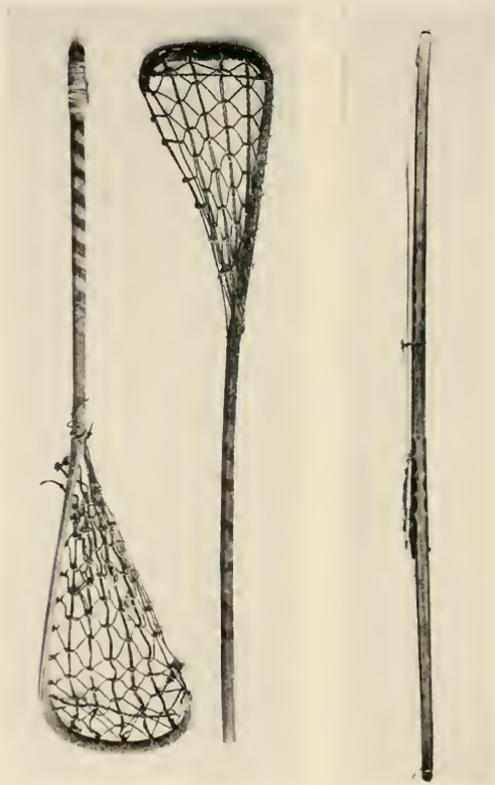


FIG. 116.—Lacrosse clubs of the Iroquois. A bow with arrows.

In this manner the following matters were studied and analyzed: The law defining the position, the powers, and the disabilities of a chieftainess, or *Goyānegō'nā'*; the law defining the position, the powers, and the disabilities of the tribal chiefs, and of the federal or *Royaner* chiefs of the league (or Extended Lodge), and the manner of their nomination, installation, and removal for cause; the law of the extinction of the *ohwachira* (or uterine family), having federal or *Royaner* chief titles, called *Ē'yoñdoñgwe'do'k'dēn'*, *i. e.*,

they will run out of persons, and so no more men will be available for candidates for chiefships; the law defining the position, the powers, the disabilities, and the authority of the Onondaga chief, De'hadodā'ho'; and of his co-tribal Royaner chiefs; individually and in their collective capacity of Federal Fire-Keepers; the law of the method, the limitations, and the effect of the action of these Fire-Keepers in confirming, or in referring back for cause for review, to the Council of their peers, any of its acts, whether unanimous or not; the law limiting suffrage for the nomination of chiefs to the mothers in the clans; and the law recognizing descent of blood and fixing the status of persons in the female line; the law of the sacredness of the lodge and of private property; the law of hospitality, good neighborhood, and good fellowship; the law of murder, and of rape, and of highway robbery; the law of the police, or the regulation of the internal affairs of the league, symbolized by the Long Wing of the Gull and the Staff which were placed in the hands of the great federal chief, De'hadodā'ho'; the law of the domestic relations; the law of hunting and fishing; the law of planting and the protection of the crops; the law fixing daytime and the place for holding the sessions of the Federal Council and for the demeanor of the Royaner or federal chiefs at such sessions; the law defining the position, the powers, and the limitations of the Merit, or the so-called Pine-Tree chiefs; the law for the adjustment of homicide, obviating the former *Lex talionis*; the law of homicide by a Royaner or federal chief; and the law of the Union or Federation of Clans and of Lands (or Peoples), with an extensive explanatory preface.

A number of other rituals and traditions of the Iroquois were analytically studied, and Mr. Hewitt also collected a number of Museum specimens, including a very fine wooden mask of a Disease God, painted red; it is a work of art. Some of these are illustrated in this paper.

FIELD-WORK AMONG THE CHOCTAW AND CATAWBA

Dr. John R. Swanton, ethnologist, of the Bureau of American Ethnology, was in the field from the middle of April to the end of May, 1918. On leaving Washington he went immediately to Char-enton, Louisiana, where he spent about one week amplifying his grammatical sketch of the Chitimacha language already prepared, and clearing up some doubtful points which had developed during its composition.

After completing this work he proceeded to Philadelphia, Mississippi, in order to ascertain something regarding the present con-

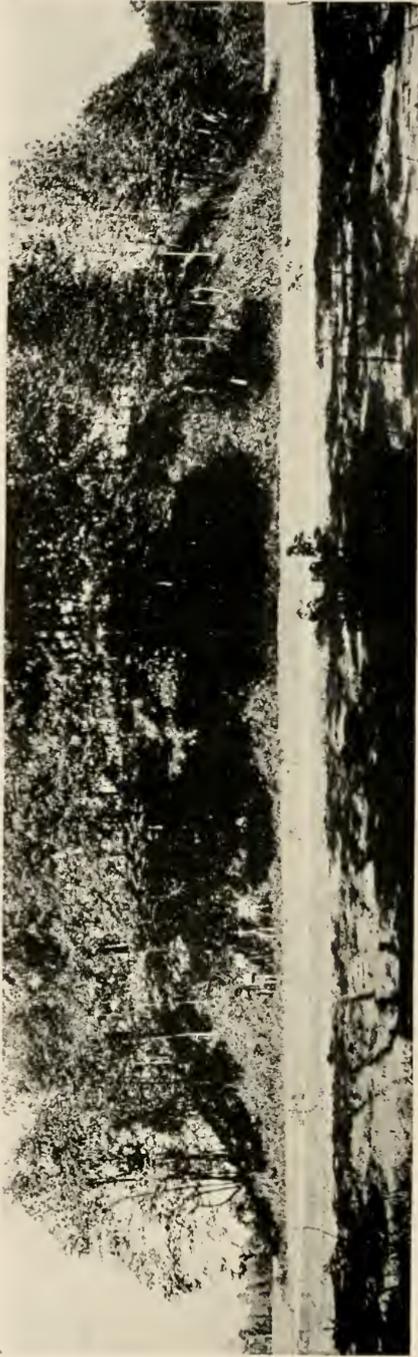


FIG. 117.—Nanih-waya, or "Mother Hill" of the Choctaw.

dition of the Choctaw Indians in that neighborhood, the descendants of those who remained in their old country after the greater portion of the tribe had emigrated to what is now Oklahoma. On the way he stopped at Bay St. Louis to visit a small band of Indians living in the country north of that place. He learned that this was a band of the Sixtown Choctaw, the southernmost division of the Choctaw nation, but that all of the old people were dead and practically nothing regarding their ancient manner of life was known to the survivors.

Near Philadelphia (Mississippi) remnants of three Choctaw bands or clans are still to be found, and in the few days spent in interviewing them—this being merely a reconnoissance—a few interesting data regarding their social organization and former customs were secured. A visit was also made to the famous Nanih-waya, or "mother hill," of the Choctaw, where, according to some versions of the Choctaw origin legend, the ancestors of this tribe emerged out of the earth. This is an artificial elevation of considerable size in the midst of a fairly level tract of country, surrounded partly by Nanne Warrior Creek, so named from the hill, and partly by a low earthen rampart, traces of which are now barely visible. Several photographs of this hill were taken.

The remainder of the time, until the end of May, was devoted to a study of the Catawba language on the Catawba reservation near Rock Hill, South Carolina. Early in the eighties the late Dr. A. S. Gatschet, of the Bureau of Ethnology, collected a vocabulary and other linguistic material on the reservation, and recently Dr. Michelson spent a short time there studying the people and their language, but our knowledge of it is still very imperfect and any additional material is sure to be of value. Although fairly well known to about 20 persons, this language is no longer in common use and few Catawba retain it in anything like its ancient purity. Its peculiar value consists in the fact that it is the only surviving dialect of the eastern Siouan group and that by which the other Siouan fragments from the same area must be interpreted. It appears to be the most aberrant of all the Siouan dialects and to contain features of great value in tracing the evolution of the entire stock. Dr. Swanton was able to collect considerable material, principally detached words and phrases, also a slight amount of textual material, being assisted very much by Dr. Gatschet's manuscript vocabulary. Some notes of general ethnological character were also secured, but the tribe has lived so long in close contact with white people that it is doubtful whether much of this is purely aboriginal.

RESEARCHES AMONG THE OSAGE

In the month of May, 1918, Mr. Francis La Flesche, of the Bureau of American Ethnology, visited the Osage Reservation to continue his field researches among the people of the Osage tribe. During his stay among these people, Mr. La Flesche prevailed upon Wa-xthi'-zhi to give in full the Ga-hi'-ge O-k'oⁿ, "The Rite Belonging to the Chiefs," which, up to that time, he had persistently declined to do excepting to give it in paraphrase. His unwillingness to repeat the rite and to recite in detail its wi'-gi-es (spoken parts) was strengthened by the recent loss of his only son and also of a grandchild, losses which he attributed to his giving the tribal rites without the traditional prescribed ceremonial forms, and the open criticism of some of the men who, in times past, had often taken part with him in the actual performance of the ceremonies. But after much persuasion he finally consented to give the rite in full.

Wa-xthi'-zhi prefaced his narrative with the story of the development of the governmental organization of the tribe which had passed through four experimental stages before it finally satisfied the people. These stages were as follows:

First. When the affairs of the people were in the control of one great tribal division known as the Hoⁿ-ga U-ta-noⁿ-dsi, a division whose tribal symbol is the earth. During the control of this division the affairs of the people were in a continual state of chaos and confusion and there were no fixed rules of action.

Second. When the Wa-zha'-zhe, a division whose tribal symbol is the waters of the earth, persuaded the Hoⁿ-ga U-ta-noⁿ-dsi to submit to a movement toward an organization that would better satisfy the people of all the great tribal divisions. This movement the people called, figuratively, "A departure to a new country." It was at this time that the people organized a military form of government to be controlled jointly by four great tribal divisions. These four divisions were empowered to initiate war movements, the organization for such a purpose to be known as Do-doⁿ-hiⁿ-toⁿ-ga, "War Party by Hundreds," and these four divisions also controlled the tribal hunting expeditions. It was during this stage that the tribal war rites and the rites pertaining to the ceremonial naming of the children were formulated.

Third. In course of time the people became conscious of a disadvantage in the method prescribed for the organizing of a war party. This method was burdened by a multiplicity of ceremonial forms which made it impossible to act promptly when haste became urgent. For this reason another "Departure to a new country"

took place, a movement that made it possible to suspend the tedious ceremonial forms that were hitherto observed when organizing a war party. A single gens or a number of gentes were now empow-



FIG. 118.—Osage Warrior with Pictured War Symbols on His Body.

ered to organize war parties. A war party organized by the new method was called Tsi'-ga-xa Do-do", a name which may be freely translated "Outside the (Sacred) House." With this new depar-

ture, which was really an addition, the military form of the government was regarded as complete.

Fourth. Finally the people made another "Departure to a new country," at which time the people put into effect an organization which they believed would safeguard the tribe from disruption by internal dissensions. In this fourth and final stage the internal affairs of the tribe fell to the control of two hereditary chiefs, one for each of the two great tribal divisions, namely, the Ho^{n'}-ga and the Tsi'-zhu: the first, in the tribal symbolic system, representing the earth, and the latter the sky, with all its celestial bodies. These chiefs were chosen, on the Ho^{n'}-ga side from the Po^{n'}-ka Wa-shta-ge gens, and on the Tsi'-zhu side from the Tsi'-zhu Wa-shta-ge gens.

Upon the completion of this organization the two chiefs took upon themselves the rite of fasting, by which each one sought for some sign of approval from Wa-ko^{n'}-da, "The All-Controlling Power." To the Po^{n'}-ka Wa-shta-ge, on the seventh day of his fast, was revealed the art of healing by scarification. The instruments used were to be made from the wing-bones of the pelican or the wing-bones of the eagle. To the Tsi'-zhu Wa-shta-ge was revealed the art of healing by the use of medicinal roots. The two chiefs were also given the power to heal the sick by ceremonially feeding to them certain foods declared to be sacred and life-giving. In recognition of this healing power of the two chiefs the people of their respective gentes adopted Wa-stse'-e-doⁿ, "The Good Doctor," as a sacred personal name to be bestowed upon their children. A rite was formulated for each of the two chiefs to perpetuate the memory of these events.

During the second and third stages of the development of the government, a rite, religious in character, was reverently observed by the people, namely, the rite of tattooing. According to this rite a man who had achieved success as a chosen war leader was permitted to have tattooed upon his chest, neck, and shoulders conventional designs of certain symbols, all of which pertained to war. These were: The sacred ceremonial knife. The outline of this implement runs from under his chin down the middle of his chest to his abdomen; the sacred pipe which he used for offering smoke to Wa-ko^{n'}-da when appealing to him for success, and which he carried throughout the war expedition. The outline of this pipe runs from either side of the middle of the knife design and terminates behind his shoulders; the thirteen rays of the sun which symbolize the number of o-doⁿ (military honors) every warrior must strive to win. These conventional rays run upward from either side of the

knife between its point and the pipe design, terminating behind the shoulders (fig. 118).

The woman, upon whom depends the continual existence of the tribe, was no less honored than the warrior who risks his life for the people. Upon her forehead, chest, back, arms, hands, and the lower part of her legs are pictured, in conventional designs, the sun, stars, the earth, the powers from whose united force proceed life in all its manifold forms. The lines running down from her shoulder to her

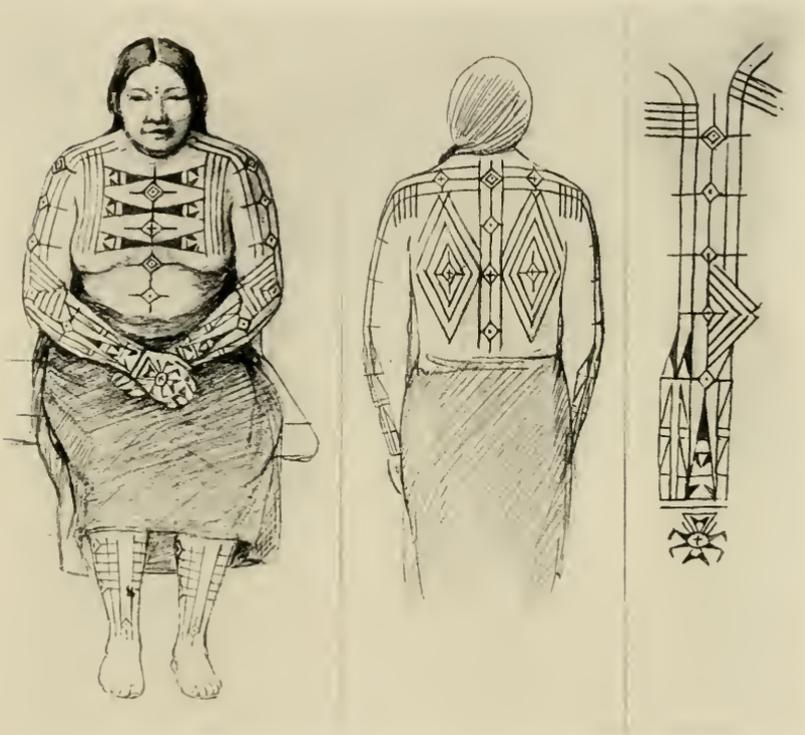


FIG. 119.—Osage Woman with Conventional Symbols Pictured on Her Body.

wrist symbolize the "paths of animals," in reality, life descending from the sun and the stars to the earth, represented in the conventional design of a spider pictured on the hand (fig. 119).

When the fourth stage of the tribal government was completed this rite was transferred to the Po^{n'}-ka Wa-shta-ge chief and also added to the rite formulated for him. The translation of the story of this combined rite, as given in full by Wa-xthi'-zhi, is in process of completion. It contains 31 wi'-gi-es (recited parts), songs, diagrams, illustrations, charts, and text.

MATERIAL CULTURE AMONG THE CHIPPEWA

During the summer of 1918 Miss Frances Densmore, of the Bureau of American Ethnology, visited four localities and her work included a wide field of research. The first reservation visited was Fort Berthold in North Dakota. The purpose of this trip was a final consultation with the Mandan and Hidatsa Indians concerning their music



FIG. 120.—Woman placing tobacco in ground before felling birch tree.

to complete her bulletin on that subject. Information on important points was verified, and additional material was secured, especially regarding the musical instruments used by these tribes. Among the latter data was a description of a "double whistle," said to have been used by the Mandans in former times, and a peculiarly decorated drum used by the Goose women's society. A close examination of a similar drum in the North Dakota State Historical Society revealed a trace of this decoration, almost obliterated by age and use. This specimen was kindly loaned by that society for illustration.



FIG. 121.—First Incision in Bark of Birch Tree.



FIG. 122.—Removing Bark from Birch Tree.

A study of Chippewa material culture, extending over several previous years, was continued on the White Earth and Red Lake reservations in Minnesota, special attention being given to the history and development of Chippewa art. A conventional form of design was found to have existed before the present floral patterns, said by the Indians to be comparatively modern. Examples of these



FIG. 123.—Chippewa Woman Carrying Pack of Birch Bark.

early designs were obtained from the old women, and include conventional flowers and leaves, as well as geometric patterns. Industrial art was also studied, one of its interesting phases being the process of securing and storing birch bark, as well as the manner of its use. Before digging a medicine herb the Chippewa puts tobacco in the ground as an "offering." The same custom is observed before cutting a birch tree, the tobacco being first held toward the zenith and the cardinal points, with low "talking." This can scarcely be termed "supplication," as the mental attitude of the Chippewa when

addressing a "spirit" is that of a respectful friend rather than a suppliant in the white man's understanding of that word. The Chippewa says simply, that he desires the herb, root, or bark for a necessary purpose and asks that he be successful in his use of it.

The writer requested that a birch tree be cut for her according to the old custom, and this was done by a reliable informant at White Earth. Tobacco was placed at the root (fig. 120), and the tree was



FIG. 124.—Chippewa woman adjusting deer hide in position for process of smoking.

felled in such a manner that the bark would not come in contact with the ground. In taking the bark a longitudinal cut was made (fig. 121), after which the bark was turned back (fig. 122), passed beneath the trunk of the tree and removed in a large sheet. This work was always done by the women, who fastened the sheets of bark in packs, usually placing 100 sheets in a pack and tying them with strips of the inner bark of the basswood. In this manner the bark was taken from the woods (fig. 123) and, if not needed for im-

mediate use, was stored in dry, cool shelters. Birch bark was used in making many forms of containers, and sheets of the bark were sewed together as coverings for dwellings. Next in importance to birch bark may be considered the deer hide, which furnished the early Chipewea with material for their clothing, bedding, etc. The tanning of hides was studied, and the process of "smoking" a hide was photographed at Red Lake (fig. 124). The hide was suspended above a shallow hole in the ground, in which a slow fire was kept burning. The smoke from this fire imparted a golden yellow color to the hide. The woman shown in the illustration is expert in the work, and when tanning this hide was wearing her hair loose on her shoulders, according to the custom of one in recent mourning. The writer continued the collecting of medicinal herbs, which was begun in 1917, and recorded much data concerning the early customs of the Chipewea.

The last locality visited was in the vicinity of Lake Winnebigoshish where some old graves had been "washed out." More than 250 fragments of pottery were collected, 110 of which were pieces of the rims and necks of jars. The decorations of these were not unusual in character, showing various imprints of roulette, twisted cord, woven fabric, sharp stick, or thumb-nail, but these were combined in such variety that only three or four duplicates were found in the entire collection. Thirty-four fragments of jars were large enough to show the curve of the sides and the size, which varied from a few inches to about a foot in diameter. The color of the pottery fragments also showed a wide variety, including black, orange, and very pale gray, as well as the familiar browns and reddish shades. Among numerous human bones collected was a skull obtained from an Indian who found it in that immediate locality. The skeletal material was submitted to Dr. Hrdlička, of the National Museum, who reports that "the bones are those of a male skeleton, in all probability Indian. They are possibly not over a few decades old." The large bones were pierced near one end, the puncture breaking into the marrow cavity. These artifacts show the use of a conical instrument.

STUDIES OF THE KIOWA, TEWA, AND CALIFORNIA INDIANS

In June Mr. John P. Harrington, of the Bureau of American Ethnology, went to Anadarko, Oklahoma, where, with the assistance of very intelligent informants, he was able to revise and greatly increase his Kiowa material, which includes very complete grammatical notes and some texts. At the end of June Mr. Harrington proceeded to

Taos, New Mexico, where, coming as he did fresh from the Kiowa field, an excellent opportunity was afforded during the following weeks for comparison of the Tanoan with the Kiowa. In addition to abundant grammatical material, the vocabulary of the language was thoroughly studied. For instance, the lists of names of plant and animal species were made very complete, and although the work was primarily a linguistic one many new identifications were obtained.



FIG. 125.—Ventureño Informant.

Comparative studies of the two idioms in Oklahoma and New Mexico furnished an overwhelming weight of evidence supporting the discovery of the genetic relationship of Tanoan and Kiowa, and show that the Tano-Kiowan is an offshoot of that great stock of languages which gave rise to the Uto-Aztecan. The relationship between Tanoan and Kiowa is comparatively close and is the more remarkable because the Kiowa are a small tribe having the culture

of the plains Indians whose earlier home was in what is now western Montana, while the Tanoans are a typically Pueblo division inhabiting the Rio Grande drainage of New Mexico. It is proposed that the linguistic family thus established, including Uto-Aztecan, Tanoan, and Kiowa, be termed Patlan, a name derived from the word meaning "water" or "river" in all these languages.

In August Mr. Harrington proceeded to California to continue his studies among the Mission Indians of the Chumashan region of southern California. It was his good fortune to be able to make most important additions to the Ventureño grammar, securing many old words which it had been impossible to obtain at previous visits and which are most important for throwing light on all the related languages.

A searching ethnological questionnaire was used with the informants, yielding very gratifying results, especially in the field of material culture. Detailed information on ancient dance regalia and the process of preparing native tobacco and its uses was obtained. An adequate description was procured on ancient traps for ground squirrels and other small animals whose names had been given by various informants, but had never been satisfactorily described. Quite a little new and important information on archery was obtained. Mr. Harrington had special success in learning from a couple of aged women the ancient childbirth practices, including a unique description of the method of cutting the navel cord by means of a carrizo knife after the blood had been dried out of the section by the application of warm decoction *pespibata*. A bed of warm coals was made on the floor and a layer of medicinal herbs was placed on top of this, on which the mother and child lay for three days after childbirth. Sociological problems were intensively investigated and new information was gathered, especially on mortuary customs. Likewise, a few old songs, among which is an especially pretty quail song which has the refrain *ka, ka*, imitating the cry of the quail brought out with a peculiar stressed voice. This and some of the other songs doubtless form parts of old cycles, the other songs of which have not been recovered.

Mr. Harrington obtained from Manuel Chura, who was born in 1820, and is therefore nearly 100 years old, much linguistic information, and 15 very rare songs, such as used to be sung at the Indian fiestas in the thirties or forties of the past century. He also obtained several splendid songs from José de los Santos Juncos, who is also nearly a centenarian.

FIELD-WORK AMONG THE SAUK AND FOX

Dr. Truman Michelson, ethnologist, of the Bureau of American Ethnology, spent two and a half months at Tama, Iowa, among the Sauk and Fox Indians. Shortly after his arrival, July 1, the death



FIG. 126.—Some Fox Children in Gala Attire.



FIG. 127.—A Ceremonial Drum used in the Fox "Religion-Dance."

of William Wanatie's son occurred. Dr. Michelson was given tobacco and told to go to the house and be one of those to sit up all night with the corpse. Wanatie is the owner of one of the drums connected with the so-called religion-dance; and the oppor-

tunity to observe the ceremonies was unequaled. A few days later Ella Davenport died, probably of tuberculosis; however, her parents believed that she had been witched, and he was asked to be one of those to watch her grave at night for a number of days, being assured that Indians knew very well that witches were afraid of white people and would not harm them. It appears that Fox Indians believe that if a person has been killed by a witch, the witch will return in the form of a dog, owl, or bear, tap four times on the grave of the deceased, whereupon the dead will come back to life and the witch will then proceed to torture the person by cutting out his or her tongue and stringing his or her heart. He of course embraced the opportunity; and with a few Indians sat up with loaded shotguns for a few nights watching the grave. Unfortunately the witch did not come. After such a favorable opening he seized the occasion to obtain a number of texts written in the current syllabary on the origin of death, the ceremonies connected therewith, etc., which have since been translated. These texts all supplement rather than contradict each other. The grammatical analysis of the text appurtenant to the Owl sacred pack, begun with Edward Davenport at the U. S. Indian School at Carlisle, was completed. A number of texts collected in previous seasons, some appurtenant to ceremonials and the like, and a few folk tales were translated in the course of the summer, as were the personal names of approximately nine-tenths of the entire Fox population.