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EXPLORATIONS AND FIELD-WORK OF THE  
SMITHSONIAN INSTITUTION  
IN 1920



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# EXPLORATIONS AND FIELD-WORK OF THE SMITHSONIAN INSTITUTION IN 1920

## INTRODUCTION

Investigation of the unexplored regions of the earth and extending scientific knowledge of imperfectly known localities have from the beginning been an important phase of the Institution's activity in the "increase of knowledge." This pamphlet serves as an announcement of the more important expeditions sent out during the calendar year 1920, and more detailed accounts of the scientific results are later published in the Proceedings of the U. S. National Museum, Bulletins of the Bureau of American Ethnology, and other series of publications issued under the direction of the Institution.

Not only has our knowledge of little known regions been increased through the numerous expeditions sent out by the Institution during the 75 years of its existence, but also the collections in natural history and anthropology in the Museum have been greatly enriched thereby. The urgency of some of the field-work is illustrated by the Australian expedition herein briefly described. The remarkable Australian mammal life has been but meagerly represented in the National Museum and the rapid extermination of the native animals through various agencies renders increasingly difficult the securing of an adequate collection. However very satisfactory shipments are being received from the present expedition and it is hoped that a good representation will be secured for the Museum before it is too late.

## GEOLOGICAL EXPLORATIONS IN THE CANADIAN ROCKIES

During the field season of 1920, geological exploration was continued by Secretary Charles D. Walcott in the Canadian Rocky Mountains, with two main points in view, (1) the determination of the character and extent of the great interval of non-deposition of sedimentary rock-forming material along the Front Range of the Rockies west of Calgary, Alberta; (2) the clearing up of the relations of the summit and base of the great Glacier Lake section of 1919<sup>1</sup> to the geological formations above and below. The party going from Washington consisted of Dr. and Mrs. Walcott and Arthur Brown.

<sup>1</sup> Smithsonian Misc. Coll., Vol. 72, No. 1, 1920, p. 15.

Mr. Peacher 198111

Mr. Ingman 198111

Cascade Mt. (6,821')



FIG. 1. Panoramic view of mountain ridge, south side of Lake Minnewanka, from the north slope of Mount Ingham, the (1,750' x 1,800' x 1,128' x 1,100') north of the Ingham, Alberta, Canada. Photographed by Walscott, 1920.





FIG. 2.—Cliffs rising above the northern shore of the head of Lake Minnewanka. Photograph by C. D. Walcott, 1920.





FIG. 3.—Eastward facing cliffs above Ghost River on the Rocky Mountain front. The Ghost River formation is on top of the great lower cliff, and the Devonian limestones in the broken cliffs above. Photograph by C. D. Walcott, 1920.



FIG. 4.—A great headland on the north side of Ghost River, which flows out of the mountain through a broad U-shaped canyon valley. Photograph by C. D. Walcott, 1920.



Early in July work was begun along Ghost River northeast of Banff and about 53 miles (85 km.) west of Calgary, Alberta. The route taken was along the north shore of Lake Minnewanka (fig. 1, Frontispiece) and through the Devils Gap to Ghost River, which here runs north and south at the foot of high eastward-facing cliffs of Cambrian limestone, capped by limestones of Devonian age. Lake Minnewanka is a beautiful sheet of water (fig. 2) in the broad bottom of a pre-glacial river channel, the eastward extension of which forms the Devils Gap.

The Rocky Mountain front (fig. 3) is formed of masses of evenly bedded limestone that have been pushed eastward over the softer rocks of the Cretaceous plains-forming rocks. This overthrust is many miles in extent and occurred long ago before the Devils Gap,



FIG. 5.—Devils Head (9,204 ft.), a butte rising above the cliffs of Fig. 3 on the north side of Ghost River Gap. Photograph by C. D. Walcott, 1920.

Ghost River Gap and other openings were cut through the cliffs by running water and rivers of ice. Great headlands (fig. 4) and high buttes (fig. 5) have been formed by the silent forces of water and frost, many of which stand out against the western sky as seen from the distant foothills and plains.

It was among these cliffs that we found that the first great cliff (figs. 3 and 4) was of lower Middle Cambrian age, and that resting on its upper surface there were 285 feet (86 m.) of a yellowish weathering magnesian limestone, here named the Ghost River formation, which represents the great lost interval between the Cambrian below and the Devonian above. Sixty miles to the west, over four miles in thickness of limestone, shales and sandstones (22,670 feet (6,890 m.)), occur in the lost interval of the Ghost River cliffs.

Upper Cambrian cliffs.



Devonian cap.



FIG. 6.—Western side of cliffs at the eastern end of upper valley of Clearwater River, 22 miles north of Lake Louise Station. The Devonian limestones cap the ridge on the right with Ordovician rocks beneath and Upper Cambrian in the lower cliff. Photograph by C. D. Walcott, 1920.



FIG. 7.—A contented outfit on a Sunday afternoon near the head of the Clearwater River. Photograph by C. D. Walcott, 1920.



FIG. 8.—Photographing far above timber line (9,400 ft.) over Pipestone Pass. Photograph by Mrs. Mary V. Walcott, 1920.





FIG. 9.—Result of an hour's fishing in Lake Minnewanka near Banff.  
 Photograph by Mrs. Mary V. Walcott, 1920.



FIG. 10.—The avalanche lily forces its way up through the hard snow, and its beautiful slender green leaves and yellow flowers fairly cover the thin outlying margins of the winter's snow. Photograph by Mrs. Mary V. Walcott, 1920.



FIG. 11.—Our pack horse "Pinto" preferred to take a short cut at the ford and went down in deep water and was dragged out. Getting ready to get her up. Photograph by Mrs. Mary V. Walcott, 1920.



FIG. 12.—Getting "Pinto" up on her feet in shallow water. Photograph by Mrs. Mary V. Walcott, 1920.

Returning to the Bow Valley, the party left the Canadian Pacific Railroad at Lake Louise and went north over Pipestone Pass to the Siffleur River, which is tributary to the Saskatchewan. In the northward-facing cliffs 25 miles (40 km.) east of the Glacier Lake section of 1919, and 40 miles (64 km.) north of Lake Louise, a geological section was studied that tied in the base of the Glacier Lake section of 1919 with the Middle and Lower Cambrian formations. Returning up the canyon valley of the Siffleur River to the wide upper valley of the Clearwater River, a most perfectly exposed series of limestones, shales, and sandstones of Upper Cambrian and later formations was found (fig. 6) which cleared up the relations of the upper portion of the Glacier Lake section to the Ordovician formations above.

The field season was marred by forest fire smoke in July and August, and almost continuously stormy weather in September. Some of the incidents of the trail are illustrated by figures 7-12. The trout of Lake Minnewanka (fig. 9) increased our food supply for days while on Ghost River, and the camp on the Clearwater was a paradise for man and beast (fig. 7). On Pipestone Pass the avalanche lily was found forcing its way up through the hard snow (fig. 10), and in a treacherous ford of the Pipestone River, Arthur's war bag and the sugar and flour got a soaking.

The party is indebted in many ways to the officials of the Rocky Mountains Park, and to the officials of the Canadian Pacific Railroad, all of whom gave assistance whenever it was possible to do so.

#### GEOLOGICAL FIELD-WORK IN THE UNITED STATES

Dr. R. S. Bassler, Curator of Paleontology, U. S. National Museum, was engaged in field-work in Ohio and Illinois during the latter half of June and the first part of July, with the result that two large, instructive exhibits and important additions to the study series of fossil invertebrates were obtained. Proceeding first to Northside, Ohio, Dr. Bassler made arrangements for the shipment to Washington of a large, well-preserved fossil elephant skull which had been purchased by the Museum through the efforts of Dr. E. O. Ulrich, Associate in Paleontology. This specimen, discovered in glacial gravels near Cincinnati some years ago, was long the prize exhibit of a local saloon; in fact, it was so highly regarded for advertising purposes that repeated offers of a considerable sum for its purchase were invariably refused. With the coming of prohibition, its former usefulness departed and the Museum was able to secure it for a



nominal amount. Teeth of this species (*Elephas columbi* Falconer) are contained in our collections, but such a complete skull is of rare occurrence, there being only one or two others in North American museums. The specimen is further valuable in giving evidence as to the proper position of the tusks in the skull, a subject of long controversy.

The second important exhibit secured during the trip was a slab, measuring four by eight feet, of highly fossiliferous limestone from the Richmond formation of Early Silurian age as exposed near



FIG. 13.—Beginning of excavation for exhibition slab of Richmond limestone near Oxford, Ohio. Photograph by Bassler.

Oxford, Ohio. Such a specimen had long been desired for the exhibition halls to show the advancement in life from the primitive Cambrian forms, represented in the large Cambrian sea-beach sandstone exhibit, to the higher and more complex species of succeeding geological periods, but notwithstanding the numerous occurrences of fossiliferous limestone of Ordovician and Silurian age, it was not until 1920 that a layer affording slabs of suitable size and sufficient perfection of preservation was brought to the attention of the Museum. This was discovered by Dr. W. H. Shideler, Professor

of Geology at Miami University, Oxford, Ohio, who most generously assisted in quarrying out the specimen. As shown in the accompanying photograph (fig. 13) representing the beginning of the excavation for the thin bedded, fossiliferous layer desired (marked *x*), numerous large blocks of stone had to be removed before the real task of quarrying the slab was begun. The work was completed successfully and the exhibit is now being installed in the hall of invertebrate paleontology. The perfection of the fossil shell remains on this slab

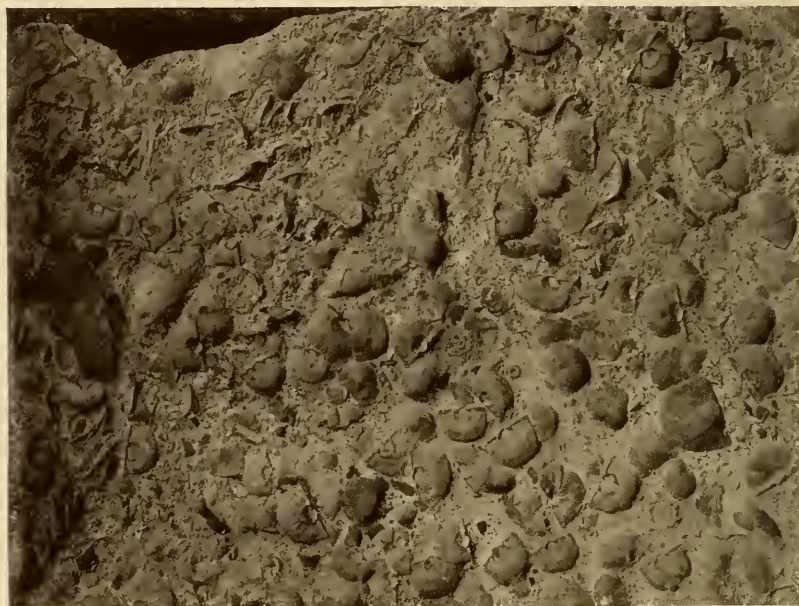


FIG. 14.—Surface of fossiliferous limestone slab, one twenty-fifth natural size.  
Photograph by Bassler.

is evidenced in figure 14, which, however, shows only in a small degree the distinctness of the shells upon the rock background.

Upon the completion of the quarrying operations at Oxford, Dr. Bassler proceeded to Chicago, Illinois, where he was engaged in the preparation of casts of type specimens of fossils contained in the collections of the Walker Museum, University of Chicago. The paleontological collection of the National Museum, which includes the celebrated Walcott, Ulrich, Springer, Harris, Nettelroth, and Rominger collections, is especially rich in type specimens of Early Paleozoic fossils, but nevertheless the Walker Museum possesses



many unique types not represented at all in Washington. Permission to prepare casts of these and thus advance our study series toward the completeness which the National collections should attain, was generously granted by Dr. Stuart Weller, Director of the Walker Museum. In two weeks time Dr. Bassler was enabled to finish casting all of the Ordovician and Silurian types, leaving the remaining Paleozoic species for a future trip. The work was done quickly by using the modeling compound (plastocene) to make the mold from which the cast is prepared. After dusting the fossil with talcum powder the modeling compound is carefully pressed upon it and then withdrawn, thus securing a clear-cut impression into which the plaster is poured. Bubbles can be avoided by first pouring thin plaster of Paris into the mold and distributing it uniformly with a camel's hair brush. The thicker plaster is then introduced as usual to fill the cavity. When dry the modeling compound is torn away, thus leaving the complete cast but also, unfortunately, destroying the mold.

Field-work in vertebrate paleontology was limited to a short trip made by Mr. J. W. Gidley, Assistant Curator, in the latter part of August to Williamsburg, Virginia, where scattered remains of a fossil whale had been found in the Miocene strata outcropping nearby. It was at first hoped that an entire skeleton could be secured here, but careful search proved the bones to be so scattered and fragmentary that no exhibition material was available although some interesting additions to the collection of fossil vertebrates and some excellent Miocene shells for the exhibition series were obtained.

Mr. William F. Foshag, of the Division of Mineralogy, at his own expense made sundry trips into interesting mineral localities in California and secured a considerable quantity of desirable material for the Museum's collections, including an excellent series of borax minerals.

#### FIELD-WORK IN ASTROPHYSICS

In astrophysical research the Institution was unusually active. Early in 1920, Dr. Abbot had a long discussion and correspondence with Professor Marvin, Chief of the United States Weather Bureau, on the applications of solar radiation measurements to meteorology now being officially practised in Argentina and Brazil on a basis of daily telegraphic reports from the Smithsonian observatory near Calama, Chile. Professor Marvin felt strongly the inadequacy of existing solar radiation observations as a basis for studies of the dependence of temperature on the solar variation. While the Chilean results might be excellent, still they were for the most part not

checked by independent observations. The Mount Wilson work yielded results on less than a third of the days, and might well be affected by variations of atmospheric humidity incident to the site so near the Pacific Ocean and the cities about Los Angeles. These objections could not but be admitted by Dr. Abbot, and led him to make a great effort to strengthen the observations of solar variation.

Mr. John A. Roebling, of New Jersey, had indicated a strong interest in the work. In conference with Dr. Abbot in May, 1920, he generously gave the sum of eleven thousand dollars for the purposes



FIG. 15.—Montezuma solar observing station near Calama, Chile. Dwelling house, shop and garage.



FIG. 16.—Montezuma solar observing station. Entrance to spectrobolometer tunnel. Also pyrheliometric apparatus.

first, of removing the station theretofore on the plateau near Calama, Chile, to a nearby mountain high enough above the plain to avoid dust and smoke; second, of removing the "solar constant" outfit from Mt. Wilson to the best mountain site available in the United States; third, the balance for any other objects closely associated with these investigations.

Under the zealous and able management of Director A. F. Moore, a new observing station was selected and prepared at a place called Montezuma, about 8 miles south of Calama on a mountain rising about 2,000 feet above the local level, and about 9,500 feet above sea

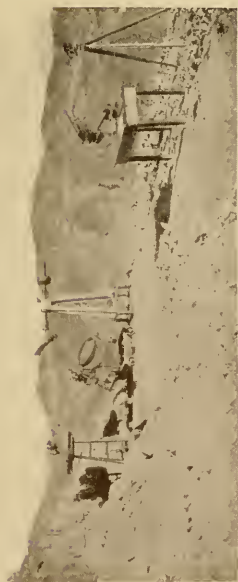


FIG. 17.—Montezuma solar observing station. Coelostat and pyrheliometric apparatus.



FIG. 18.—Montezuma solar observing station. The peak on which the observatory is located.



FIG. 19.—Hauling materials from Calama for the solar observing station at Montezuma.



FIG. 20.—Solar observing station at Montezuma. Dwelling house.



FIG. 21.—Town of Wenden, Arizona. Mt. Harqua Hala in the background.



FIG. 22.—Packing apparatus to Mt. Harqua Hala.



level. The instruments are arranged in a tunnel excavated horizontally in solid rock near the summit of the mountain. Observers' quarters, computing rooms, garage and shop are located some three hundred feet lower in a sheltered ravine. These quarters can be reached by the auto truck in 50 minutes drive from Calama. No road had to be constructed, as there are no trees in the region, and a way was found smooth enough, and of sufficiently easy grade, without working. Within about two months of receipt of the Institution's telegram, Mr. Moore completed these arrangements, removed the



FIG. 23.—Observatory on Mt. Harqua Hala.

outfit from its former location and recommenced observing August 5, 1920, at Montezuma with the loss of but ten days for the removal. He regards the new site as excellent, and expresses doubt if a better one could be found in the whole world.

In December, Mr. Moore returned to the United States, turning over the Directorship of the Chile Station to Mr. Leonard H. Abbot, formerly assistant, who is now assisted by Mr. Paul Greeley. Telegrams giving the values of solar radiation observed are sent as heretofore to Buenos Aires and forwarded from there to Rio de

Janeiro. Both the Argentine and Brazilian Weather Bureaus employ them with approval for forecasting purposes.

Dr. Abbot, with the advice and assistance of the U. S. Weather Bureau, which carried on special observations in several localities for the purpose, selected a site on Mount Harqua Hala, near Wenden, Arizona, as the best place to relocate the Mount Wilson outfit. A building, partly underground, was erected there in July and August by local contractors. Messrs. Abbot and Aldrich occupied the Mount Wilson Station as usual from July 1 to September 15, when the outfit



FIG. 24.—Coelostat and pyrheliometer, Mt. Harqua Hala.

was removed to Mount Harqua Hala, where observations were begun on October 2, 1920. Dr. Abbot took charge and continued observing until January 25, 1921, assisted by Mr. Fred A. Greeley. Mr. Aldrich then relieved Dr. Abbot, and it is expected will himself be succeeded about May 1, 1921, by Mr. A. F. Moore, formerly at Calama.

Thus the Institution has now in charge two first-class solar radiation observatories, which are to be operated continuously hereafter until the question of the value of the solar variation as a meteorological datum is definitely settled. Heretofore the measurements have

been secured on nearly 70 per cent of the days at Harqua Hala and on nearly 80 per cent at Montezuma. The agreement of results on days in common has hitherto been remarkably close and leads to the hope of surely detecting solar variations as small as 1 per cent.

The conditions of living at Montezuma, while lonely, are not excessively so. Frequent motor trips to the city of Calama for supplies, and occasional visits to the copper mine at Chuquicamata, where great kindness is experienced, help to break the monotony. At Mount Harqua Hala, however, the isolation is excessive. There



FIG. 25.—Top of Mt. Harqua Hala after a snowstorm, showing fog-bank in the background.

is a single neighbor, Mr. Ellison, a mining prospector located a mile away, on whose three burros depends the transportation for the observatory. It is 11 miles from Wenden to the foot of the mountain trail, which is 5 miles more in rising about 3,000 feet. Mail is received only about once in two weeks, when supplies are ordered by heliograph signaling with Morse code to the merchants in Wenden, at the cost of several hours hard work with the lights. Water must be hauled from Mr. Ellison's camp, over a mile distant and 850 feet below, except when at rare intervals rain falls. The two observers



cook, wash, cut firewood from the small oak bushes and dwarf yuccas about, and repair or alter the building or the apparatus as occasion requires, besides carrying on the solar investigation.

During the occupation of Mount Wilson in 1920, many pieces of research were successfully carried through by Messrs. Abbot and Aldrich besides the measurements of solar variation. One of the most interesting was the perfecting of the solar cooker begun several years ago. A parabolic cylindrical mirror with polished aluminum surface of about 100 square feet focuses the sun's rays upon a blackened tube filled with mineral oil communicating to an iron



FIG. 26.—Solar cooker on Mt. Wilson.

reservoir of oil in which are two baking ovens. A continuous circulation of the heated oil keeps the ovens hot enough to perform all cooking operations except frying. Excellent bread, meat dishes, vegetables, cereals, canned fruits and vegetables and preserves were cooked there by Mrs. Abbot, who had charge of this part of the experiments and who was much envied for her cool kitchen and novel appliance by the ladies of the mountain. This solar cooker was constructed on Dr. Abbot's plans largely at the cost of grants from the American Academy of Arts and Sciences in Boston, and the National Academy of Sciences. It has proved successful, but must be regarded



at least for the present as rather a luxury for rural and relatively cloudless regions, than as a generally useful appliance.

#### ZOOLOGICAL EXPLORATION IN AFRICA

The generosity of friends of the Smithsonian Institution made it possible to engage Mr. H. C. Raven, well known for his previous



FIG. 27.—The Chimpanzee was one of the most interesting animals in the forest. Their calling and shouting could frequently be heard early in the mornings and on moonlight nights. Adult female, Uganda, July, 1920.

work in Borneo and Celebes, to accompany the "Smithsonian African Expedition, under the direction of Edmund Heller in conjunction with the Universal Film Manufacturing Co.," which sailed from Brooklyn, July 16, 1919, on the steamship City of Benares, and arrived in Cape Town, August 13.



FIG. 28.—A fine leopard secured at Masindi, in Uganda, by jacking, June, 1920.



FIG. 29.—The large gray and black civet is a beautiful animal which is seldom seen owing to its nocturnal habits. Budongo Forest, June, 1920.





FIG. 30.—One of the specimens of *Genetta* collected during the time we were encamped on the Kafue River about sixty miles above its confluence with the Zambesi, in Northern Rhodesia, December, 1919.



FIG. 31.—The “standard-wing night jar.” Masindi, Uganda, June, 1920.



FIG. 32.—*Lates*, a large perch of Lake Tanganyika.



FIG. 33.—Kaffirs cleaning elephant skeletons at the camp of Major Pretorius, in the Addo Bush. The South African Government has ordered the destruction of these animals—the only herd of the kind in the world today, living so far beyond the confines of the tropics, with the exception of the few in the Knysna Forest. Kenkel Bosch, Cape Colony, September, 1919.



FIG. 34.—Wahutu men dancing at Nyanza on the shore of Lake Tanganyika. Their voices, jingling bells on the ankles and stamping feet add excitement to the scene.



FIG. 35.—Among the Wahutu who live on the coast of the lake and the Watuzi of the mountains it is customary for a few of the best dancers to come forward that their skill in jumping and whirling may be demonstrated to better advantage.



In the vicinity of Cape Town, Mr. Raven was able to collect only insects and invertebrates, and from there he went to the Addo Bush, where 19 days were spent in collecting small mammals and birds. Going through Durban and Johannesburg, Mr. Raven spent two weeks collecting at Ottoshoop in the Transvaal, after which he proceeded to Victoria Falls, and from there he left for the Kafue River



FIG. 36.—A young chief of the Wahutu ready to lead his men in the dance. Nyanza, Lake Tanganyika, February, 1920.

region, where he camped for several weeks. After spending some weeks along the Congo, he reached Lake Tanganyika, where camp was made for about a month. The next stop of any length was in Uganda, where a few days over a month were spent in collecting in the Budongo Forest. As the whole forest was in the sleeping-sickness area, it was necessary to get a special permit from the district commissioner to enter it, and the native boys had to be examined by a



FIG. 37.—The Watuzi of the mountainous region northeast of Lake Tanganyika in one of their very picturesque dances. Each man carries a long lance or two, and a bow with one or more arrows.



FIG. 38.—Women of Liri on the Albert Nile repairing the wall of a hut with mud. The walls are made with wooden supports and between these are placed rows of stalks of elephant grass partly buried in the ground and fastened together with grass. The whole is then covered with mud and a roof built so that it overhangs and protects the walls from the erosive effect of rain.

doctor before entering the area and again on leaving it. Work here was finished on July 14, 1920, after which Mr. Raven returned to the United States, sailing from Cairo, September 2, and arriving in New York, September 17.



FIG. 39.—A Dinka woman and her child at Shambe on the upper Nile. It is a rather common sight to see the natives cleaning their teeth with a bit of stick. Sometimes they pound the end or split it with a knife so that it becomes brushlike.

Though not numerically large the collections are of unusual interest on account of the manner in which they supplement those obtained by other expeditions in which the Smithsonian Institution has been interested. Among the most important material may be mentioned 697 mammals (including 272 specimens from South Africa, a region hitherto very imperfectly represented in our collections; 152 from





FIG. 40.—The Victoria Falls of the Zambesi River. Above the falls the river is about a mile wide but drops over a cliff nearly four hundred feet into a narrow gorge which in some places is less than one hundred and fifty yards in width.



FIG. 41.—A native village at Port Bell in Uganda, with Lake Victoria Nyanza in the distance and to the right an acacia tree in which a colony of weaver birds have made their nests.



FIG. 42.—Primitive irrigating machinery, on the Blue Nile at Khartoum, August, 1920. Oxen, donkeys or camels are used to turn such water wheels.



FIG. 43.—Sheep grazing near the temple of Medina Habu in Upper Egypt.

Lake Tanganyika; the chimpanzee of Uganda), 567 birds, 206 reptiles, and 193 fishes. The photographs here reproduced were all taken by Mr. Raven, who has also prepared the legends which accompany them.

#### BOTANICAL COLLECTING IN AFRICA

Dr. H. L. Shantz, Botanist, Office of Seed and Plant Introduction, Bureau of Plant Industry, United States Department of Agriculture, was also a member of the Smithsonian African Expedition, and his chief objects were to secure live plants of agricultural value for introduction into the United States, to study the agricultural methods of both natives and Europeans, and to collect plants for the National Herbarium of the United States National Museum. This work began at Cape Town, August 13, 1919, and terminated at Port Said, September 2, 1920.

The vegetation of the Cape region has long been known to European botanists, and has received more attention than that of any other portion of Africa. It is difficult to imagine a region which has so many striking features. The wealth of Proteas and Ericas alone would make this region unique. Lilies of various and beautiful types, Iridaceae, Amaryllidaceae, and Orchidaceae, each represented by many genera and species, the Arum lily or calla, which occurs everywhere in wet soil, and Pelargoniums, which here cover the mountain sides, make of this Cape region a natural botanical garden, so rich and varied that any botanist will here find plants of absorbing interest. At Kirstanbosch there has been established the National Botanic Gardens now under the direction of Dr. R. H. Compton. If the well-laid plans are fully carried out, it will be possible to find here all of the more interesting indigenous plants of South Africa, and to this garden will come botanists, horticulturists, and agriculturists interested in South African plants. American botanists would be proud if we had anywhere in our country a garden to compare with it.

East of Port Elizabeth in the Addo Bush, which is a low thorn thicket of trees and vines about 15 to 20 feet high, are food plants of especial interest. Among the succulents, none are more interesting than the speckbroom (*Portulacaria affra*), a source of forage for the wild elephant herd of the bush as well as for other large herbivora, ostriches, cattle, sheep, or other domesticated animals. This plant has been introduced into the United States and is doing especially well in southern California in the lower chaparral zone and should greatly improve the forage value of the natural range. Here are many interesting plants such as the picturesque *Acacia horrida*, with



its large white spines, the Boer Bean, *Schotia speciosa*, the young beans of which are cooked and eaten, also many interesting Aloes, Lilies, Cotyledons, and Euphorbias. The elephants' foot (*Testudinaria elephantipes*) and many species of asparagus also occur here.

The Karroid plateau was seen only during the rest period, when its vegetation, which consists of desert grasses and shrubs, is in appearance identical with portions of the Great Basin in Nevada. Especially interesting features of this desert are the great number of species of



FIG. 44.—On the Karroid Plateau, west of De Aaar. This desert shrub, known as Karroo bush (*Pentzia*), is a valuable forage plant, resembling our bud sage of the Nevada and Utah deserts. Cattle, sheep and ostrich are the chief grazing animals.

Mesembryanthemum, several of which are edible, and the Karroo bush (*Pentzia*), a valuable forage plant, areas of which resemble in general appearance our Bud Sage areas of Nevada and Wyoming.

Passing northwest to the region about Kimberley, there is a scattered growth of Acacias, over an open desert grass type similar in some ways to the vegetation of west Texas and portions of Arizona and New Mexico. The high grasslands of the Transvaal, on the other hand, with a grass vegetation dominated by *Themeda forskalii*, reminds one of *Andropogon scoparius* areas in the drier portions of

our prairies. Here corn is the principal crop and the large ranches with houses far apart, each with a clump of trees, make the resemblance to our prairies in the earlier days even more striking.

The portion of the Transvaal north of Pretoria, known as low Veld, consists of a scattered growth of relatively small trees over a grass cover composed of rather coarse tall grasses. This is one of the most widely distributed types and an exceptionally interesting one. The grasses are burned off each year and only such trees as can resist the fires can maintain themselves under this condition. This type becomes somewhat modified at Lourenço Marques, where the vegetation, although quite luxuriant, still showed signs of a prolonged drought period. Here, as in the region north of Pretoria, the Kaffir Orange (*Strychnos pungens*) is abundant, and there are many species of Acacia and Combretum. The Cashew Nut (*Anacardium occidentale*) is everywhere a prominent tree and has the appearance of being indigenous, although introduced from South America. It forms a large evergreen tree and is never cut down by the natives, who prize it both for the fruit and for the nut, from which they secure both food and a strong alcoholic beverage. Another tree of unusual interest is the Morula (*Sclerocarya caffra*), which has a valuable oil and edible nut, with a fruit useful for making jam and an alcoholic drink.

Of the more strikingly beautiful trees of this section are the red flowered and fernlike-leaved *Delonix regia*, the beautiful blue flowered Jacaranda, and the Mahogany Bean (*Pahudia quanzensis*) which produces in its large pods a large black bean with a brilliant scarlet cup-shaped aril at the base and is one of the important timber trees.

The vegetation at Salisbury reminds one of the low Veld above Pretoria, a grassland with scattered trees, singly or often in clumps. At Bulawayo the grasses are less luxuriant and the trees smaller and more xerophytic. The vegetation about Victoria Falls, except for the small forest irrigated by spray from the falls, is also xerophytic in character. At Kafue the grasses seem more luxuriant but the trees are much as at Victoria Falls. Here a number of important fruits were secured, most of which are still undetermined. A nut tree of unusual interest, because of its value for food and oil and the remarkably light weight of the wood, was secured here. It has been known as the Manketti Nut (*Ricinodendron rautanenii*). Here also occurs the Beobab (*Adansonia digitata*), the largest tree in Africa, useful to natives as a source of Bast fiber and as food. The acid white pulp which fills the fruit and surrounds the seed is eaten or dissolved in water to produce a refreshing drink.

The dry, open forest around Elizabethville gives way, before Bukana is reached, to the tall grass and scattered trees which form the great Savanna, which surrounds the tropical forest of the Congo. The Lualaba is lined with oil palms (*Elaeis guineensis*) throughout almost the whole of its course, and during much of the time swamps of Papyrus are abundant along its course. Most interesting were the great numbers of wild Sorghum grasses, some of which may prove



FIG. 45.—Two large mango trees (*Empe oribo*) at Kigoma on Lake Tanganyika. The trees bear two crops of fruit a year, a large crop in January and February, and a small crop in August and September. The fruits are large, fully five inches long, of excellent flavor and with practically no fiber around the seed. The building in the back is the railway station.

valuable in our dry-land agriculture. The oil palm, which belongs to the native who planted it, is probably the most useful native plant in all Central Africa, and its oil is used by the natives as food and for making soap with which to wash their clothes.

The dense tropical forests which cover much of the central Congo were seen at Kindu on the Congo River, where they form a dense canopy, but where the undergrowth is not entirely shut out. At Kigoma and Ujiji, on Lake Tanganyika, the grassland is dotted with



large mango trees, the fruit of which is large and of excellent quality. These trees were probably introduced by Arab slave dealers and



FIG. 46.—Watuza chiefs dressed for the dance. They are, from left to right, Kikovio (son of Ararawe), Mizambo (a Bagamwa or prince of the fourth generation) and Ararawe (brother of the head chief, Andugu).

The dress consists of an undergarment of bark cloth, made from the bark of a fig tree, of two skins of leopard or serval cat, one over the shoulder and one around the loins. Each carries a long bow, decorated with banana fiber, two arrows and a long spear.

They live largely on cattle, and inhabit the high mountain grasslands of Urundi. They are exceedingly tall, slender and athletic men, are alert and pleasant and are almost untouched by white influence.

merchants, and probably all originated as seedlings. Along the shore of Tanganyika in Urundi many plants were collected. In the highland back of the lake at N'gano N'gano, the rolling hills are covered

with excellent grasses of high forage value, and support thousands of cattle. The Watuzi who inhabit this region are one of the least known but most interesting tribes in all Africa. They are tall, slender, athletic men, with thin lips and straight noses, and are



FIG. 47.—A grove of cocoanut palms at Dar es Salam, Tanganyika Territory, with a native (Swahili) hut in the background.

The whole region about Dar es Salam and for fifteen or twenty miles inland is occupied by an almost continuous cocoanut palm grove. The notches in the trees facilitate the gathering of the nuts.

probably the best athletes in the world, especially at high jumping, which is one of their chief accomplishments. Many grasses and many bulbous plants from this region give promise of value as plant introductions. A great variety of bananas, beans, and cereals are grown by these natives.



At Dar es Salam, a broad strip of coast is given over largely to the cultivation of the coconut palm, although the streets are often lined with wild figs, *Delonix regia*, and *Terminalia catappa*. Zanzibar is given very largely to the cultivation of cloves, and here are also grown many tropical fruits, and there is a small but exceedingly interesting botanical garden. Tanga is somewhat similar to Dar es Salam in vegetation.



FIG. 48.—Bank of the Victoria Nile at Masindi Port in Uganda. A luxuriant growth of papyrus, water-lilies, morning glories and other water plants. Much of Lake Kioga is covered with this type of vegetation.

While the vegetation of the north shore of Lake Victoria is rich and varied and reminds one of that seen in the Congo and on Lake Tanganyika, the outstanding features in Uganda are the areas of elephant grass, *Pennisetum purpureum*, and the immense tracts of bananas which extend for miles and miles, for bananas are relatively as important to Uganda as corn is to Illinois.

There are several small tropical forests in Uganda, and at Entebbe an unusually interesting botanical garden. The flame of the forest (*Spathodea*), a prominent tree through much of tropical Africa, the

kidurii (*Antiaris toxicaria*), and many other trees are prominent here. At Entebbe one may see Para rubber, Cera rubber, Cacao, sugar cane, yams, corn, rice, wheat, and other temperate crops harvested at the same time.

The principal results of the expedition were the collection of about 1,000 botanical specimens for the National Museum, and the introduction of about 1,600 plants for growth as agricultural plants in this



FIG. 49.—The Uaso Nyiro River at Archer's Post. It flows through a semi-desert country abounding in big game animals. It is lined throughout by groves of Dum Palm.

country; the more important being forage plants, nut plants, fruits, and vegetables. The acquaintance was made of many men interested in plants and agriculture, throughout the Continent, who can be of service in connection with securing additional material. First-hand observations were made of the methods of agriculture pursued by African tribes as well as the Europeans, and a large number of photographs were taken which illustrate the natural vegetation and agricultural crop methods.

## AUSTRALIAN EXPEDITION

During the past year Mr. Charles M. Hoy has continued the work of collecting material in Australia, under about the same conditions as those mentioned in the last report on explorations. In this period collections were made at the following localities:

"Farina, S. A.: Work in the Farina district was done at Lindhurst, 30 miles east of the town of Farina. Nineteen days were spent there, resulting in the collection of 110 birds and 64 mammals. A few reptiles and insects were also collected."

"Kangaroo Island, S. A.: Twenty-six days were spent, in the field, on



FIG. 50.—Aboriginal grave yard, North Australia.

Kangaroo Island with the result of 85 mammals, 51 birds, and miscellaneous reptiles, amphibians, and marine specimens collected."

"Port Lincoln (Eyres Peninsula), S. A.: Twenty-two days were spent in the field resulting in the collection of 86 birds and but 15 mammals. A few miscellaneous specimens including reptiles, crustacea, etc., were also obtained."

"Busselton, W. A. (50 miles south): Camp was pitched 50 miles south of the town of Busselton, on the edge of the Government Timber Reserve. Forty days were spent in camp (May 14-June 23). The weather was the worst that I have experienced. During the whole 40 days, there were only three days free from rain. Over 18 inches fell in that time. It was impossible to keep things dry and even the tent fly went green with mould. Despite these handicaps, however, a pretty fair collection was obtained. The collection contains 94 mammals, 46 birds and a few miscellaneous alcoholic specimens (reptiles and land shells)."





FIG. 51.—A rufous rat-kangaroo from New South Wales.



FIG. 52.—Phascogale, a mouse-like marsupial from New South Wales.





FIG. 53.—A young kangaroo. Photographed on Kangaroo Island, Australia.

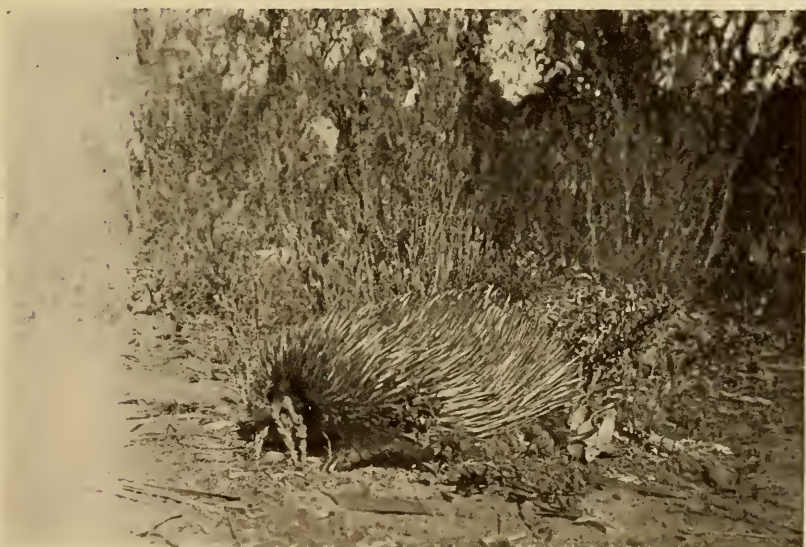


FIG. 54.—An Echidna or "spiny anteater" photographed on Kangaroo Island, Australia. The long bird-like beak projects from behind the plant which conceals the animal's face.

"Derby, W. A. (32 miles southeast): Twenty-three days were spent in the above locality, August 7-29. The locality visited was very poor in both mammal and bird life and a collection of only 43 mammals, 68 birds and 10 reptiles secured."



FIG. 55.—A native of North Australia.

In the last letter received from Mr. Hoy, from Port Darwin, Northern Territory, dated September 25, 1920, he writes, in part, as follows:

"I have decided to work the Northern Territory and then go overland to Queensland via the old wagon road. I will travel in a buckboard and will go south from here, to the Catherine River, then east along the Roper, and then to the McArthur. On reaching the latter river I will go south along the river, then to Anthony's Lagoon and east across the tableland to some point in Queensland—most likely Gloncurry. The trip will take about four months and will have many advantages. The road is an easy one, being an old established route with plenty of good water along the way, and the trip ought to be productive of very good results."

During the year two shipments were received from Mr. Hoy, the last one arriving here in September. A total of 440 mammals, well prepared, several of which were hitherto unrepresented in our collection, together with series of skeletal and embryological material; 570 bird skins, with 24 additional examples in alcohol, and smaller collections of reptiles, amphibians, insects, marine specimens, etc., were received.

Up to the time of Mr. Hoy's visit to Australia the Museum had received not over 900 specimens of birds from that country; the majority of these were old, mounted, and without precise data, some of them dating back to the time of the Wilkes Exploring Expedition. About 350 mounted birds, displayed at the Centennial Exposition in Philadelphia in 1876, by the several Australian colonies, and presented to the National Museum at the close of the exposition, formed the largest single contribution to our collection; the remainder of the material consists of many smaller lots, obtained by gift or exchange at long intervals. About 140 species, including several of the distinct forms of Kangaroo Island, are represented in the material received from Mr. Hoy, all well prepared and with adequate data. Some of them are quite new to the Museum collection, and others, such as the lyre bird, have not previously been available in our study series.

#### BIOLOGICAL EXPLORATION IN HAITI

Dr. W. L. Abbott, of Philadelphia, accompanied by Mr. E. C. Leonard, of the National Museum, as botanical collector, made a visit of exploration to southern Haiti from February to July, 1920. Dr. Abbott undertook this visit chiefly that he might study the bird life of Gonave Island, hoping to complete certain series he had collected on a former visit. The island is about 30 miles long and 10 miles broad, and consists of a low mountain range bordered by a belt of foothills that merge gradually on the north coast to a level beach fringed by mangroves, but on the south slope descend rather abruptly into the sea. Dense thorn thickets cover the arid mountain sides and foothills, while the uplands, called La Table, open into



large grassy tracts with only occasional trees or shrubs. Due to the scarcity of water and, in many places, to large outcrops of bare coral rock, the island is poorly adapted to agriculture, but the grassy uplands furnish excellent grazing. The forests yield a fair amount of *lignum vitae*. The party spent three weeks on the north coast, working around Anse Galette and Etroite, and later a week on the south coast in the vicinity of a small fishing village called Pikmi.

The regions visited on the mainland were St. Marc, Etang or Manneville, Fond Parisien, La Mission, Furcy, and Pétionville, with Port au Prince as base.



FIG. 56.—Royal Palm groves of Fond Parisien.

Etang is on the northwest shore of Etang Saumatre, a large lake nearly 20 miles east of Port au Prince, bordered on the west by the plains of the Cul de Sac, on the north by the mountains of Grand Bois, and on the south and east by the foothills of La Selle Mountains. The lake is about 50 feet below sea level and very salty. Among the interesting natural features of the region is a series of large springs, flowing into the lake through a belt of marshy meadows which are covered by a short sod composed almost entirely of several species of sedges. An excellent opportunity was offered to study both the arid cactus forests and cat-tail marshes that occur in the Cul de Sac.

The large royal palm groves of Fond Parisien, situated on the southeast shore of Etang Saumatre, give it a picturesque appearance.



In old French times Fond Parisien was considered one of the most beautiful spots in Haiti, but a flood has covered the greater part of this once fertile district with stones and gravel, transforming it into a desert. The large areas of black mucky swamp land to be found



FIG. 57.—“Strangler plant” (a species of *Clusia*) on a large leguminous tree near Pétionville.

here are utilized in sweet potato farming, while some cotton is grown in the drier parts.

La Mission is a day's journey to the south from Fond Parisien. The most striking features of this region are the open pine forests



FIG. 58.—Pic de Bromt (called "Morne de Wézan"). A new species of grass was found growing on the summit of this mountain.

*Morne St. Vincent*



FIG. 59.—Weaver bird and nests in a thorn tree. Fond Parisien.

and occasional wet thickets, the latter sheltering a luxuriant growth of ferns. The natives are, however, rapidly destroying the pine trees both by burning the forests repeatedly and by girdling the pines for splinters, which are sold in the markets as kindling.

Furcy and Pétienville are not far from Port au Prince. Both are easily accessible and are among the few localities which have been visited by naturalists.

Nearly 10,000 specimens of plants were collected, as well as a number of land shells and insects.

The birds obtained by Dr. Abbott during this expedition numbered 201 skins, with a few alcoholic specimens and skeletons. By far the most interesting ornithological observation made was the discovery in some abundance of an introduced weaver bird, *Hyphantornis cucullatus* (Müller), a native of West Africa. This species was found at several points in Haiti, where it occurs in colonies and affects much the same type of country as do related species in Africa. Nearly completed nests, without lining, were found about the middle of May, but no eggs had been deposited at this date. They are strongly woven of narrow strips of palm or banana leaves, and have an entrance at the side. An illustration of the manner of nesting is shown in figure 59. Two smaller species of west African weavers, belonging to other genera, are known to occur in Porto Rico, where they have existed for many years, but the date and circumstances of their introduction, as well as those of the species discovered in Haiti, are at present unknown.

#### MALACOLOGICAL FIELD-WORK IN CALIFORNIA AND THE HAWAIIAN ISLANDS

On the way to the First Pan-Pacific Scientific Congress held in Honolulu, August 2-20, 1920, Dr. Paul Bartsch, curator of mollusks, U. S. National Museum, stopped for three days in Glacier National Park, where some collections were made.

He also spent a day on shipworm investigation about Mare Island, where he had placed at his disposal, by the commandant of the station, a tug and pile extractor, and the necessary officers and men to make every minute of his stay count, the result being a careful examination of pilings throughout the stretch of San Pablo Bay and the adjacent shores of San Francisco Bay. This investigation resulted in establishing the fact that the mollusk which has been doing the damage estimated at some \$25,000,000 last year is a new species of *Teredo*, which Dr. Bartsch has named *Teredo beachi* in honor of the commandant of Mare Island.

Dr. Bartsch, in preparing a monograph on the land shells of the *Epiphragmophora californiensis* group, was very much puzzled how to account for the presence of two very closely related subspecies at Pt. Pinos, California. He took this occasion to visit Pt. Pinos, and there found that the two subspecies do not occupy the same habitat. The smaller of the two was found in great abundance under plants on two of the rocks lying off the Point, separated from the mainland by a gap across which one could easily leap, while the larger subspecies, which was rather rare, was found on the ground, buried beneath needles and vegetable detritus. Two subspecies of the



FIG. 60.—The home of *Epiphragmophora californiensis* Lea, a species of land shells, off Pt. Pinos, California.

*Epiphragmophora tudiculata* group were found to occupy a similar range.

Mr. Henderson and Dr. Bartsch arrived in Honolulu a few days prior to the meeting, and this time was used for collecting land, fresh-water, and marine shells on the island of Oahu. They also collected mullusks during their sojourn about the wonderful crater of Kilauea, on the occasion of the visit by the congress to the island of Hawaii. Several stations were likewise made between Kilauea and the Kohala coast. A large number of marine shells were secured from the rocky shores of Honaunau Bay.

Since the first accommodations to be secured for the return were dated September 8, the intervening time between the close of the



Congress and this date was spent in collecting specimens. Dredgings were made in Pearl Harbor, where the commandant placed one of the dredges at their command. They were also rendered the necessary assistance in making a search for shipworms, with the result that a new species of *Teredo* was discovered, which has been named *Teredo parksii*, in honor of Admiral Parks, in charge of Yards and Docks, U. S. N. They also dredged in Maunalua Bay, on the south side of Oahu and in Kaneohe Bay, on the east side of the same island. Specimens were also collected on various occasions at Haleiwa Beach, on the north end of Oahu, and the beach and shallow water adjacent to their cottage at Waikiki were thoroughly scratched over. Trips were also made into various parts of the mountains, where land shells of many kinds were secured.

Another excursion carried them to the island of Maui, where marine shells were collected wherever possible along the shore, and land shells were secured on their ascent of the magnificent extinct volcano of Haleakala.

One of the very interesting observations made on this trip to the Hawaiian Islands was the finding of an existing marine flora and fauna at a considerable elevation above the level of the sea on the gently sloping bench at the southeast point of Hanouma Bay. This flora and fauna consist of algae, quite a number of species of mollusks, crustaceans, echinoderms and other marine organisms, which occupy pools and puddles kept ever moist and supplied with fresh water by the spray from the breaking surf, which incessantly pounds that shore. Dr. Bartsch considers this an important observation, since the occurrence of fossiliferous laminae bearing marine organisms between sheets of lava has been held to indicate that they were deposited at or below sea level and their occurrence above this has been held as evidence of elevation. We have here an instance which indicates that this is not necessarily the case, for such a lamina would be produced if a new outpouring of lava were to cover up the place mentioned.

#### BOTANICAL EXPLORATION IN JAMAICA

In February, 1920, Mr. William R. Maxon, Associate Curator in the Division of Plants, United States National Museum, and Mr. Ellsworth P. Killip, aid, were detailed to make botanical collections in Jamaica. The expedition was made possible largely through the co-operation of the New York Botanical Garden, the Gray Herbarium of Harvard University, the Field Museum of Natural History, the University of Illinois, the Arnold Arboretum,



FIG. 61.—Windsor Plantation, south of Port Antonio.



FIG. 62.—Residence at Cinchona.



FIG. 63.—Higher peaks of the Blue Mountains as seen from the southwest; Mossman's Peak (unexplored) at the left, separated from Blue Mountain Peak (2,225 meters) by Portland Gap.



FIG. 64.—In the heart of the Blue Mountains. The denuded areas are landslips due to erosion in areas long under cultivation in coffee.



and Mr. Oakes Ames in contributing to the field expenses of the work. Two months were spent in the island, and upwards of 10,000 specimens were brought back, representing about 1,700 collection



FIG. 65.—Fern-covered bank on trail to Morce's Gap. The tree ferns in the center are *Cyathea pubescens*.

numbers. The material has been shared among the contributing institutions, the ferns and flowering plants having already been fully identified.



From headquarters in Kingston field-work was carried on in several widely separated parts of the island, the courtesy of free transportation on the Jamaica Railway having been extended by the colonial government. Through the kindness of Mr. J. G. Kieffer, general manager of the United Fruit Company in Jamaica, a house on the company's plantation at Windsor, in the rich banana region south of Port Antonio, was placed at the disposal of the party. About 10 days was spent here, trips being made to Mooretown, Mill Bank, Cuna Cuna Pass, and the northern foothills of the John Crow range.



FIG. 66.—A characteristic fern (*Dicranopteris bifida*), growing in vinelike masses near Morce's Gap.

The most productive period was one of three weeks in March, spent in the Blue Mountain region, with headquarters at the botanical station at Cinchona, the lease of which had been renewed by the Smithsonian Institution in January, 1920. Located on a projecting southern spur at an altitude of 1,500 meters, equipped with a serviceable laboratory and most comfortable living quarters, Cinchona served as an excellent base for botanical exploration in the Blue Mountain region, most of the peaks lying within fairly easy reach. Extensive collections were made on John Crow Peak, at New Haven Gap and Morces Gap, and in the vicinity of Cinchona, as well as on trips to Thompson's Gap, Hardward Gap, and the summit of Blue Mountain

Peak. Over 800 numbers were collected in this region. In preparation for a projected work by Mr. Maxon on the ferns of Jamaica, particular attention was paid to this group, nearly 200 species being here collected.

Other regions visited include Hollymount, on the upper slopes of Mount Diabolo, in the central part of the island, the coastal territory of Montego Bay, and the southern border of the "Cockpit Country," the last a wild, little inhabited, wooded area of innumerable limestone sinks lying southeast of Montego Bay. Collections at Cook's Bottom, Mulgrove, Mocho, and Ipswich yielded a number of new or otherwise very interesting species. Just before leaving Jamaica Mr. Maxon made a brief visit to Pigeon and Great Goat islands, lying off Old Harbour.

Much of the success of the trip is due to assistance extended freely by officials of the United Fruit Company, acknowledgment of which is gratefully rendered.

#### BOTANICAL EXPLORATION IN BRITISH GUIANA

Mr. A. S. Hitchcock, Custodian of Grasses, visited British Guiana, making the trip through the co-operation of the United States Department of Agriculture, the New York Botanical Garden, and the Gray Herbarium. He left New York, October 4, 1919, and arrived at Georgetown, October 22, stopping on the way at St. Thomas, St. Croix, St. Kitts, Antigua, Guadeloupe, Dominica, Martinique, St. Lucia, and Barbados. He left Georgetown, February 2, 1920, and arrived in New York, February 16, stopping four days in Trinidad and one day at Grenada.

Six weeks were spent at Georgetown, and other points along the coast; three weeks at the Penal Settlement on the Mazaruni River, from which were visited Bartica, Kalacoon, and Kartabo; two weeks on a trip up the Demerara, Essequibo, and Potaro rivers to Wismar, Rockstone, and Tumatumari; and ten days on a visit to the North-western District, including Morawhanna on the Barima River, Issorora, the Rubber Station on the Aruka River, and the Yarikita Police Station on the Venezuelan border.

Four sets of plants were collected including 1,134 numbers, with extra sets of the grasses. On account of the extremely damp climate it was necessary to use artificial heat in drying the specimens. Two oil stoves were kept burning night and day, the specimens being between corrugated paper. After drying, the plants were sprinkled with naphthalene powder to prevent subsequent molding.

British Guiana has an area of about 90,000 square miles, is about 400 miles deep, and extends about 250 miles along the coast (Lat.  $1^{\circ}$ - $8^{\circ}$  N., Long.  $57^{\circ}$ - $61^{\circ}$  W.). There are three counties: Demerara, including the drainage system of the Demerara River and to the Abary River on the east; Essequibo, including the drainage system of the Essequibo River and all to the west; and Berbice, including



FIG. 67.—St. Thomas. The wall is covered with coralita (*Antigonon leptopus*), an ornamental vine with handsome racemes of pink flowers. The palms are royal palms.

the drainage system of the Berbice River and east to the Courantyne River. Georgetown, at the mouth of the Demerara River, has a population of about 60,000. The only other city is New Amsterdam, at the mouth of the Berbice River, with a population of about 9,000. The entire population of the colony is about 300,000, about 4,000 of whom are whites. The bulk of the population consists of East

Indians (42.7 per cent) and negroes (39 per cent). The chief product of the colony is sugar, which, together with the by-products rum and molasses, constitutes about three-fourths of the exports. Other products are gold, rice, balata, timber, and cattle. The country is fairly healthy, the death rate being about 35 per 1,000 (14.8 per 1,000 among whites). Yellow fever is absent, but malaria and dysentery are prevalent.



FIG. 68.—Antigua. An old sugar mill. These old stone mills, formerly used for crushing the cane, are common on the islands. Oxen were attached to the long beam. The crushing or grinding is now done in modern sugar factories.

The rainfall at Georgetown is about 90 inches, with a dry season September to November, and another short dry season in the spring. The temperature at the same place is, in the daytime, about 88° F. in the summer, falling four to six degrees at night, and in winter four to six degrees lower. The temperature at night in winter rarely falls below 75° (the minimum record for 35 years is 69°).



The coastal region of the colony for 10 to 40 miles inland is a flat plain scarcely above sea level. Back of this there is a belt with hills



FIG. 69.—Georgetown, British Guiana. One of the main streets with rows of rain tree (*Samanca saman*).



FIG. 70.—Morawhanna, British Guiana. A typical village of the interior.

as much as 200 feet high. Toward the southwest the land rises and at the Venezuelan-Brazilian border culminates in the famous Mt. Roraima, a table mountain rising to a height of 8,500 feet. With

the exception of the savannas of the southern part of the country (Rupununi District) and a few other small areas, the whole country is covered with dense virgin rain-forest.

Communication in the interior is almost entirely by boat along the numerous streams, but unfortunately is hindered by falls and rapids above the influence of the tide (30 to 60 miles).



FIG. 71.—A giant mora tree (*Dimorphandra excelsa*) in the virgin forest of British Guiana, near Tumatumari. The base is broad and buttressed. Attached to the trunk is a species of *Marcgravia*.

The scientific activities of the colony are mainly under the control of Prof. J. B. Harrison, Director of Science and Agriculture, who extended to Mr. Hitchcock many courtesies.

The Jenman Herbarium, an important collection of British Guiana plants, is at the office of the director in Georgetown. There is an excellent botanical garden with a large collection of trees and shrubs, including a very fine series of palms.

COLLECTIONS OF LIVING ANIMALS FOR THE NATIONAL  
ZOOLOGICAL PARK

As in former years, friends of the Smithsonian Institution, while on expeditions abroad, collected and sent to Washington interesting living animals for the National Zoological Park.

Mr. W. J. La Varre, who has before made collections of this kind, visited South America and explored the upper waters of the Amazon.

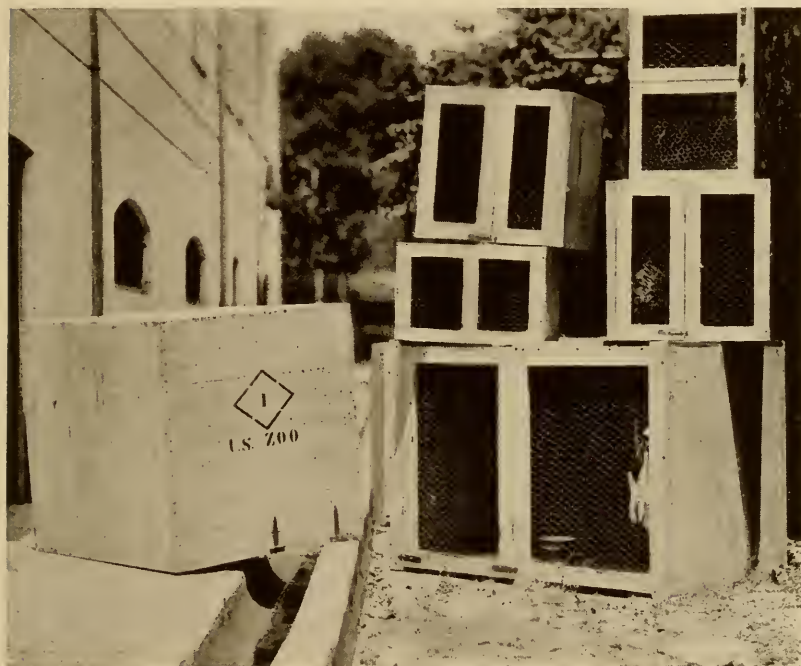


FIG. 72.—Animals for the National Zoological Park awaiting shipment at Manaus, Brazil. Photograph by La Varre.

He left the United States in June, 1919, and traveled directly to Manaus, Brazil, the jungle metropolis about 1,000 miles up the Amazon at the mouth of the Rio Negro. From Manaus he ascended the Rio Negro, by small steamer and launch, into Venezuela. He found much of interest, but no trace of the so-called "cannibals" of the region, or of anything savage, either beast or man. The natives, poor, half-breed rubber gatherers—Spanish, Portuguese, Negro, and Indian mixtures—treated him cordially and most hospitably, sharing their rude homes of thatch with him and giving him as much of their food as they could possibly spare. Six months were spent with these





FIG. 73.—Girls of the Rio Negro, Brazil. Photograph by La Varre.



FIG. 74.—Native Batalao of rubber gatherers, Rio Negro, Brazil. Photograph by La Varre.



kindly, primitive people, in geographical and zoological research, exploration, and hunting.

The general scarcity of mammal life along these famous rivers was surprising. So many rubber gatherers live here that the country has,



FIG. 75.—Border marker between Brazil and Venezuela, with government officials of both countries. Photograph by La Varre.

in fact, been hunted out, and the natives themselves are often hard pressed for food. Pacas and peccaries were plentiful, and numbers were shot for use in the camp. Tapir tracks were crossed several times, and small deer were occasionally killed by the natives.

Curiously enough, only two wild monkeys were observed, although examples of various species were commonly seen in the possession of natives. Birds, on the contrary, were plentiful—among the conspicuous species were toucans, curassows, macaws, and parrots. Mr. La Varre left the jungle in February, and arrived in the United States near the end of March, 1920. His collection of living animals, which he presented to the park, included a specimen of the rare black-headed ouakari monkey (*Cacajo melanocephalus*), a species never before represented in the collection. This monkey is a member of the



FIG. 76.—White-backed Trumpeter (*Psophia leucoptera*) from the Rio Negro, now in the National Zoological Park. Photograph by La Varre.

only genus of short-tailed monkeys inhabiting the New World, and is very seldom seen in captivity.

Other animals in the La Varre collection are capuchin and squirrel monkeys, an ocelot, two margay cats, egrets, a scarlet ibis, and a number of parrots and paroquets. A large living specimen of the rare and curious matamata turtle, a gift to the park from Mr. A. T. S. Hore, of Manaos, was brought home with the lot. Another American resident of Manaos, Mr. Edward B. Kirk, also contributed some interesting birds, among which was a fine specimen of the very rare white-backed trumpeter (*Psophia leucoptera*) from the Rio Negro.

A second collection of living Neotropical animals was brought to the park by Dr. William M. Mann, of the Bureau of Entomology, United States Department of Agriculture, who visited Honduras in the spring of 1920. Dr. Mann's duties in other lines naturally absorbed most of his time, but he succeeded in landing in good condition a number of valuable animals. His collection included pacas, agoutis, kinkajous, squirrels, a mantled howler monkey, and some reptiles, among which was a specimen of Rossignon's snapping turtle, a species rarely taken by collectors.

Other valuable animals were collected and presented to the park by Hon. Henry D. Baker, American Consul at Trinidad, British West Indies, and by Mr. Isaac Ellison, of Singapore, Straits Settlements. Mr. Ellison succeeded in landing and placing in the park a thrifty young male orang-utan, three years old. This is one of the most interesting and valuable gifts received in many years. The animal has now become thoroughly adapted to his new home and promises to become a most unusually attractive addition to the collection.

The National Zoological Park also shared in the large collection of African animals collected and brought to America for the New York Zoological Society by Mr. A. K. Haagner, director of the National Zoological Gardens at Pretoria, South Africa. Included in the lot received at Washington are a lechwe antelope and a specimen of the Rhodesian baboon, recently discovered and described by Mr. Haagner.

#### ANTHROPOLOGICAL EXPEDITION TO THE FAR EAST

Under the auspices of the Smithsonian Institution and in connection with the Rockefeller Foundation and the Peking Union Medical College, Dr. Aleš Hrdlička made an extensive trip to the Far East during the first half of 1920. The objects of this trip were continuation of the studies relating to the origin of the American aborigines; examination of the oldest skeletal and other human remains in Japan; the furthering of the interests of physical and medical anthropology in China; and a personal visit to the rapidly disappearing full-blooded Hawaiians. The countries visited included Japan, Korea, Manchuria, northern China, the boundary of southern Mongolia, and the islands of Oahu and Hawaii in the Hawaiian Archipelago.

In Japan especial attention was given on one hand to the physical characteristics of the people, and on the other to the prehistoric anthropological collections. The latter have by now assumed considerable importance. They are deposited in the universities and medical schools of Tokio, Kyoto, Sendai, Osaka, and Kumamoto,



FIG. 77.—Average types of Japanese children. Photographs presented by Mr. Tsunawo Araki.



and are being steadily added to by new explorations in prehistoric mounds and shell heaps. They date all from the Neolithic period, nothing earlier having thus far been discovered in eastern Asia; and they show both an old diversity, as well as more or less relation to the Aino and to the Japanese.



FIG. 78.—Japanese child.

In Korea special facilities were obtained for visiting the museum at Seoul, which was found unexpectedly rich in Korean and Turkestan antiquities. The people represent quite a distinct subtype of the yellow-brown stem from that of the Japanese as well as that of the Chinese; they are more like the western Siberian or southeastern Russian Tatars.

One of the most interesting features in Korea are the mound burials of the people. These mounds are all hemispherical, in contradistinc-



FIG. 79.—Of the best in Central Japan. Photographs presented by Mr. Tsunawo Araki.

tion to the conical mounds of Manchuria and northern China. They are of various sizes; they occur singly, in clusters, and in whole "cemeteries": they are frequently assiduously cared for, and many are most picturesquely located on the slopes of hills, where they appear to the best advantage. The Koreans are a modern race of mound builders. The country is full of archeological remains, including some big mounds and dolmens, and deserves much closer scientific attention than it has so far received.



FIG. 80.—A Korean Hamlet. From a few houses to large villages, they cluster in the nooks of the hills like mushrooms.

The Manchus and the northern Chinese, particularly those of the Chihli Province, are for the most part tall, well-built people, quite different in bearing and even in physiognomy from the southern Chinese, though there is no sharp delimitation. They, too, present a fruitful field for detailed anthropological investigation.

The southern or inner Mongolians were found to be a rather mixed lot, more so than the northern Mongolians who were visited by Dr. Hrdlička in 1912. A series of photographs was secured here as well as in Korea and Japan. In Japan, through the kind help of Dr. Tsunawo Araki, there was obtained a large collection of portraits

of Japanese children, while the Tokyo Dental College, through the good offices of Professor Mitsuru Okada, contributed several hundreds of portraits of its students.

China, for the anthropologist and archeologist, is one vast open museum, in which something of absorbing interest is met with at almost every step. In addition the people, and particularly the students in colleges, impress one with their native abilities. China in the future may well be relied upon to give the world many a philosopher and scholar of distinction.



FIG. 81.—Mounds near a Korean village. At sunrise on special days it is not unusual to find before each mound a prostrate figure in devotion before the grave of a father or mother.

The stay at Peking was principally devoted to assisting in the development of the medico-anthropological work at the Union Medical College, and the organization of the "Anatomical and Anthropological Association of China." The college has an excellent staff of well-trained young workers such as Drs. Cowdry, Black, Howard, and others, the majority of whom are seriously interested in those branches of anthropology which are nearest the medical sciences; and there are bright prospects for anthropological work in other parts of China, due to the presence there of English-speaking (mostly American)





FIG. 82.—Babies and their nurses at Sen Sen, Korea.



FIG. 83.—A young matron of a good family, with baby and servant, at Sen Sen, Korea.

medical missionaries, who are naturally interested in investigations of that nature.

While at Peking, certain investigations were carried on, with the help of Professor Davidson Black, on Chinese teeth; and a conference was held with the representatives of several Chinese ministries, as well as of the Chinese Geological Survey and the Peking Union



FIG. 84.—A Korean girl.

Medical College, on the subject of the foundation at Peking of a "Museum of Natural History of China," the establishment of which would mean so much for the progress of the Chinese themselves, and for facilitating the work of foreign men of science in the Chinese Republic. There exists already, under the direction of Dr. V. K. Ting, a very creditable geological museum, which could serve as a nucleus of the more comprehensive institution.



FIG. 85.—The surgical class at Severance College, Seoul, Korea,  
Dr. A. I. Ludlow operating.



FIG. 86.—Chunhuzes. A rare photograph of the North-Mongolian brigands.

On the return trip a stop was made at Hawaii, and with the kind assistance of the staff of the Bernice Pauahi Bishop Museum at Honolulu, and particularly of Dr. Gregory and Mr. Stokes, some studies were carried out on the native Hawaiians in several of the most favorable localities. It was found that the Hawaiians, even



FIG. 87.—Chinese woman with artificially deformed feet, at Peking. This crippling deformation is still extensively practised by the Chinese. A Chinese woman without deformed feet is not regarded as "*comme il faut*."

where free from historic admixture with whites or negroes, present an old blend of several ethnic elements (yellow-brown, Indo-European, and Negro or Negrito); this blend, however, has already reached a degree of approach to physical unity which permits the student to deal with it as with a racial subvariety or subtype. But this subtype is rapidly vanishing through new contacts.





FIG. 88.—Full-blood Hawaiian.



FIG. 89.—Full-blood Hawaiian.



FIG. 90.—Full-blood Hawaiian.



FIG. 91.—Full-blood Hawaiian.

## THE OJIBWA OF MINNESOTA

During the fall of the past year, Dr. Aleš Hrdlička was called once more to Minnesota to assist the Department of Justice in settling the subject of mixed bloods and pure bloods among the Ojibwa. (See *Smithsonian Explorations* for 1917.)

The whole work, now concluded, presents a good illustration of the practical value of anthropology in certain directions. The results are outlined in the following extracts from a letter to the Institution from Mr. R. C. Bell, Special Assistant to the Attorney General:

The Department of Justice in 1910 instituted approximately 1500 suits in the United States Court for the District of Minnesota involving Indian lands. This litigation to January, 1916, has cost the government a very large sum and little had been accomplished.

The blood status of the Indians became the determining factor and it was ascertained that all the available evidence (principally testimony as to genealogy) on this issue was found unreliable and always unsatisfactory. Consequently, the Department of Justice, in the spring of 1916, procured the services of Dr. Hrdlička to make a physical examination of the Indians and report his conclusions as to their status. The doctor spent more than three months in this work and examined approximately 800 individuals.

The Department of Justice, the Department of the Interior, and counsel for the defendants agreed to accept his findings as a basis for settlement, and the litigation now has been terminated, resulting in the recovery of more than \$1,000,000 in land and money for the Indians; besides, the cost of the work since 1916 has been insignificant in comparison to the cost prior to that time.

Furthermore, a commission was created by an Act of Congress to make a roll of the allottees of the White Earth Reservation. The law required, in addition to much other information, that the blood status of the Indians be given. This roll, which affects the title to approximately 725,000 acres of land, has been completed; and the commission in preparing it followed the findings of the doctor. Only those thoroughly familiar with the situation can appreciate the far-reaching importance of this work.

## FIELD-WORK ON THE MESA VERDE NATIONAL PARK

The Chief of the Bureau of American Ethnology, Dr. J. Walter Fewkes, continued his field-work on the Mesa Verde National Park, Colorado, during June, August, and September, 1920, in cooperation with the National Park Service of the Department of the Interior. Excavation and repair work was done on the Fire Temple Group and Oak Tree House, ruins in Fewkes Canyon and at Cedar Tree Tower, situated about a mile north of Spruce Tree House, leading to important contributions to our knowledge of the culture of cliff dwellers.

He was ably assisted in this work by Mr. J. A. Jeancon, who made the originals of the ground plans of the Fire Temple Group and Cedar Tree Tower here published.

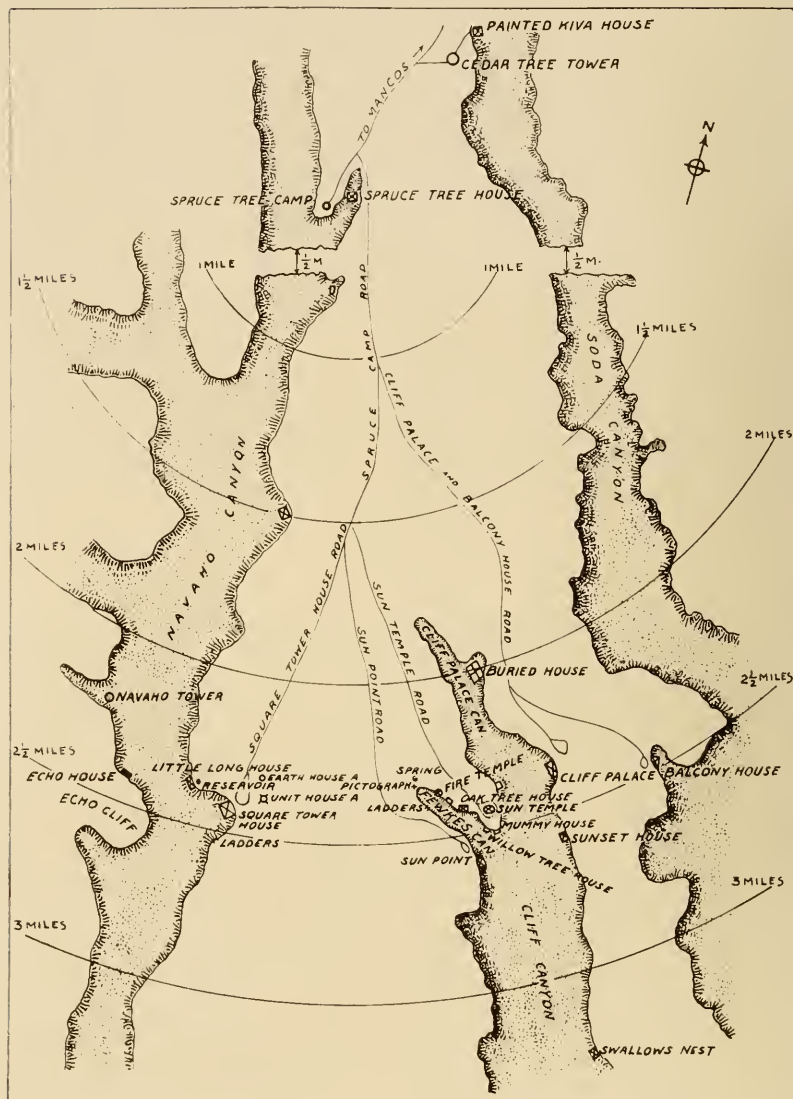


FIG. 92.—Map of Sun Temple Area in the Mesa Verde National Park, Colorado.



The opening of Sun Point Road along the south rim of Fewkes Canyon (fig. 92) is a most important addition to the park from the tourist's point of view. For about a quarter of a mile along this road one can look down into Fire Temple (fig. 94) and Fire Temple House, Oak Tree House (fig. 103), and the two ruins under Sun Temple, the walls of one of which, Willow Tree House, are in the same condition as when the cliff dwellers left the mesa: the other,



FIG. 93.—Ladders into Fewkes Canyon from Sun Point Road, opposite Fire Temple. Photograph by G. L. Beam. Courtesy of the Denver and Rio Grande Railroad.

Mummy House, on a lower level, is notable for its fine masonry. On the point across Fewkes Canyon, rise in full view the walls of Sun Temple, and beyond it, nestling in the cliff, is the magnificent Cliff Palace. The fine cliff dwelling Sunset House ("Community House"), a prominent ruin in Cliff Canyon, is likewise conspicuous. The road along Fewkes Canyon from which these prehistoric buildings are visible has already become a very popular drive, being only about two and a half miles from Spruce Tree Camp. The accom-

panying map (fig. 92) shows the relative position and approaches to the above mentioned ruins. A fine trail, one of the most beautiful in this area, was developed under the north rim of Fewkes Canyon, to



FIG. 94.—Fire Temple from Sun Point Road. Photograph by G. L. Beam. Courtesy of the Denver and Rio Grande Railroad.

connect the above ruins. Three ladders (fig. 93) placed in the cliff opposite Fire Temple enable the traveler to reach this trail, which ends in ladders on the canyon rim opposite Cliff Palace near the point

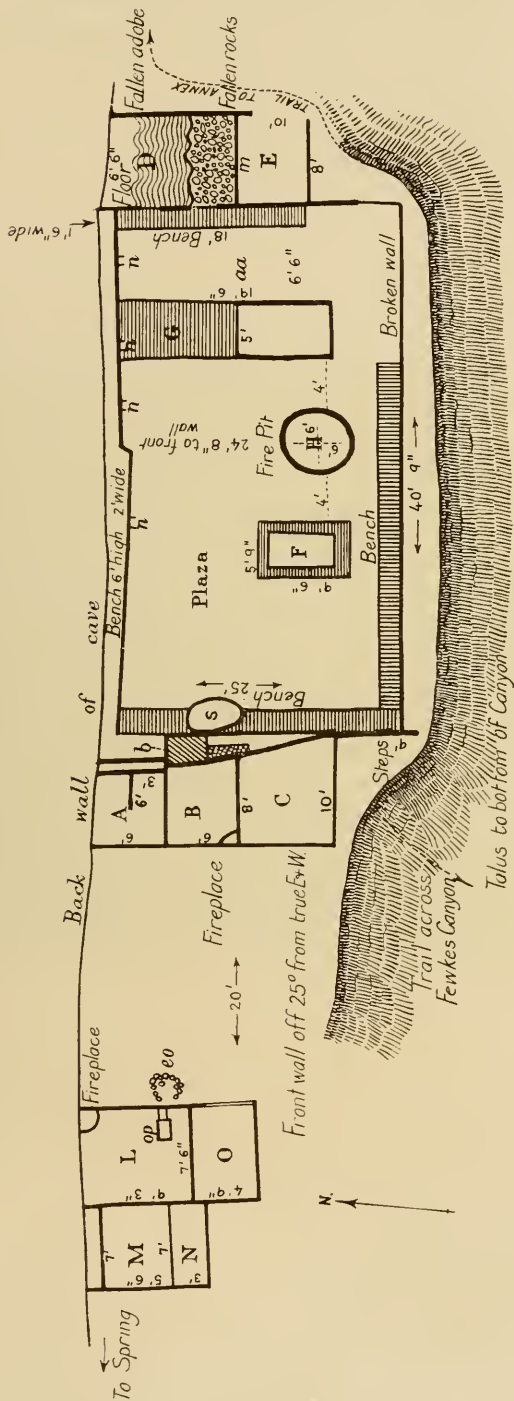


FIG. 95.—Ground plan of Fire Temple.

where the discoverers stood when their eyes first beheld this most impressive cliff dwelling of the Southwest.

The most important discovery of the past season was the determination by excavation that a large cliff house was not a dwelling, but specialized for some communal purpose. This ruin (fig. 98) was devoted to fire worship, a cult which up to this year, although suspected, had not been demonstrated as existing among cliff dwellers—at least no specialized building for that function had been recognized.

In 1915 there was discovered on the promontory opposite Cliff Palace a building with semicircular ground plan that was interpreted



FIG. 96.—Western end of Fire Temple Court, half excavated. Photograph by Fewkes.

as a specialized religious structure and called Sun Temple. While work on it was in progress a reconnoissance was made of cliff houses situated in the canyon below, to one of which was given the name Painted House. Like Sun Temple, it was suspected of having also been dedicated to some religious cult of the cliff dwellers, but its true significance was not apparent until the spade of the archeologist last season verified this suspicion and revealed its true purpose. Painted House, upon excavation, proved to be one of the most exceptional cliff ruins yet recognized in the Southwest. The results of the excavation have led Dr. Fewkes to designate it Fire Temple, and by



implication to regard it a temple of the eternal fire. Attention should be called to the importance of the discovery that the cliff dwellers had a New Fire Cult and possibly that rites of new fire and conservation of the same existed among prehistoric people of the Mesa Verde.

The rites of kindling the new fire among the descendants of the cliff dwellers, as the Hopi, occur in July and November and are known as the Lesser and Greater fire ceremonials. The act in both is performed by means of a fire stick or drill made to rotate in a



FIG. 97.—Eastern end of Fire Temple Court. Photograph by G. L. Beam. Courtesy of the Denver and Rio Grande Railroad.

notched board; the same kind of fire sticks have been found in Spruce Tree House, Square Tower House, and elsewhere.

Probably it is to the Lesser Fire ceremony at the East Mesa of the Hopi that we should look for the nearest survival of the cliff dweller's rite, as in it we find the personation of a phallic being, Kokopelli, whose picture was well preserved up to a few years ago on the wall of the secret chamber of the Fire Temple where fire was created. This Lesser New Fire, called Sumykoli, is celebrated by a fraternity of fire priests, now extinct, known as the Yaya priesthood. The Yaya priest at Hopi carries in his hand during this ceremony a rattle of

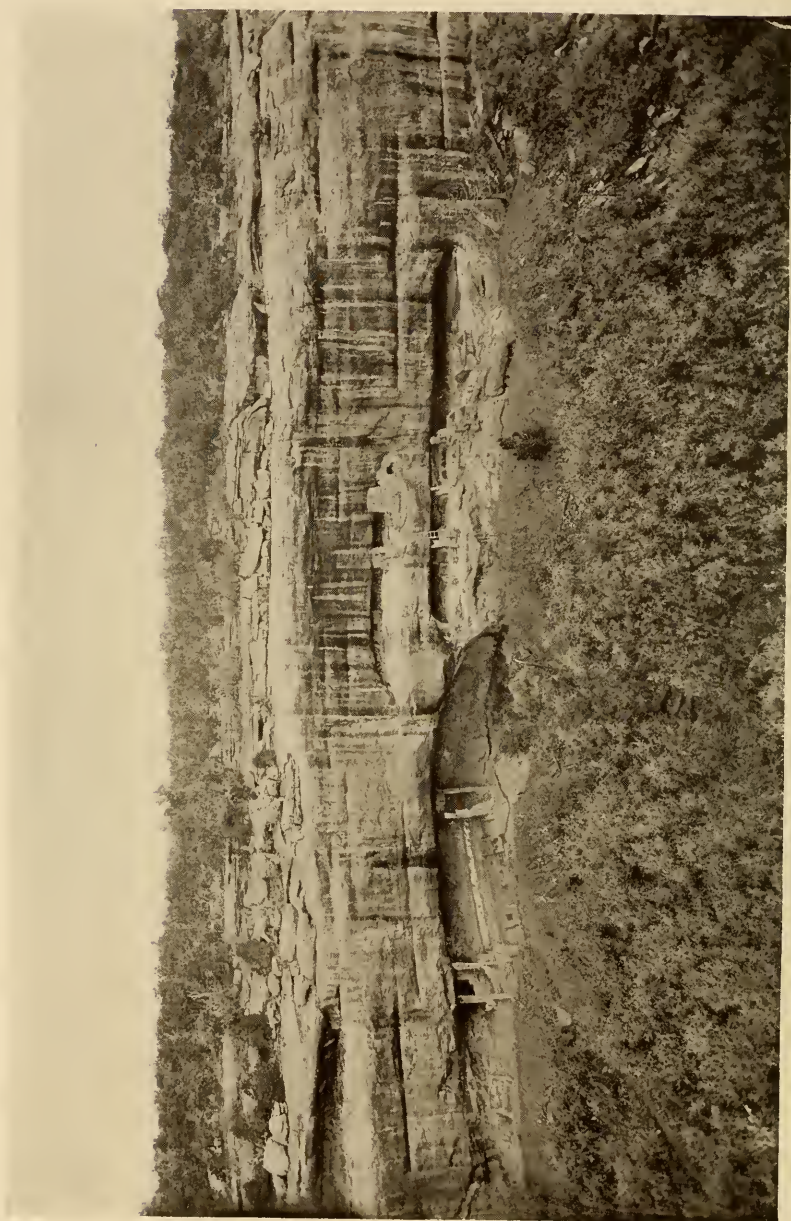


FIG. 98.—Fire Temple Group of Ruins. Photograph by G. L. Beam.  
Courtesy of the Denver and Rio Grande Railroad.

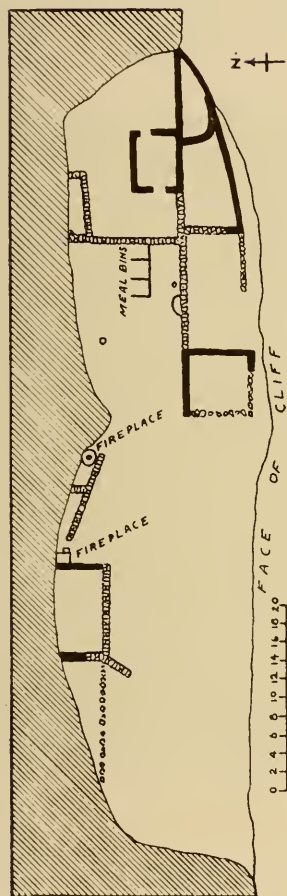


FIG. 99.—Ground plan of Upper Cave of Fire Temple House.

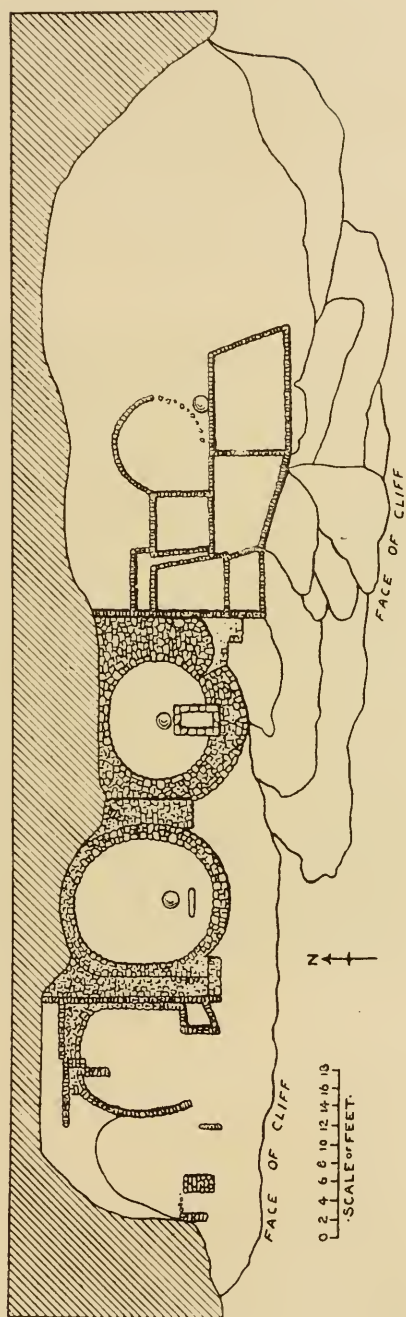


FIG. 100.—Ground plan of Lower Cave of Fire Temple House.



exceptional construction. Two of these, now in the museum of the Brooklyn Institute, were found in a cliff dwelling in the Chelly Canyon, which seems to indicate that there formerly existed among the cliff dwellers of that canyon a fire priesthood like the Hopi Yaya. As the cliff dwellers of Chelly Canyon and those of the Mesa Verde were closely related it is a fair conclusion that the latter also had a well-developed New Fire Cult, and possibly a Yaya priesthood.

The masonry of Fire Temple points to an early epoch in the evolution of the Mesa Verde culture, possibly one contemporary with the



FIG. 101.—Western end of Fire Temple Court. Photograph by G. L. Beam. Courtesy of the Denver and Rio Grande Railroad.

first settlement in Cliff Palace cave, but anterior to the erection of the unfinished Sun Temple, which marks a later or culminating phase of cliff house development. Architectural features that Fire Temple shares with Sun Temple may be interpreted by the close relationship of fire and sun cults among the cliff dwellers. Earth Lodge A, excavated in 1919, is the ancient type in the evolution of buildings on the mesa antedating stone walls, and there are evidences of successive stages illustrating cultural epochs from the crude Earth Lodge A, which the earliest colonists constructed, to those of horizontal ma-



sonry (fig. 108), the highest products of the mason's craft in pre-historic North America. This evolution may have occurred on the area now reserved as a national park, but was not limited to it.

After the abandonment of Fire Temple and the desertion of buildings of the culminating epoch that followed, people of like culture may have still inhabited the great pueblos at Aztec and in the Chaco. But these in time also succumbed and were deserted before the arrival of the white man. Their descendants were amalgamated with nomadic or non-pueblo peoples and their survivors still inhabit the modern



FIG. 102.—Bins for grinding corn in upper cave of Fire Temple House. Photograph by J. A. Jeancon.

pueblos along the Rio Grande. Both blood and culture suffered changes in this mixture, and architectural features remain to especially indicate the modifications. The Hopi, Zuñi, and modern Rio Grande pueblos have no specialized buildings like Sun Temple nor Fire Temple for sun or fire cults, although they have ceremonial rooms where they formerly kindled the new fire annually. They no longer conserve the fire in this room, but there are legends that they did so in former times, pointing to a remote cultural connection between the cliff dwellers and their modern survivors, the Pueblos.

The general form and arrangement of rooms at the east and west ends of the central court of Fire Temple differ from any cliff ruin or pueblo in the Southwest. Significant facts show that the building (fig. 97) is unique, as will readily appear from the following statements. Excavations in other cliff houses of the same size reveal household utensils, as pottery, and other domiciliary objects. No cooking places, grinding bins, or household implements were found in the extensive work at Fire Temple. Moreover, every cliff house of size on the Mesa Verde has one or more specialized gener-



FIG. 103.—Oak Tree House from Sun Point Road. Photograph by G. L. Beam. Courtesy of the Denver and Rio Grande Railroad.

ally circular subterranean rooms for ceremonies. There were no kivas in Fire Temple. But the one exceptional positive feature in this ruin that separates it widely from the cliff dwelling is stronger than these negative evidences. In no cliff house, and indeed in no pueblo, do we find a similar large circular fire pit filled with ashes in the center of a rectangular court. This structure would seem to be the key to the meaning of the whole building. That great fires were once built in this fireplace, as the abundant ashes indicate, no one can doubt. This fireplace is too large for an oven for culinary purposes and although we know that the cliff people sometimes cremated the dead the absence of calcined human bones would disprove the theory that

it was used as a crematory. A natural conclusion would be that it was constructed for ceremonies connected with fire.

The significance of the two low-walled rectangular enclosures one on each side of the central fire pit, is unknown. Each was partially filled with soil and ashes when excavated and it is suggestive to record that the stratum of earth above them as well as the whole surface of the hardened floor of the court was filled or covered with charcoal and burnt brush. Great fires must have raged over the



FIG. 104.—Cedar Tree Tower before excavation. Photograph by J. A. Jeancon.

whole court in addition to that in the fireplace, after the temple was deserted.

We find several other facts that fit in very well with the interpretation that this building was a fire temple. On the east and west ends of the court (figs. 97, 101) there are banquettes, the former evidently seats for those who watched the ceremonial performance in the court. There are niches in the rear wall where possibly sacred objects may have been placed; a wall of the cliff bears triangles and zig-zag paintings, symbols of sex life; but, most important of all, on the wall of one of the rooms at the west end of the court there are paintings in red,



one of which, now erased, represented a phallic being still associated with New Fire ceremonies among the Hopi, while others represent fire itself. At the New Fire ceremony among the Hopi one of the four fraternities that celebrate it is the order of Horn Priests, who wear on their heads imitations of the horns of mountain sheep. A large number of paintings of mountain sheep cover the walls of the west room of Fire Temple where fire was supposed to be kindled.

The massive walled buildings at the east and west (fig. 94) ends of the court formerly reached to the roof of the cave, and although two stories high no wooden beams for flooring occur in their con-



FIG. 105.—Cedar Tree Tower after excavation. Photograph by J. A. Jeancon.

struction. Wherever a lower story existed it was filled in with rubble on top of which was laid an adobe floor. On the white plastering, which is well preserved, there are numerous figures in red, mostly triangles and symbols of lightning; female and male symbols similar to those in sacred rooms.

Just west of Fire Temple there is a group of rooms from which utensils were excavated. In the floor of one of these rooms is a vertical shaft which opens outside the house walls like a ventilator. The former use of this structure is unknown.

Although Fire Temple was not inhabited there were undoubted dwellings nearby. A hundred feet east of it there are two low caves, one above the other, in which may have lived those who once made



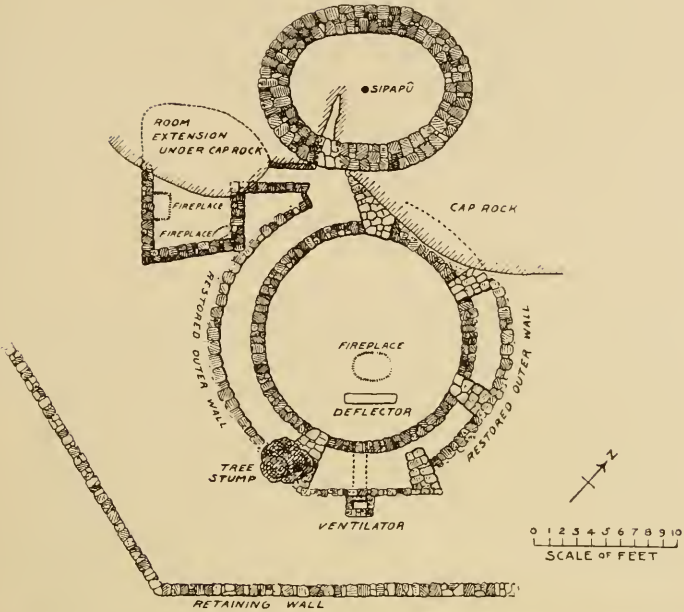


FIG. 106.—Below, Cedar Tree Tower and kiva; above, ground plan of Cedar Tree Tower and kiva. Photograph by G. L. Beam. Courtesy of the Denver and Rio Grande Railroad.

use of this sanctuary. Dr. Fewkes has called the ruin (fig. 98) situated in these caves the Fire Temple House and supposes it was the habitation of the fire priests and their families. The rooms in the lower cave were fitted for habitation, and it had two, possibly three, circular ceremonial rooms; but the upper cave (fig. 99) is destitute of kivas. The large rooms of the upper house (fig. 100a) may have been granaries for storage of provisions, although possibly some of its rooms were inhabited. In the rear of the large rooms identified as granaries was found a small room with a well-preserved human skeleton accompanied with mortuary pottery. One of these mortuary offerings is a fine mug made of black and white ware beautifully decorated; a specimen worthy of exhibition with the best in any museum. In the rear of the cave were three fine grinding bins (fig. 102), with metates still in place.

The upper house is now approached from the lower by foot-holes in the cliff and a ladder shown in the illustration. Evidences of a secondary occupation of kivas in the lower house appear in double walls and those of crude masonry without mortar, forming a rectangular room built diagonally across the room. The plastering on the rear walls of the lower house is particularly well preserved, but there are very few rooms in addition to the kivas. One of the kivas has in place of a deflector and ventilator shaft a small rectangular trench enclosed by a well-made wall, as in Sun Temple.

Work was done on the large cliff ruin, Oak Tree House (fig. 103), on the trail an eighth of a mile east of Fire Temple Group. Three new kivas were excavated to their floors and the walls repaired, adding to the four already known. No signs of these buried kivas were visible when work began. All these kivas show fine masonry; after the most easterly had been used as a sanctuary for a time it was abandoned and five well-preserved grinding bins were set in the floor so as almost to conceal it. The upright slabs of stone and metates of these structures were reset, showing fine examples of these prehistoric mills. Many other novel features were brought to light in the excavation of Oak Tree House, which may be regarded as one of the most instructive ruins of the park. One of the exceptional features of Oak Tree House is a fragment of a circular wall in the rear of the cave, made of willow and other sticks set in mortar, like what is called "stick and adobe" construction in other regions.

The ground plan of one of the kivas is semicircular and shows a rectangular room on the straight side communicating with the chamber by means of two passageways. The ventilator opens directly into this room, whose function is unknown.

In one of the grinding bins there was excavated a bundle of grass, *Koeleria cristata*, of exactly the same form as the brushes with which Hopi maidens sweep their metates after grinding meal; one more resemblance between cliff dweller and Hopi customs.

In his classic on the "Cliff Dwellers of the Mesa Verde," Baron G. Nordenskiöld figured and described a nameless ruin designated a tower (fig. 104), situated in the cedars about a mile north of Spruce Tree House. To this ruin the author has given the name Cedar Tree



FIG. 107.—Section of floor of Cedar Tree Tower, showing ceremonial opening. Photograph by J. A. Jeancon.

Tower, on account of an ancient cedar tree (fig. 105) hanging over the top of the north wall. Nordenskiöld closes his brief description with the remark, "Perhaps it should be regarded a religious building."

The desirability of testing this surmise of the talented Swede led the author, in August, 1920, to excavate this tower and the area about its base, which led to the discovery that although it appeared to stand alone there were two subterranean rooms connected with its base situated on the west and south sides. The larger of these rooms (fig. 106) had all the structural features of a typical kiva of a Mesa Verde cliff dwelling. This subterranean structure, its floor excavated

in solid rock, was circular with pedestals for supports of a roof, the beams of which were absent, and had a central fire hole, ventilator, and deflector. It communicated with the tower by a subterranean



FIG. 108.—Square Tower House. Photograph by G. L. Beam. Courtesy of the Denver and Rio Grande Railroad.

passage which bifurcated, one branch opening through the tower floor, the other into a square room situated on the southwest side, also subterranean, partially constructed under a large rock forming a





FIG. 109.—Yucca House National Monument, Lower House; Mesa Verde in the distance. Photograph by W. H. Jackson. Courtesy of the U. S. Geological Survey.

veritable cliff chamber. In the middle of the solid rock floor of the tower which served as the foundation of the tower walls a circular hole or *sipapû* (fig. 107), symbolic of the entrance to the underworld, had been drilled, affording evidence that the tower was used for ceremonials. A distant view down Soda Canyon may be had from the top of the tower, although it is situated some distance from the rim of the mesa and shut in by a dense growth of cedars and pinyons.

An automobile road constructed around Cedar Tree Tower was continued through the cedars to join the Mancos road. Several ladders were placed in position and a trail opened down the steep wall of Soda Canyon from Cedar Tree Tower to Painted Kiva House, an instructive cliff dwelling about a quarter of a mile away, formerly practically inaccessible. To the west of the Mancos road about the same distance from Spruce Tree House as Cedar Tree Tower there is another tower of the same type, but with walls of adjacent rooms projecting above ground. Several other similar towers have been reported on the mesa, in the Mancos, McElmo, and Hovenweep Canyons, and elsewhere. The relation of a tower to kivas and other buildings of Square Tower House is shown in figure 108.

A preliminary examination was made of the ruin at Aztec Springs now called Yucca House National Monument, in the Montezuma Valley, with a view to future excavation and repair of this important site. As no satisfactory photograph of this ruin has ever been published a view of the Lower House of this ruin taken in 1874 by W. H. Jackson is by his permission given in figure 109. It is planned to begin work on the Lower House of this great ruin in the spring of 1921.

#### FIELD-WORK AMONG THE HOPI INDIANS

Dr. Walter Hough, curator of ethnology, U. S. National Museum, spent the month of June among the Hopi Indians of Arizona, a tribe with which he has been associated for 25 years. At present some of the Hopi tribes are making rapid progress toward assimilating the culture of the white man, while others; though becoming more and more affected, show changes to a lesser degree. As these changes have taken place through peaceful assimilation and were not forced by war or other disruptive agency they present an interesting field for ethnological research on normal modifications of social structures due to contacts. Some notes on this subject are appended.

#### MATERIAL WELFARE

The Hopi have prospered during the last quarter of a century. From the period when they knew almost nothing of money the Hopi

have advanced to a complete familiarity with United States currency. Purchases can be paid for with check. Some of the more advanced have bank accounts. The Hopi were always acquisitive and frugal, and their habits have put them in a rather good financial condition. Their agricultural products have had a better market and the prices are less subject to the former fixed low valuations of the local trader.

#### SOCIAL CHANGES

The most effective cause of social changes was the enforced attendance of children at government schools and the sending of children to distant Indian schools. Causing considerable friction at first, this has now been accepted in most cases as advantageous.

A result not prevised is the weakening of the clan discipline whose former regulative authority was silent but powerful. The weakening of this authority produced much laxity for a time and it was found necessary to appoint policemen and a "judge." The government found it necessary to send away girls not noticeably under parental discipline to schools until they should become discreet. This measure was quite opportune and had a beneficial effect.

#### DECAY OF NATIVE CEREMONIES

In this connection there is ensuing a rapid decay of native ceremonials. The heaviest loss to the native cult is felt by the death of the old men of a former generation. Very shortly there will be no one of the tribe who has not had training in school and more and more of these will evade the call of the native religion.

Some fraternities have suspended operation and others are very weak. Notably the woman's harvest ceremony at Walpi has passed out and the Snake Society there is about to discontinue.

#### CHRISTIANIZATION

Missions to the Hopi were carried on from time to time during a period of several hundred years without appreciable results. When the disintegration due to government control had progressed missionary efforts began to bear fruit.

The Baptist mission at Polacca has a stone church and a considerable and growing number of converts. Other branches of this mission are doing well.

A slight cleavage is observed between the Christians and non-Christians but no friction. The Hopi are agreed to let things work out as they will.

ARCHEOLOGICAL INVESTIGATIONS IN UTAH, ARIZONA, AND  
NEW MEXICO

During May and early June, 1920, Neil M. Judd, curator of American archeology, United States National Museum, continued his archeological reconnoissance of the arid region north of the Rio Colorado, Arizona, in behalf of the Bureau of American Ethnology. Attention was chiefly directed to the Toroweap Valley and several caves in an extensive lava flow on the east slope of Mt. Trumbull; to the unwatered mesa known as Pariah Plateau; to certain portions of House Rock Valley not previously visited<sup>1</sup> and to the upper two-



FIG. 110.—Ruin surmounting a circular butte of white sandstone near the eastern rim of Paria Plateau and not far from the Rio Colorado. Note the upright slabs in the foreground—a frequent feature of prehistoric dwellings in this region.

thirds of Bright Angel Creek. In addition, a number of caves in Cottonwood Canyon and Kanab Creek, Kane County, Utah, were examined for evidence of ancient habitations.

In Bright Angel Creek several open ruins and three groups of cliff houses were inspected; a complete survey was found impossible on account of unexpected high water which prevented access to the narrow, walled-in portion adjoining the Grand Canyon of the Colorado.

In contrast to the conditions which were encountered in this beautiful gorge, lack of water and forage for pack animals seriously

<sup>1</sup> Smithsonian Misc. Coll., Vol. 70, No. 2, 1918.





FIG. 111.—Cliff dwellings on the west side of Bright Angel Creek, above the mouth of Beaver Creek. Through the doorway of the right-hand room will be seen a bench, made from a cottonwood log, which forms an unusual feature of the ruin.



FIG. 112.—A group of small storage cists near several ancient ruins at the foot of the upper falls, Ribbon Falls Canyon, Bright Angel Creek. The inaccessible cliffs surrounding this section of the canyon form an amphitheater whose narrow entrance was guarded by a second fall over one hundred feet in height.

restricted investigations in the other sections above noted. The hurried inspection of the Mt. Trumbull region was made in an automobile, it being impracticable to use horses in this parched country during the summer months. Exposed pueblo ruins bordering the east rim of Pariah Plateau and overlooking the Painted Desert proved more numerous than was anticipated. In size, in arrangement of rooms and in the quality of their masonry these ancient dwellings are superior to those seen elsewhere in northwestern Arizona; likewise, potsherds examined at each site exhibit greater perfection of form and a higher decorative technique. These two factors—architectural

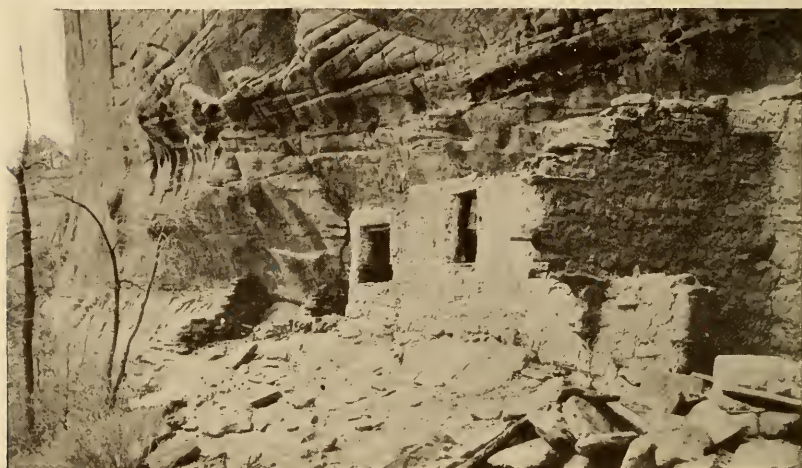


FIG. 113.—Part of a cliff village in a cave on the east side of Cottonwood Canyon, near Kanab, Utah. The village includes nineteen rooms and a nearby spring furnished excellent water for the ancient inhabitants.

and ceramic remains—alone are sufficient to connect the former inhabitants of this region with the pre-Puebloan peoples east of the Rio Colorado and to warrant the expectation that additional investigations will disclose the approximate points at which the Colorado River was crossed in ancient times.

Following his researches for the Bureau of American Ethnology, Mr. Judd proceeded to New Mexico as director of an archeologic reconnoissance of the Chaco Canyon National Monument. This survey was conducted under the auspices of the National Geographic Society and had for its prime object close examination of the aboriginal remains in the above monument with a view toward selec-

tion of a possible site for exhaustive investigation and permanent repair.

The Chaco Canyon National Monument was created by presidential proclamation March 11, 1907, and includes 18 major ruins of very great significance in the study of ancient Pueblo life. Unlike the vast majority of cliff houses and other ruins found elsewhere, each of these huge buildings was constructed along preconceived plans



FIG. 114.—Grand Canyon of the Colorado from the lower Toroweap valley, southeast of Mt. Trumbull. Evidence of prehistoric habitations were not lacking in this region but the dwellings were widely separated and poorly preserved.

and as a community enterprise. The studied arrangement of their rooms and the perfection of their masonry rank them as the very finest examples of prehistoric architectural accomplishment in the United States. Not only did the ancient inhabitants of Chaco Canyon excel as builders with stone, but the lesser objects, found in and about the great communal dwellings, show that they had attained remarkable skill as makers of pottery, ornaments and implements of various





FIG. 115.—The north wall of Pueblo Bonito, viewed from the northeast. This is the largest and justly the most famous of all the Chaco Canyon ruins; it covers nearly three acres of ground and some of its walls still stand to a height of forty feet. When occupied Pueblo Bonito probably contained as many as 800 rooms, sheltering over 1200 individuals.



FIG. 116.—The north-central portion of Pueblo Bonito, from the southeast, showing its position relative to the north wall of Chaco Canyon. Sections of fourth story walls appear in the above illustration. Like most of its neighboring ruins, Pueblo Bonito was constructed in a series of terraces overlooking a central court or plaza; the outer wall was pierced by small windows above the first floor but had few doorways.





FIG. 117.—A portion of Kimmenioli ruin, showing the present condition of its walls. About 135 ground floor rooms are still traceable; originally the building was three, perhaps four, stories high. Although one of the finest in the national monument this great communal dwelling is not so well known as some of its neighbors in Chaco Canyon which is situated some ten miles to the north and east.



FIG. 118.—Pueblo del Arroyo, occupying an insecure position on the very edge of Chaco wash, 300 feet west of Pueblo Bonito. Flood waters have exposed the remains of an older dwelling beneath the walls of the larger structure and now threaten the latter. View from the north.

sorts. The beauty and technique of such specimens warrant the belief that these canyon dwellers had reached a plane of esthetic as well as social development not surpassed elsewhere in the Southwest.

Although the 18 major ruins constitute the main feature of this national monument there are, in addition, hundreds of "small house" remains scattered throughout the entire Chaco Canyon district. In culture as well as in architecture these lesser dwellings were closely allied to the larger structures. Talus pueblos and small cliff houses are to be found along the north side of the canyon; elsewhere the mud walls of a "pit house" have been disclosed—a crude, semi-



FIG. 119.—Part of Pueblo Pintado, as seen from the northwest. This ruin was visited by Lt. J. H. Simpson, August 26, 1849, on his memorable advance into the Navaho country; the large timbers noted by Simpson and other early explorers have since been torn from the walls, causing obvious destruction to the latter.

subterranean shelter—older than any of the other habitations yet observed in this region. Certain it is that comprehensive investigations in the Chaco Canyon drainage will add largely to present knowledge concerning the prehistoric pueblo peoples of the southwestern desert country.

#### MUSIC OF THE PAPAGO AND PAWNEE

In February, 1920, Miss Densmore went to the Papago Reservation in southwestern Arizona to continue her study of Indian music for the Bureau of American Ethnology, residing for more than four

weeks at a government station called San Xavier Mission. The Papago tribe was selected partly because of its desert habitat (fig. 120), the intention being to compare the phonographic records of Papago songs with those of Arabian songs obtained from Arabs who were temporarily in Washington, D. C. (Subsequent results proved the value of this comparison.) According to the last census there are 7,465 Papago Indians on the reservation, but not one "mixed-blood" family. It is said further that there has never been any intermarriage between this tribe and Mexicans or Spanish. Their manner of life is becoming modified, but many primitive customs remain and were observed. A primitive burial place was found by Miss Densmore.



FIG. 120.—Habitat of Papago Indians. (Photograph by Miss Densmore.)

These burial places were constructive on the side of a mountain and consisted of low walls of rocks, roofed with timber and tightly closed with stones. Bodies were removed after a time to make room for other burials. A skull and a few bones remained in the tomb examined.

The subjects studied were: (1) Songs used in treating diseases caused by spirits of dead Apaches and Papago; (2) songs connected with the "purification" of returned warriors who had killed Apaches, and (3) songs connected with dreams, games, and dances. Musical instruments formed a subject of special investigation. A native flageolet was obtained (fig. 12) together with the tradition concerning its origin. The music of this instrument was phonographically recorded and has been transcribed. The Papago beat upon an over-



FIG. 121.—Papago playing on native flageolet.



turned basket instead of a drum, striking the basket with the palms of one or both hands. "Rasping sticks" are sometimes used with such a basket, as shown in figure 122.



FIG. 122.—Papago and native musical instruments.

After a brief stay in Phoenix, Arizona, Miss Densmore went to Camp McDowell (formerly Fort McDowell) and was present at a

gathering of Mohave Apaches, explaining her work and securing their consent to record songs on a subsequent visit. The adobe buildings of the old fort are in ruins, but a few of the smaller and more substantial buildings remain.

From Arizona Miss Densmore went to Pawnee, Oklahoma, arriving April 12, a few days before the Morning Star Ceremony. This is one of the most important ceremonies of the year as it is held for the purpose of securing good crops. At this time the "Morning Star Bundle" is opened and its contents displayed for several hours, while the proper rituals are sung. Miss Densmore was allowed to enter the lodge for a brief time and to view the sacred articles (it is said



FIG. 123.—Pawnee lodge of Morning Star Ceremony. (Photograph by Miss Densmore.)

only one other white person has been accorded this privilege). During the remainder of the ceremony, which lasted many hours, she stayed outside the lodge (fig. 123) and make manuscript notes of the songs. An approach to two-part music, heard at this time, had not been previously observed. While at Pawnee a sufficient number of songs was recorded to complete the musical study of that tribe.

In November, 1920, Miss Densmore returned to Arizona to resume work among the Papago. The principal work was done at Vomari, a point near the Mexican border and 80 miles from the railroad. Interesting material was collected also at Sells, formerly known as Indian Oasis. Among the subjects studied were: (1) The Papago expeditions to the Gulf of California for salt and for "medicine power,"

each sort of expedition having its songs; and (2) the rain-making ceremonies, including the manufacture of tizwin. In connection with the latter a visit was made to Santa Rosa, at the extreme north of the reservation, where a tizwin camp and lodge were photographed. A specimen of the cactus syrup used in making tizwin was obtained, as well as a large basket which had been used in serving this wine.

Many sites of legendary or geographic interest were photographed. Miss Densmore travelling more than 360 miles by auto on this trip.

The most important result of this expedition was the hearing of a form of three-part music at a Papago dance. This was said to be a native musical custom. So near an approach to polyphonic music has not been hitherto observed by Miss Densmore and the subject will receive further investigation.

#### OZARK CAVES AND MOUNDS IN MISSOURI

During the summer of 1919 the work of cave exploration in the Ozark region was continued by Mr. Gerard Fowke, for the Bureau of American Ethnology. Almost his entire time was given to a thorough examination of two large caves in Pulaski County. The first, known as Miller's cave, is three miles northeast of Big Piney postoffice. The opening is in the vertical face of a high cliff fronting Big Piney River, with a steep talus slope beginning 30 feet below the floor of the cave and extending to the water's edge. The perpendicular wall below, with a projecting ledge which forms the roof, prevents a direct entrance, and the interior can be approached only through another cave whose opening is in a ravine near by. A narrow passage, barely large enough to admit a man in a crawling or crouching position, connects the two, and it is only through this that access can be gained to the main cave. The inmates were absolutely safe from molestation, as one man could defend this opening against any number. A little stream flowing along the foot of the east side of the cavern ensured a supply of water at all times: game was plentiful in the neighborhood: the river abounded in fish; and fertile, level bottom lands, easily cultivated, on either side of the stream furnished much corn and other farm products.

A ditch and embankment across an isthmus guarded a peninsula on the opposite side of the river, and on both sides low house mounds and abundant debris furnished proof of two large village sites. Whether there was any connection between the villages and the cave dwellers cannot be determined.

A bed of clean, pure ashes whose depth ranged from 3 to 6½ feet, according to the irregularities of the clay, was found in the cave

reaching from wall to wall, a width varying from 45 to 70 feet. This bed was so loose as to be almost like a snow bank; but for the most part they were as compact as if much trampled over while wet. When solidly packed, the mass would measure fully 800 cubic yards in volume; but when loosened by excavation, 200 cubic yards more. All the wood had to be carried from either the top or the bottom of the hill, which is about 400 feet high, and passed through the small opening from the other cave. It is safe to say no more fuel would be used than was strictly necessary. When it is considered how little fire is requisite for the needs of an Indian household, and that the limited space suitable for residence would not provide sufficient room for more than half a dozen families at a time, it is quite clear that this amount of ashes meant a very long occupancy. Even with continuous habitation, several centuries would be required for such a quantity to accumulate; and if residence was desultory and intermittent, as is customary with roving or hunting tribes, or if it was only a winter home for some of those living in the villages mentioned, the period would be greatly lengthened. Yet the remains found in these ashes were of the same character from top to bottom. The artificial objects found numbered about 75 mortars, more than 200 pestles, hundreds of flint knives or spear heads, numerous implements of bone, antler, and shell; quantities of crude pottery fragments, a few tomahawks, and two pipes. While the many mortars and pestles indicate much use of grain, seeds, and nuts, at the same time the great amount of mammal, bird, and fish bones showed that a large part of their sustenance was derived from animal food. Of more than 20 skeletons found in various stages of decay, only two were of aged individuals, most being remains of children or young persons. The skulls were of low type. Not an ornament of any sort was found except a few rude ones of bone or shell. Some of the human bones, mostly those of children, were charred and broken, and mingled with the debris of food animals and ashes as if the flesh had been used for food, and the broken bones thrown aside with the refuse. There was no evidence of the cremation of bodies; the condition of these bones points to the practice of cannibalism.

The second cave explored is situated a mile south of Waynesville, on land belonging to Dr. J. W. Sell, and was probably a temporary camping place. Its opening is on a hillside facing Roubidoux creek, and is easily accessible from either the top or the bottom of the hill. A few rods back from the entrance, water stands on the floor throughout the year: so that only the front part of the cave was used for shelter. At the entrance is a pile of earth washed from the sloping



surface of the hill above, over the ledge that forms the roof. This accumulation spreads for 50 feet into the cave, but not so far on the outside, because there it washes down the slope. From its surface to the clay floor on which it rested the greatest depth was a few inches over six feet. From top to bottom there was found in this cave the ordinary debris of an Indian campfire. Buried at various depths here and there, in the portion within the cave were 14 human skeletons, most of them so decayed that only a few fragments were remaining. They are of persons of various ages; some of the skulls were low, small, and flat.

A long period of occupancy is indicated by the conditions here as at Miller's cave. While the amount of earth heaped in front of the cave does not seem large, yet it all has come from a space not exceeding 6,000 square feet in area and most of this is bare rock with humus of decayed vegetation existing only in the crevices or on the few flat surfaces. All the other water from the hill runs to the slopes and does not reach the cave. A violent storm passed over the region soon after the work was concluded, in which 12 inches of rain fell in three days, yet not more than a wheelbarrow load of soil was washed down over the roof to the pile already there. It is evident that centuries would be required to build up the mass, throughout which these traces of man's presence are scattered promiscuously.

During all the period these caves were in use no improvement took place in the fabrication of stone implements or pottery. Specimens found nearest the top of the ashes or dirt could not be distinguished from those of the same class from the rock or clay floors. The inhabitants remained in the same plane of culture.

The thousands of small mounds extending southward from the upper swamp region of Missouri have long been a puzzle to archeologists and until recently it has been supposed that in this state they are confined to the southeastern portion: but in the course of Mr. Fowke's field-work they have been found to extend to the north and west as well. Groups of them have been located in Oregon, Dent, Phelps, Pulaski, Osage, and Morgan counties, the latter along the Benton County line. Their purpose has not yet been determined, although Thoburn's hypothesis that they are due to the Pawnees, whose line of migration was through the area in which they occur, and are the remains of earth-covered houses, seems the most tenable yet advanced. This theory implies that when this tribe passed beyond the region in which suitable timber for supporting the weight of the earth, and also earth adapted to such use, could be procured, they were compelled to substitute for them small poles overlaid with grass.

Comparison with the typical modern Pawnee earth lodge, a photograph of which Miss Densmore published in her account of field-work for 1919, corroborates Thoburn's interpretation of these Missouri mounds.

#### ARCHEOLOGICAL RECONNOISSANCE IN HAWAII

With an allotment from the Bureau of American Ethnology, Mr. Fowke spent the entire summer of 1920 in the Hawaiian Islands, making a careful examination of all ancient works of whatever nature, that could be visited with the time and opportunities at his command.

While there is abundant evidence everywhere that the old Hawaiian people were extremely industrious, using vast quantities of stone in



FIG. 124.—Pawnee ceremonial earth lodge, exterior. Photograph by Miss Densmore.

the construction of their temples, houses, garden enclosures, fish ponds, and taro terraces, there was nothing discoverable among all these remains which could be attributed to a prehistoric tribe, or to any other race than that found in possession when the islands were first known to the white man.

The five principal islands were visited and explored as thoroughly as was possible in the circumstances. It was not practicable to examine every feature of interest, where there is so much demanding attention; but at no place could there be discovered any indication which would seem to justify excavation with the expectation of un-

earthing beneath the top soil remains which might differ in general character from those on the surface. There being no difference between remains belonging to the historic period and those superficially showing evidence of great age, it is logical to conclude that when that branch of the Polynesian race, now known as Hawaiians, left their home in the distant South Seas and migrated to these islands, they found the territory without inhabitants; and there is no reason whatever for supposing that any people culturally different from the historic Hawaiians had ever previously lived on the islands.

#### FIELD-WORK AMONG THE FOX AND PLAINS CREE INDIANS

Dr. Michelson, ethnologist of the Bureau of American Ethnology, began field-work among the Fox Indians at Tama, Iowa, about the



FIG. 125.—The dwelling in which the White Buffalo Dance of the Fox Indians is held. The building is the typical "bark" house used by the Fox in the summer and early fall.

middle of June. His main purpose was to restore phonetically a text containing the autobiography of an Indian woman written in the current syllabary which he had obtained in the summer of 1918, to correct the translation where there was need, to elucidate some ethnological references contained in the text, to clear up some grammatical obscurities, and to work out the verbal stems so far as was feasible in the field. All this was successfully accomplished, and Dr. Michelson left for Saskatchewan in the latter part of July for a preliminary investigation of the Plains Cree. The results of this investigation show that the Plains Cree are tall and have a cephalic index



FIG. 126.—An aged Plains Cree (File Hills Agency).



FIG. 127.—Tipi of the Plains Cree (File Hills Agency).



of about 79, and evidently are the same type as the one which formerly occupied the Mississippi Valley, thus confirming the results of Dr. Boas, announced in 1895. The general grammatical principles which have been worked out for Fox apply also to Cree. In some respects Cree is more archaic than Fox, in others less so. Ethnologically the Plains Cree are about half way between more typical Indians of the Plains, such as the Blackfeet, and the Central Algonquins. An analysis of the myths and tales which cluster around the culture hero shows that we practically have the myths and tales of the culture heroes of the Blackfeet and Ojibwa combined. All this is just what one would expect from the geographical position of the Plains Cree.

#### ARCHEOLOGICAL EXPLORATIONS IN TENNESSEE

Mr. W. E. Myer, of Nashville, Tenn., spent September and October, 1920, making explorations for the Bureau of American Ethnology in the Cumberland Valley around Nashville. He discovered on the H. L. Gordon farm, one mile northeast of Brentwood, in Davidson County, the remains of an ancient Indian walled town. These were situated in a woodland and had never been disturbed by the plow. Their partial exploration brought to light some new and interesting details of the life of the inhabitants. Traces of 87 house circles and faint indications of several more could be made out. This town covered 11.2 acres and was surrounded by an earthen embankment which formerly supported a palisaded wall, equipped with circular towers every 55 feet.

The ancient inhabitants, for some unknown reason, had deserted this village and the site had never afterward been occupied or disturbed. The deserted structures had gradually fallen down and the remains slowly buried under from 10 to 14 inches of earthmold. In some of these circles portions of beautiful, smooth, hard-packed, glossy-black floors were found. In the centers were the ancient fire-bowls, yet filled with the ashes of the last fires kindled in these homes before their owners left them forever. Near these fire-bowls often could be seen the metates, mullers and other household utensils, just as left the last time used. Underneath the floors were the stone slab graves of the little children, one of which is shown in figures 128 and 129.

A level open space was found near the center of the town and on the western side of this plaza was a low flat-top mound that had originally supported some important building. Adjoining this mound

on the west was an earth circle which probably outlined the ruins of the town house. At the center of this sacred structure, on the unique black glossy floor, an ancient altar (fig. 130) was found. It was still filled with the pure white ashes of what had once been the sacred fire.



FIG. 128.—Child's grave after removal of infiltrated soil, before disturbing mortuary vessels.

This altar was carefully preserved and is now in the Bureau of Ethnology. The Gordon site is of much interest because here we have an ancient Indian village just as the original inhabitants left it.

#### THE FEWKES GROUP

Mr. Myer also partially explored an unnamed Indian village group at Boiling Spring Academy in Williamson County, Tenn. At the

request of many citizens of Tennessee Mr. Myer named this site the Fewkes Group, in honor of Dr. J. Walter Fewkes, who had visited it and recognized its possibilities a few months before.



FIG. 129.—Child's grave after removal of body. Note floor composed of broken pottery.

At least two different peoples have lived on this site. The earlier people built the mounds and most of the other remains. At a later date a small band of some other tribe located here. The earlier people buried their dead either in hexagonal or almost circular stone slab graves, the bodies closely flexed. The later band used rectangular stone slab graves with the body extended full length on its back.

The Fewkes Group consists of four mounds, one on each of the four sides of a level plaza, the traces of about a dozen house circles, and a small remnant of what was once a considerable stone slab cemetery.



FIG. 130.—Altar.

Mound No. 2 on the map is a low oval mound situated on the western side of the plaza. The site of this mound had been lived upon for some time before any mound was raised. At last the mound was commenced and raised to a height of three feet and a building for domestic purposes erected thereon. This building was later torn down and then the mound was raised three feet higher. The mound was again used for domestic purposes for a period. Then a town house



or sacred ceremonial house was built on it. This sacred building also had one of those rare, beautiful floors made of clay, smoothed, then hardened by fire, and finally covered with a coating which is yet black and glossy. In the center of the building, on this beautiful floor, an altar was found. It was similar to the altar shown in figure 130.

This building had walls made of cane stalks with the leaves attached, which had been woven in and out between the upright posts which supported the roof. These canes may have had a coating of earth, though no trace of it could be found, and the walls also had a



FIG. 131.—Mortuary vessel from child's grave.

covering of woven cane matting. In some way the building was destroyed by fire. Earth was thrown on the remains in time to smother its still glowing embers, which produced a large amount of powdery charcoal containing fragments of cane stalks with the leaves attached, and portions of the woven cane matting. After this sacred building was burned the mound was raised one and one-half feet or more in height. All trace of its last use has been destroyed by 85 years of cultivation.

The low mound, No. 3, on the south side of the plaza, was a burial mound belonging to the first settlers. The mortuary vessel shown in figure 131 came from a hexagonal grave in this mound.

Mound No. 1 on the north side of the plaza is 180 feet across the base and 25 feet high. It is the most conspicuous mound in the group. Lack of funds prevented its exploration.

House circle No. 6 was one of the group of buildings, Nos. 6, 10, and 11, whose functions were doubtless closely interwoven. No. 6 contained in its center an altar or fire-bowl.

There was evidence that this town had either been taken by an enemy and burned, or the ancient inhabitants, forced to flee, had burned their homes to prevent their falling into the hands of the invader.



FIG. 132.—House circle No. 17. Cleared floor of wigwam, showing ancient fire-bowl. Body of child was found by side of upright stone. Its head rested within edge of fire-bowl. Top edges of upright stone slab sides of another coffin in corner to right of women.

House circle No. 17, shown in figure 132, was a typical dwelling. It was evidently the home of a neat housekeeper. No broken animal bones, pottery, fragments, or other evidences of untidiness littered the floor. The floor was of hard-packed clay and a fire-bowl was sunk in the center of the floor. At this fire-bowl a puzzling burial was unearched. A child, about eight years of age, was buried by the side of the upright stone slab, with its head resting just within the extreme edge of the fire-bowl, whose rim had been cut away at this point to admit the top of the child's head. The fire-bowl was found still filled with ashes, and although the ashes covered the top

of the child's head, the head showed not the faintest trace of the action of fire. The graves of two infants were also found in the floor of this house.

At both the Gordon and the Fewkes groups every piece of bone and every fragment of pottery was carefully saved and location noted. These thousands of fragments will give a reliable record of the food animals and practically a complete list of all the sizes, colors and shapes of their domestic pottery.

Both these sites, when explorations were completed, were accurately restored to their original shape for the benefit of coming generations. The interesting altars, fire-bowls, building post-holes, and vestiges of domestic life were carefully preserved, and again covered up so as to allow their future study. It is strongly urged by the citizens of Tennessee that the Fewkes Group be made a national monument.

Mr. Myer discovered a great Indian fortress on the long, narrow point of land between the Harpeth and Cumberland rivers, at their junction, in Cheatham County, Tennessee. This fortress consists of a thin, double-faced bluff, about three-quarters of a mile in length, and only from 10 to 250 feet wide along its tall and narrow summit. It faces both rivers and has nearly perpendicular sides along its entire length on both streams. It can be scaled with very great difficulty and at only a few places. The Indians protected these few places of ascent with breastworks or mounds. This was a central place of refuge for a series of scattered Indian settlements extending about six miles up and five miles down the Cumberland River and about five miles up the Harpeth.

The four pipes from this region are unlike any found elsewhere in the valley, and probably the culture of the ancient people who used this fort was different from any other known at present in the Cumberland Valley.

On a recent visit Dr. Fewkes examined the great unexplored mound group on Harpeth River at the mouth of Dog Creek, in Cheatham County. This group is the remains of one of the important prehistoric settlements east of the Mississippi.

There is a great mound, with wide earthen platforms, capping a hill in the up-stream end of this settlement. A portion of the hill has been artificially shaped so as to give greater prominence to the works on top of it. Surrounding these works on the summit are the ruins of a large edifice and other important remains. This portion of the settlement covers about 40 acres and is said to be connected by an embankment with the remainder of the mounds in Mound Bottom,

about two miles down the Harpeth. The Mound Bottom portion, shown in figure 133, covering about 50 acres, contains Mound No. 2 with large platform; Mounds Nos. 1, 4, 5, and 6; cemetery No. 7, and other traces of a considerable population.



FIG. 133.—Mound Bottom. Other great mounds belonging to this unexplored group.

#### ARCHEOLOGICAL EXPLORATIONS IN NEW MEXICO

During July, and a part of August, Mr. J. A. Jeancon, special archeologist of the Bureau of American Ethnology, made a reconnoissance and conducted intensive archeological work at Taos, New Mexico. While it has been known for a long time that there was excellent archeological as well as ethnological material to be obtained in this valley, no archeological research has been done there before the present work in the summer of 1920.

The great number and variety of sites seem to indicate a long period of occupancy of the region. These sites are well-defined small house groups, each indicating one, two, or more rooms. There are also great communal groups as that at Bagley ranch and the Arroyo Hondo. The mounds are sometimes over 20 feet in height; the pottery sherds scattered over these sites range from the primitive black-and-white ware to what appears to be the so-called biscuit ware.

A small pueblo ruin at Llano was selected for excavation and, while the yield of pottery was small, many interesting facts were obtained. The ruin is located on the south bank of the Little Rio Grande, one mile and a half from the plaza of Ranchos de Taos. Situated on the edge of a high mesa it commands a magnificent view of the country for miles around, excepting to the east, where the view is cut off by



the mountains. The fields which probably furnished the villagers well-watered agricultural areas are situated in the valley below.

The excavation showed that there had been two occupations on the site. In several places the remains of earlier old walls show beneath the present walls, indicating that the first and second buildings had



FIG. 134.—Ruin at Llano, Taos Valley.

totally different ground plans. All of the walls (fig. 134) were made of a mixture of wood ash, small stones (about the size of pebbles ordinarily found in gravel), and adobe which when exposed to the air becomes very hard. The walls of the second occupation are not as well made as those of the first, but the floors of both resemble those of the older villages still inhabited, where the blood of animals was used to give them temper and polish.

The general plan of the ruin recalls those of southwestern Colorado. The kiva at Llano (fig. 135) was completely surrounded with rooms and when the roof was intact its surface was a small plaza surrounded by the buildings of the main group. An evidence of the two occupations is that the more recent kiva was built inside the older, and the space between their walls had been filled in with rubbish. No roof timbers remained in the ruin, but there were in the kiva four upright posts upon which the former roof rested. In about the center of the kiva there was an excellent fireplace, and in the floor directly



FIG. 135.—Kiva at Llano, Taos Valley.

adjoining the fireplace a plastered pit (fig. 135), an unusual adjunct to the fireplace, the purpose of which is unknown. Between the fireplace and the pit is a stone slab, one foot high and about nine inches wide. The excavations brought to light a very small number of the undecorated sherds of white ware; the black-and-white pottery is unusually hard and fine, but the black or rather brownish-black ware used for cooking and storage is very soft. The forms of and designs on the black-and-white pottery strongly suggest the San Juan ware.

During the month of May, 1920, Mr. Jeancon made a satisfactory reconnoissance in the country lying south and southwest of Dulce,



FIG. 136.—Ruin in La Jara Canyon.



FIG. 137.—Ruin in La Jara Canyon.

New Mexico. He found in Burns, La Jara and other canyons indications of two periods of occupation evinced by the pottery which belongs to the old pre-Spanish black-and-white and the hard-coiled wares. The houses of the earlier period were "earth lodges" of a primitive type. The house remains point to the second occupation and are in many cases built on the tops of high masses of sandstone (fig. 136), and show the crudest workmanship. A common site for buildings is the edge of high points (fig. 137), along the terraced (natural) sides of the canyons. All of the later sites give



FIG. 138.—Dulce Ruin.

an impression that they were more or less defensive and hastily erected. Associated with these buildings are remains of metal objects, apparently of Spanish manufacture; many of the beams in the houses plainly show the marks of metal tools. The pottery has a bluish-black color, closely resembling a modern vitrified brick, and is so hard that when struck it rings with a clear bell-like tone. The surface suggests old Hopi ware and the decorations are similar to the older Zuñi and Acoma designs.

The pottery and associate remains probably do not antedate the reconquest of the Southwest by the Spaniards in 1690. It is known that some of the pueblo people fled from the Spaniards at the time of



the great rebellion and took refuge in the mountains to the north. It is probable that further investigation will show that in this area the ruins ascribed to the second period were built and inhabited by refugees from Zuñi and Acoma.

#### ARCHEOLOGICAL EXPLORATIONS IN EASTERN TEXAS

Archeological field-work was carried on in 1920 by the Bureau of American Ethnology in co-operation with the University of Texas under direction of Professor Pearce and Professor Engstrand. Several localities in Texas were visited and considerable intensive work done in the eastern part of the state.

The region in eastern Texas to which most attention was given was in the vicinity of the little city of Athens in Henderson County. Judge A. B. Watkins of that city has long taken a keen interest in the history and archeology of the region and was of great help to Professor Pearce in his field-work. A number of aboriginal objects, complete specimens of pottery, clay pipes, conch-shell cores, fine arrowheads and human bones were obtained from an ancient burial ground two miles northeast of Frankston on the De Rossett Farm. One of the objects found was a "turkey call" or whistle made from the drumstick of a turkey. This is identical with those used not many years ago by old white hunters on the frontier and Professor Pearce feels sure that the white man's use of this device was borrowed from the Indian. Professor Pearce finds that the east Texas region contains numerous mounds, village sites and burial places, among which may be mentioned Nacogdoches, Panola, Bowie, Wood and other counties.

Three interesting mounds on the Morrall Farm four miles east of Cherokee County were investigated. The highest of these mounds has an altitude of about 35 feet above the level valley or field in which they are all located and is about 80 feet across at the base. This mound is very steep and even now after long erosion its sides rise at an angle of  $45^{\circ}$ . Mound B is 180 feet long by 75 feet wide and rises only 15 feet above the general level. The other three mounds in the vicinity of Athens have been ploughed into and have no regularity in form.

On the Quate tract east of De Rossett farms there are Indian mounds which were not regarded as very ancient. Several mounds situated in Harrison County on the farm of Mr. Lane Mitchell, of Marshall, were examined and remains of earth lodges with central fire pits were reached. These mounds are probably very ancient.

Numerous other sites were explored, yielding a collection of pottery, stone implements and other objects, illustrating the life of the prehistoric aborigines of eastern Texas.

Everything found implies that the Indians of this region lived in relatively settled villages, had considerable agriculture, made pottery extensively and of a high-grade, and were altogether in a considerably higher stage of culture than were those who occupied the prairies and plains.