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EXPLORATIONS AND FIELD-WORK OF THE
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CONTENTS

	PAGE
Introduction	I
Geological Explorations in the Canadian Rockies (Dr. Charles D. Walcott)	1
Field-Work in Structural Geology in Tennessee (Dr. R. S. Bassler).....	9
Geological Field-Work in Central New York (Mr. Erwin R. Pohl).....	13
Geological Field-Work in Europe (Dr. Charles E. Resser).....	16
Collecting Fossil Footprints in Arizona (Mr. Charles W. Gilmore).....	20
Investigation of Glacial Deposits near Des Moines, Iowa (Dr. James W. Gidley)	23
Investigation of Evidences of Early Man at Melbourne and Vero, Florida (Dr. James W. Gidley).....	23
Exploration of a Pleistocene Spring-deposit in Oklahoma (Dr. James W. Gidley)	27
Field-Work in Astrophysics (Dr. Charles G. Abbot).....	28
Biological Explorations in Western China (Rev. David C. Graham).....	31
Exploration of Haitian Caves (Dr. Gerrit S. Miller, Jr.).....	36
Marine Invertebrate Studies at the Tortugas (Dr. Waldo L. Schmitt).....	40
Study of the Crustaceans of South America (Dr. Waldo L. Schmitt)....	40
Experiments in Cerion-breeding at the Tortugas (Dr. Paul Bartsch).....	44
Botanical Expedition to Brazil (Mrs. Agnes Chase).....	48
Botanical Investigations at European Museums (Mr. E. P. Killip).....	53
Anthropological Studies in Southern Asia, Java, Australia, and South Africa (Dr. Aleš Hrdlička).....	59
Archeological Investigations at Pueblo Bonito and Pueblo Del Arroyo, New Mexico (Mr. Neil M. Judd).....	80
Archeological and Anthropometrical Work in Mississippi (Mr. Henry B. Collins)	89
Archeological Studies of the Wupatki National Monument (Dr. J. Walter Fewkes)	96
Researches on the Archeology of Southern California (Mr. J. P. Harrington)	106
Studies of the Fox and Ojibwa Indians (Dr. Truman Michelson).....	111
Ethnological Researches among the Iroquois and Chippewa (Mr. J. N. B. Hewitt)	114
Ethnological Work among the Osage of Oklahoma (Mr. Francis La Flesche)	117
Studies of Indian Music among the Menominee of Wisconsin (Miss Frances Densmore)	119
Investigation of Shell and Sand Mounds on Pinellas Peninsula, Florida (Mr. David I. Bushnell, Jr.).....	125



EXPLORATIONS AND FIELD-WORK OF THE SMITHSONIAN INSTITUTION IN 1925

INTRODUCTION

The functions of the Smithsonian Institution as stipulated by the will of the founder, James Smithson, are "the increase and diffusion of knowledge among men." In its endeavor to increase the sum of human knowledge, the Institution conducts researches and explorations, the latter particularly in regions of the earth which have not yet been thoroughly investigated. As the founder's will did not discriminate in favor of any particular branch of science, the Institution endeavors to be partial to none, and its activities have covered geology, biology, and anthropology, with all of their various subdivisions; astrophysics, aeronautics, physics, and chemistry. The present pamphlet is intended to present in brief form, illustrated, the purpose and results of the expeditions in the field during 1925. The very limited income of the Institution from its private endowment does not permit of a comprehensive, coordinated program of exploration, and it therefore takes whatever opportunity offers to cooperate with other agencies in sending out field expeditions. The accounts, although written in the third person, are prepared for the most part by the explorers themselves, and the pictures are taken by them in the field.

GEOLOGICAL EXPLORATIONS IN THE CANADIAN ROCKIES

In continuation of geological field-work in the Canadian Rockies, Secretary Charles D. Walcott left Lake Louise Station, Alberta, on the Canadian Pacific Railway on July 9 with a camp outfit and pack horses. The field season was even more unfavorable than that of 1924. Smoke from extensive forest fires west and north of the mountain area north and east of Lake Louise interfered with photography during July and the first half of August. An eddy, or dead area in the atmosphere, hung over the mountains for several weeks, and then, after a severe gale of several days' duration, snow began falling on August 21, blanketing the canyon valleys with a depth of from 12 to 16 inches (fig. 9) and the mountain slopes with

Skoki Pass

Parnagan Peak (10,000 feet)

Pika Peak (10,015 feet)

Pipestone River Canyon

Skoki Mt. (8,250 feet)



FIG. 1. Panoramic view from the north slope of Skoki Pass and west slope of Skoki Mountain from a point 8,000 feet (2,438.4 m) in elevation (and 8 miles (12.8 km) in an air line northeast of Lake Louise Station on the Canadian Pacific Railway, Alberta, Canada. The view from left to right includes Skoki Pass, the northward facing cliffs of Parnagan Peak (10,000 feet, 3,052.4 m) and Pika Peak (10,015 feet, 3,053.1 m) to the left of Parnagan glacier and on the right of the glacier the high northeast ridge that extends to the canyon of Little Pipestone River. Then the broad canyon valley of Pipestone River and far to the north the snow clad summit of Cataract Peak (9,444 feet, 2,898.5 m). On the right the sharp ridge of Skoki Mountain (8,250 feet, 2,514.6 m) and in the distance the snow cap of Mt. McConnell (10,000 feet, 3,048 m). At Skoki Pass the quartzites of the Lower Cambrian are superjacent to the argillaceous shales of the Pre-Cambrian Hector formation. The cliffs above the small upper lake are composed of hard, thick-bedded, Middle Cambrian limestones. (C. D. Walcott, 1925.)

Tilted Mt. Cirque



FIG. 2.—Panoramic view of Tilted Mountain and Cirque. Taken from a point on the southeast slope of Fossil Mountain above Baker Lake, at 8,000 feet (2,438 m.) elevation, eight miles (12.8 km.) northeast of Lake Louise Station on the Canadian Pacific Railway, Alberta, Canada. (C. D. Walcott, 1925.)

Brachiopod Mt.



Quartzite Mt.

Redoubt Mt.

FIG. 3.—From left to right, Brachiopod Mountain (Devonian limestones), Quartzite Mountain (Pre-Cambrian capped with Lower Cambrian quartzites), and Redoubt Mountain (Middle Cambrian limestones). (C. D. Walcott, 1925.)



FIG. 4.—Close up view of Tilted Mountain Cirque showing the limestones of the Middle Cambrian Eldon formation thrust against the Devonian limestones at the head of the Cirque. The locality is 8.5 miles (13.7 km.) in an air line northeast of Lake Louise Station on the Canadian Pacific Railway. (C. D. Walcott, 1925.)



FIG. 5.—Looking over Ptarmigan Lake and Bow Valley to the Mt. Victoria massif, 12 miles (19.3 km.) southwest of Ptarmigan Lake. The mountains in the vicinity of Lake Louise are finely shown in this view, also the rounded hills and slopes of Pre-Cambrian rocks on the north side of Bow Valley. The view was taken from south side of Skoki Pass on the southeast slope of Fossil Mountain at 8,000 feet (2,438.4 m.) elevation and 8 miles (12.9 km.) in an air line northeast of Lake Louise Station on the Canadian Pacific Railway, Alberta, Canada. (C. D. Walcott, 1925.)

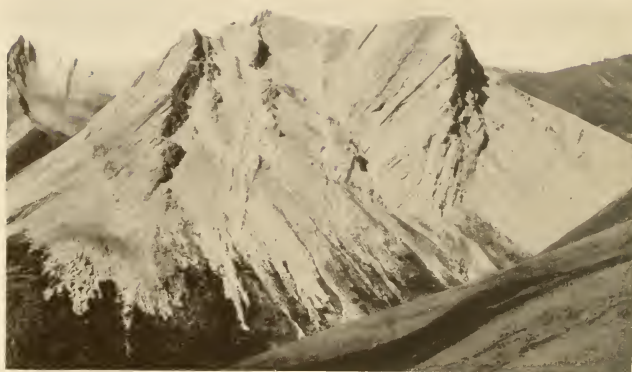


FIG. 6.—South side of Skoki Mountain from a point 8.5 miles (13.7 km.) in an air line northeast of Lake Louise Station on the Canadian Pacific Railway, Alberta, Canada.

The mountain is formed of fossiliferous Middle Devonian limestones to about half-way down the slope on the right side, where the subjacent Silurian and Lower Ordovician, Sarbach formation, is exposed. (C. D. Walcott, 1925.)



FIG. 7.—Mounts McBride and Douglas reflected in the Red Deer River at a point 14 miles (22.5 km.) in an air line northeast of Lake Louise Station on the Canadian Pacific Railway, Alberta, Canada. (Mary Vaux Walcott, 1925.)



FIG. 8.—A fine summer day in camp at south base of Skoki Mountain on afternoon of August 21, 1925 (see figure 9).

Skoki Mountain camp site is 9 miles (14.5 km.) in an air line northeast of Lake Louise Station on the Canadian Pacific Railway, Alberta, Canada. (C. D. Walcott, 1925.)



FIG. 9.—Skoki camp on morning of August 22 (see figure 8).

a gradually increasing depth up to 30 inches on the passes just above timber line.

Snow squalls followed nearly every afternoon until August 30, when camp was moved from between Fossil and Skoki Mountains to below the pass at the head of Johnston Creek Canyon. Snow came again on September 5, 9, and 18. Secretary and Mrs. Walcott returned to Lake Louise Station, packed their collections and left for Washington on September 21, which was the most beautiful day of



FIG. 10.—Looking south down Johnston Canyon from divide at its head, which is formed of limestones of the Ordovician Sarbach formation, in which the canyon has been largely eroded. See figure 2. (Mary Vaux Walcott, 1925.)

the season. Only eight camps were made while on the trail. It was more through good fortune than favorable conditions that a fine series of fossils from critical horizons in the great lower Paleozoic section north of Bow Valley was discovered and collected. These fossils increase our knowledge of the history and life of the Cordilleran Sea of this time and afford the data for comparison with life and conditions in the Appalachian Trough and the great upper Mississippi embayment of Upper Cambrian time.

In the interval between the snow storms of September 5 and 9 several new fossil zones were found in the Lower Ordovician rocks

of the Johnston-Wild Flower Canyon Pass section, and also in the Upper Cambrian west of Badger Pass. The latter find enabled Dr. Walcott to identify the *Arctomys* formation of the Glacier Lake section and to clear up the uncertainty as to the position of the strata hitherto referred to the lower portion of the Bosworth formation.



FIG. 11.—*Pedicularis contorta* Benth. Alpine lousewort.
(Mary Vaux Walcott, 1925.)

Mrs. Walcott secured a few water-color sketches of wild flowers at the camp in the open area of the upper Ptarmigan Canyon, but the storm of August 21 killed all but a few hardy asters and paint-brushes.

Mountain sheep were seen on the mountains about the head of Johnston Creek, but the rain and snow storms made it difficult to secure fine specimens desired for a group in the National Museum. One fairly good ram and a badly damaged ewe were secured, as



FIG. 12.—*Saussurca densa* (Hooker) Rydberg. (Mary Vaux Walcott, 1925.)



FIG. 13.—*Linnaca americana* Forbes. Twin-flower.
(Mary Vaux Walcott, 1925.)

well as a mule deer, which, when shot, rushed down the Canyon side and broke its fine horns in landing upon a mass of broken rock.

This year probably completes the field-work in the Canadian Rockies. A few of the problems encountered have been cleared up in the past nine years, but many remain to be studied by young, well-trained men with strong hearts, vigorous muscles, and the high purpose of the research student seeking to discover the truth regarding the development of the North American Continent and of the life of the waters in which the miles in thickness of sands, clay, and limey muds accumulated during a period of several million years of lower Paleozoic time.

Mrs. Walcott has sketched over 350 species of wild flowers during the past 20 seasons, and she and Dr. Walcott now wish to work in the mountains and valleys of southern Nevada and adjoining areas of California, where climatic and physical conditions and life, both animal and vegetable, are in strong contrast with those of the Canadian Rocky Mountains, but where the problems in which Dr. Walcott is interested in connection with the Cambrian formations of the Cordilleran area are essentially of the same order.

Acknowledgments.—Commissioner J. B. Harkin and the members of the Canadian National Parks Service gave their hearty cooperation. The effective assistance of the officers and employees of the Canadian Pacific Railway permitted a saving of time and conservation of energy, and grants from the O. C. Marsh and Joseph Henry endowment funds of the National Academy of Sciences were of great assistance. To all, sincere thanks are returned and appreciation is expressed for the cooperation that has been given over a period of years to make Dr. Walcott's work more successful than it would otherwise have been.

FIELD-WORK IN STRUCTURAL GEOLOGY IN TENNESSEE

During August and a part of September, 1925, Dr. R. S. Bassler, curator of paleontology, U. S. National Museum, continued his studies in the Central Basin and Highland Rim areas of Tennessee in cooperation, as in previous years, with the Tennessee Geological Survey. For several seasons past, he has been engaged in working out the detailed stratigraphy of these two physiographic provinces, in mapping certain areas of particular scientific and economic interest and in collecting the faunas of the various Paleozoic formations outcropping in this part of the state. By 1925, sufficient geologic knowledge had been accumulated to make possible the determina-



FIG. 14.—Outcrop of New Providence shale followed unconformably by Fort Payne chert, illustrating submarine erosion. Eagle Creek, northeast of Livingston, Tennessee. (Photograph by Bassler.)



FIG. 15.—Fort Payne chert with overlying Warsaw formation, Tullahoma, Tennessee. (Photograph by Bassler.)

tion of interesting structural features indicating discordant relations and areal restrictions in rock formations which had hitherto been thought to be essentially horizontal, widespread, and conformable with each other.

At various times during the Paleozoic era, the area now termed the Central Basin was uplifted above the sea as a low dome—the Nashville Dome, as it is generally known—the rocks sloping gently away on all sides. At times this dome was submerged partially or entirely, the deposits remaining of those then formed showing the extent of such submergences. At other times, the sea invaded the area only in bay-like indentations in which rocks of various interesting types were laid down. The resulting rock deposits hold the story of these various invasions of the Nashville Dome, but the strata, mainly limestone and shale, are so much alike that detailed preliminary studies had to be undertaken before the formations and their extent could be satisfactorily discriminated and mapped. From such studies in previous seasons it was determined, for example, that the Bigby limestone of Middle Ordovician age, the source of much of the Tennessee brown phosphate, was deposited in an arm of the sea which covered only the southwestern and western parts of the Nashville Dome. The succeeding massive Cannon limestone was developed, on the contrary, in a broad embayment occupying the eastern two-thirds of the dome, in which it varies in thickness from an inch or two along the ancient western shore line to several hundred feet along the eastern side of the basin. The Early Silurian, Richmond formation, also proved to have been formed in similar but much narrower bays entering the dome on the northern, western, and southern sides. The relative narrowness of these embayments as contrasted with the preceding Bigby and Cannon limestone bays indicates decided warping or wrinkling of the surface during the transition from the Ordovician to the Silurian. These restricted Richmond areas are also notable for their iron ores and marble deposits. The later Silurian, Devonian, and Early Mississippian formations, in many cases, were deposited in similarly restricted areas.

The occurrence and thickness of an Early Mississippian formation accumulated in one of these ancient narrow bays is illustrated in figure 14, showing the New Providence shale, a celebrated crinoid-bearing formation. Here, however, another structural feature is shown in that the horizontal strata of the New Providence shale are obliquely cut across by rocks of the overlying formation of



FIG. 16.—Chattanooga black shale with channel occupied by Fort Payne chert, east of Woodbury, Tennessee. (Photograph by Bassler.)



FIG. 17.—Eastern Highland Rim viewed from top of Cumberland Plateau near Sewanee, Tennessee. (Photograph by Bassler.)

Fort Payne chert. The edges of the lower formation are clean cut and show no signs of weathered products due to subaerial decomposition, so that this seems a true case of submarine erosion.

Viewed in most exposures, the Fort Payne chert of Keokuk age appears to be conformable with the overlying Warsaw limestone but that there was an actual time break, locally indicated by an angular unconformity, is shown in figure 15. Here the lower formation has been tilted at a slight angle and the edges of the strata worn off before the rocks of the newer formation were laid down upon it. A still different structural type is illustrated in figure 16, which shows the Fort Payne chert resting directly on the Early Mississippian Chattanooga black shale, the unconformity between the two being recorded elsewhere by 500 feet or more of shales and limestones included in the Ridgetop and New Providence formations which were absent at this place. The particular interest of this exposure is that the Chattanooga shale developed a sharply defined channel in its top, either through fracturing or erosion, in which the Fort Payne chert was deposited normally. The structure of the Eastern Highland Rim near its junction with the Cumberland Plateau was also studied. The Highland Rim forms a rolling upland averaging 1,200 feet in altitude and the Cumberland Plateau, another marked upland area, 700 feet higher. In this part of the State, the Highland Rim is traversed as shown in figure 17, by low ridges which, as a rule, are due to structural features in the underlying formations. These ridges, in most cases, are capped by hard sandstone and indicate areas of slightly downfolded strata where the general level of erosion has not proceeded far enough to entirely remove the resistant rock.

Tennessee is uniquely situated for the study of stratigraphic geology, and the State has long been classic ground. Starting with the Blue Ridge system on the east and extending westward to the Mississippi flood plain, it comprises many physiographic provinces with the underlying strata embracing almost all the divisions of the geologic column. Most of these strata are highly fossiliferous and perhaps nowhere else can the development of life be studied to better advantage.

GEOLOGICAL FIELD-WORK IN CENTRAL NEW YORK

The division of paleontology of the U. S. National Museum contains great collections of Devonian fossils from the classic New York areas, obtained years ago when the present methods of record-

ing very exact data as to precise horizon and locality were not observed. To make these collections of scientific value, such detailed information must be supplied. Towards this end, Erwin R. Pohl, of the division, spent several weeks in the summer of 1925 at the noted section along Kashong Creek near Bellona, New York, where the shales and limestone formations of the Middle Devonian ranging from the Marcellus at the base of the Hamilton through the Ludlowville, the Tichenor and Moscow divisions and passing into the overlying Tully limestone and Genesee black shale of Upper Devonian age, are well developed in splendid outcrops. Most of these formations abound in fossils and, as a result of the trip, half



FIG. 18.—Contact between Tichenor limestone (T) and Moscow shale, Kashong Creek, New York. (Photograph by Pohl.)

a ton of carefully selected material was obtained. Photographs of these formations, illustrating the stratigraphy and the opportunities for collecting, are shown herewith (figs. 18 and 19).

The Kashong Creek section starts at the shore of Seneca Lake and outcrops in the steep winding banks of the creek for more than three miles upstream to Bellona, 300 feet above the level of the lake. At several intervals the harder sandstone and limestone layers form waterfalls of some beauty. Except in the stream gorge, the region is very heavily wooded so that the collector is confined to the creek bed to penetrate the country. The section is not continuous and as the strata are folded in broad undulations and many of the beds have a lithologic similarity, correlation of the rock is sometimes quite difficult.



FIG. 19.—First falls in Kashong Creek, New York, showing Tully limestone (T) overlying Moscow shale. (Photograph by Pohl.)



FIG. 20.—Genesee black shale overlying the Tully limestone (T). Kashong Creek, New York. (Photograph by Pohl.)

The black shales of the Ludlowville division of the Hamilton were found to contain often myriads of small brachiopods and pelecypods. The Tichenor limestone forming the base of the Hamilton is also extremely fossiliferous while the Moscow shales above, abounding in fossils, can be distinguished by their slightly grayer color. Then comes a gap in sedimentation, for the Tully limestone, forming the base of the Upper Devonian, is separated from the underlying Moscow shale by an unconformity. The very characteristic blocky Genesee shales follow the Tully limestone as shown in figure 20.

Abundant collections were made in all the fossiliferous zones and with their help, it has been found possible to accurately place in this section most of the many fossils in the Museum's series previously obtained from this area.

GEOLOGICAL FIELD-WORK IN EUROPE

Dr. Charles E. Resser, associate curator of paleontology, U. S. National Museum and Dr. E. O. Ulrich, associate in paleontology, were members of the Smithsonian-Princeton expedition to Europe during the summer of 1925 for the purpose of studying the more important outcrops of the lower Paleozoic beds. The other members of the party were Prof. R. M. Field and Mr. R. M. Fullé of Princeton University and Mr. R. J. Beede of Williams College. Prof. Field kindly offered the use of his automobile, which made it possible to get about readily and to reach many places off the usual travel routes. The route followed by the party covered more than 7,500 miles by automobile alone, through central England, Wales, and the extreme north coast of Scotland, the Scandinavian countries, Germany, Czechoslovakia, Austria, Switzerland, and France.

Work was begun in Shropshire, where Mr. Edgar Sterling Cobbold of Church Stretton conducted the party to the various localities at which he has done much valuable geological work. A few days later he was again the guide to the famous Stiper Stones region on the west side of the Longmynd. Some time was spent also in studying the sections along the Onny River, in company with Mr. B. B. Bancroft. In Wales, Prof. T. C. Nicholas of Cambridge and Prof. O. T. Jones of Manchester guided the party about the Harlech Dome, on St. Tudwals Peninsula and in Central Wales. At Durness, on the extreme northwest coast of Scotland, a large series

of limestone beds were next visited which have been of special interest for many years because their contained faunas are American rather than European.

The automobile was then transported across the North Sea to Oslo, whence the party was guided by Prof. Olaf Holtedahl to the famous localities on Christiania Bay. After the very brief stay in Norway, the party proceeded to Vänersborg, Sweden, where it was met by Dr. A. H. Westergaard, detailed by the Swedish Geological Survey to be the guide in that country. Several weeks were spent studying the outcrops in the hills of the region about Lake Vänern



FIG. 21.—Professors O. T. Jones and T. C. Nicholas discussing the geology along the Rhayder River in Wales, with Dr. Ulrich. (Photograph by Resser.)

and to the south in the ancient alum quarries of Andrarum. The whole of southern Sweden has been heavily glaciated, but prior to the coming of the ice it was eroded down to the fairly flat granite floor. At a few places some of the soft, black, flat-lying Cambrian shales with a little Ordovician limestone have been preserved in low, lava-capped hills. Lenses of black, ill-smelling limestone, usually highly fossiliferous, occur in the black shales. Many hundreds of years ago quarries were begun here for the sake of this lime. Prior to 1800 wood was used in its burning but since that date the shale itself has been used, for it contains so much carbonaceous matter and sulphur that it serves the purpose well.

There were no particular objectives between Sweden and the Bohemian Basin near Prague, and therefore the intervening regions



FIG. 23.—Dr. Christian Poulsen standing in front of a very fine outcrop of the Lower Cambrian beds in Bornholm. The character of this series is well shown here. (Photograph by Resser.)



FIG. 22.—A portion of the cliff forming one face of the famous lava-capped hill Humneberg near Vänersborg, Sweden. Dr. A. H. Westergaard is standing in foreground and Dr. Ulrich is indicating the contact between the Cambrian and Ozarkian strata. The dark hole is the opening of one of the hundreds of caves made by the quarrying of the rock. (Photograph by Resser.)

were traversed rapidly. At Prague the geologists again offered every courtesy, and Dr. Jan Koliha of the famous Barrandeum Museum and Dr. Radim Kettner of the Geological Survey served as efficient guides to Barrande's classic sections. In the Museum one can see the first trilobite ever described, just 100 years ago. From Czechoslovakia the journey led to Zürich, where Dr. Ulrich remained. The rest of the party continued across the Jura Mountains and the Central Massif of France to Les Eyzies in the Dordogne country. Several days were spent in investigating the abris and caves in which remains of fossil man are preserved.



FIG. 24.—Crossing the ferry on the Beraun river near Skrej, Czechoslovakia. Dr. R. Kettner is just about to step onto the ferry. (Photograph by Resser.)

As it was necessary for the Princeton members to return at the end of August, the party was finally disbanded at Paris and Prof. Field returned with the automobile to Liverpool. Dr. Resser then proceeded to Frankfurt-am-Main, in Germany, to visit Dr. and Mrs. Rudolf Richter who have been active workers in paleontology during the last ten years, producing much excellent work.

From Frankfurt he then returned to Copenhagen and in company with Dr. Christian Poulsen of the Mineralogical Museum, made a visit to the island of Bornholm in the Baltic Sea. The island consists of a granitic mass with younger and softer rocks on the southern margin, the whole having been very heavily glaciated.

Several hundred pounds of selected fossils were collected and sent to the National Museum, a number of valuable gifts were secured, and exchanges were arranged.

COLLECTING FOSSIL FOOTPRINTS IN ARIZONA

Mr. Charles W. Gilmore, curator of the division of vertebrate paleontology, U. S. National Museum, by arrangement with the National Park Service and through the generosity of some of its friends, was enabled to visit the Grand Canyon for the purpose of making a collection of fossil footprints, and at the same time to prepare a permanent exhibit of these footprints *in situ* by the side of the famous Hermit Trail. Both of these undertakings were successfully carried out.

A series of slabs, some 1,700 pounds in weight, carrying good examples of the various kinds of imprints occurring there, were collected and shipped to the Museum. The tracks occur in the Coconino sandstone in Hermit Basin, on the trail down to Hermit Camp and from 900 to 1,080 feet below the rim of the Canyon. Their excellent preservation and variety of kind, coupled with their great antiquity, make this collection of more than usual interest. Preliminary study of the tracks has demonstrated that they represent not only a new Ichnite fauna, but probably the best preserved and most extensive series of Permian footprints known anywhere in the world.

It was found that the natural conditions were most favorable for the preparation of an exhibit of fossil tracks *in situ*. The rather steep slope of the sandstone on whose surfaces the tracks are impressed stands at an inclination of 30° facing toward the Hermit trail, over which in the course of the year hundreds of tourists travel on mule back in making their pilgrimage to the bottom of the Grand Canyon. The upper layers of the sandstone cleared off in large sheets, thus uncovering whatever tracks and trails there were to be found beneath. The work of preparing this exhibit consisted, therefore, of removing the overburden of loose dirt and broken rock, then quarrying off the loose upper laminae until a solid and continuous face covered with footprints was reached. This was done, and a smooth surface 8 feet wide and 25 feet long was carefully uncovered as shown in figure 25.

At the side of the slab leading up from the trail, a series of stone steps was laid in order to facilitate examination by those interested in the footprints covering its surface. Although this slab constituted the main exhibit, other large surfaces were similarly uncovered, so that in all there are several hundred square feet of rock surface showing imprints of feet, thus forming a permanent exhibit of the various tracks and trails to be found here.

The great antiquity of these footprints is clearly demonstrated at this locality, for it is evident that since the day when those animals impressed their feet in what at that time was moist sand, more than 1,000 feet of rock-making materials were piled up in successive



FIG. 25.—Slab of fossil footprints *in situ* on the Hermit Trail, Grand Canyon National Park. (Photograph by Gilmore.)

strata above them and this does not take into account many hundreds of feet more that have been eroded off the present top of the canyon wall.

The great length of time necessary for the cutting away or erosion of the rock to form the deep canyon and the even longer time necessary for the original deposition of this great vertical mass of



FIG. 26.—*Barobczia eakini*, new species of fossil footprints.
Crossed diagonally by track of *Laoporus nobeli* Lull.

stone when translated into terms of years, if that were possible, would be so stupendous as to be almost beyond human comprehension.

This unique exhibit gives a very definite impression of the great antiquity of the animal life that made these tracks, and it is hoped that as an example it will stimulate the preparation and preservation of other natural phenomena in our government controlled parks, monuments, and reservations.

INVESTIGATION OF GLACIAL DEPOSITS NEAR DES MOINES, IOWA

In April, 1925, Dr. James W. Gidley, assistant curator, division of fossil vertebrates, U. S. National Museum, was detailed under the auspices of the Bureau of American Ethnology to investigate an alleged discovery of artifacts at Adel, Iowa. At Des Moines, Dr. Gidley was joined by Dr. James H. Lees, assistant state geologist of Iowa, who aided in the investigation at Adel.

After a study of the locality, the general conclusion reached by Dr. Lees and Dr. Gidley was that although the artifacts (if such they are) were found at a level of 24 feet below the original surface and much below the level of Wisconsin (Upper Pleistocene) drift deposits abundantly exposed at this locality, the beds in which they were originally deposited are post-Wisconsin in age and represent a more recently filled stream channel formed perhaps by the abundant glacial waters coming from the last retreating glacial ice sheet. As the artifacts were found in a bed of coarse sand and gravel near the bottom of this ancient stream-channel fill, however, the time of their burial must have been several thousand years ago.

INVESTIGATION OF EVIDENCES OF EARLY MAN AT MELBOURNE AND VERO, FLORIDA

The discovery at Vero, Florida, a few years ago of human remains associated with those of an extinct fauna aroused considerable interest at the time, and since the first publication of the occurrence by Dr. E. H. Sellards in 1916, there has been much discussion as to the age of these remains and the manner of their occurrence. Several prominent men of science have expressed widely divergent opinions both as to the age of the deposit in which the human bones were found and as to their normal association with the extinct

animal bones with which they were found. More recently a discovery, similar to that at Vero, was made near Melbourne, about 40 miles north of that place. The importance of this new discovery was recognized, and accordingly Dr. Gidley, under the auspices of the Bureau of American Ethnology, was detailed to Melbourne, where with the aid of Mr. C. P. Singleton, a local amateur collector and the first discoverer of fossil bones in that vicinity, a preliminary investigation was made.

For this investigation, Dr. Gidley left Washington, December 15, 1924, and returned January 4, 1925. This trip resulted in locating



FIG. 27.—North bank of drainage canal about three miles west of Melbourne, Florida. Showing exposures of No. 2 and No. 3 beds and top of No. 1 bed. (Photograph by Gidley.)

several good prospects and in procuring by gift from Mr. Singleton, a fine specimen of the Florida mastodon which included a nearly complete skull and lower jaws. While in Melbourne, Dr. Gidley met Prof. F. B. Loomis of Amherst College, who also had come there to look over these fossil deposits. There followed the formulation of a tentative plan, afterwards approved by the authorities of Amherst College and the Smithsonian Institution, for a joint field expedition to more thoroughly explore the localities in the vicinity of Melbourne and to re-examine the fossil beds at Vero. This joint expedition, which left Washington on June 21 and returned August 7, met with gratifying success in the way of adding considerable new evidence to be considered in working out the problem of early man in Florida.

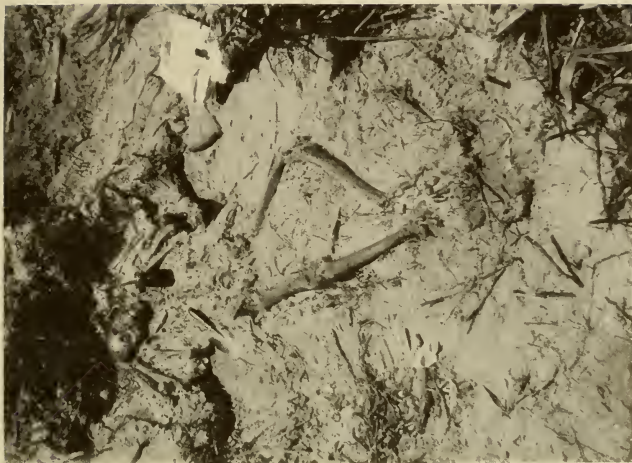


FIG. 29.—Indian burial mound at "Sunny Beach," Florida, an estate owned by Mrs. S. Thurston Ballard. Showing skeleton *in situ*. (Photograph by Gidley.)

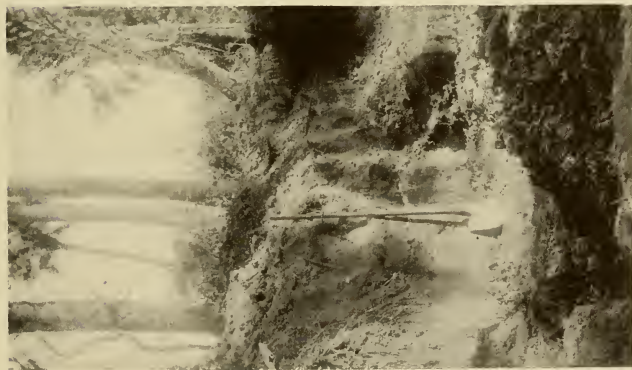


FIG. 28.—Locality about $2\frac{1}{2}$ miles southwest of Melbourne, Florida, where human artifacts and remains of extinct animals were found associated. Showing top of No. 2 bed and No. 3 bed above, with irregular contact plane. (Photograph by Gidley.)

On studying the fossil-bearing deposits at both localities, it was found that the general conditions of deposition in the vicinity of Melbourne were almost identical with those at Vero, so there was no difficulty in recognizing over a wide area at Melbourne the three principal geologic horizons designated by Sellards at Vero as Nos. 1, 2, and 3. This made the correlation of the beds of the two localities comparatively easy. It was found that at both localities, all the fossil bones taken from Sellards "No. 2" layer were primarily deposited and were definitely of Pleistocene age. Many of the bones of the lower part of No. 3 were also of this age but were often mixed with bones of more modern species. Also that "No. 3" layer usually lies unconformably upon the somewhat unevenly eroded surface of "No. 2." "No. 3" layer throughout contained numerous evidences of man, apparently of no great antiquity, while no remains of this character were found in the lower portion at least of "No. 2." However, at Melbourne there were found, at three relatively widely separated areas, human bones or artifacts associated with undisturbed, and not redeposited, fossil bones of the Pleistocene fauna. These finds were all near the top of "No. 2" level, just below the contact plane. As no human remains or artifacts were found below the top layer of "No. 2," it is assumed that man arrived in Florida about the close of the time marked by the finished deposition of "No. 2" or during the erosian interval between it and "No. 3," and that he seems to have found there a late survival of the Pleistocene fauna, certain species of which may have persisted in the south later than did their relatives in the north country. To verify these conclusions, a more extensive and carefully worked out geologic investigation of both localities should be made, especially along the contact plane between beds "Nos. 2 and 3."

This expedition also spent some time in exploring certain of the ancient Indian shell mounds and burial places of the vicinity. From these a good collection of well-preserved skulls and skeletons were obtained. There are many of these ancient Indian mounds in this part of Florida, but unfortunately the present white inhabitants of the region are digging them up as fast as located in the hope of finding buried treasures. Thus is being destroyed what historic and scientific value these mounds have for the archeologist. At the present rate it will be only a few years until these burial places of an interesting ancient people will almost wholly vanish as have the people who made them.

EXPLORATION OF A PLEISTOCENE SPRING-DEPOSIT IN
OKLAHOMA

In October, Dr. Gidley was detailed under the auspices of the Bureau of American Ethnology to examine a spring deposit in southwestern Oklahoma. This spring is situated at the base of Long Horn Mountain, on its southwesterly slope. It is about 14 miles south of Mountain View, and about 40 miles northwest of Fort Sill, Oklahoma.

The fossil bones had been discovered here in August by an Indian, Mr. Carl J. Reid Dussomé, while cleaning out the spring



FIG. 30.—Long Horn Spring, about 14 miles south of Mountain View, Oklahoma, on ranch owned by Miss Reid Dussomé, great granddaughter of Satanta, a former chief of the Kiowa Indians. Showing excavation above spring where a "banner" stone was found associated with remains of Pleistocene animals. (Photograph by Gidley.)

preparatory to enclosing it with concrete in order to get a better and cleaner flow of water for domestic purposes. Thus, an area of about 150 square feet was exposed to the bottom of the deposit which here is only 6 or 7 feet in depth. Additional excavations were made under the direction of Dr. Gidley in October, which added about 300 square feet to the area explored. The fossil bones were confined entirely to the lower 18 inches of the stratum which consists mostly of a black, sticky mud, or clay. The general results of this exploration seem to be important, although not a great amount of material was obtained. A small collection of Pleistocene fossils were procured, part being donated by Mr. Reid and

part collected by Dr. Gidley. Most important was the finding of a broken bannerstone, near the bottom of the fossil bone-bearing layer and in apparently normal immediate association with remains of an extinct horse, while remains of the mammoth, mastodon, and mylodon were recovered at the same level a few feet away. The shallowness of the fossil bone layer, the general character and disposition of the deposits, the little altered condition of the fossil bones and the aspect of the immediate surroundings, all suggest, however, a not remote antiquity for the origin of this material, and again raises the question of whether or not a remnant of the American Pleistocene fauna may not have survived to a much later date in the southern border of the United States than has hitherto been supposed.

FIELD-WORK IN ASTROPHYSICS

With the unanimous endorsement of the National Academy of Sciences, the Chiefs of the United States and British Weather Services, and of several other eminent meteorologists, the Congress of the United States increased its appropriation for the Astrophysical Observatory sufficiently to enable the Smithsonian Institution to continue the solar radiation station at Montezuma, Chile, for the fiscal year 1926. Hitherto this station has been carried in part by the income of the Hodgkins fund of the Smithsonian Institution and in part by the grants of Mr. John A. Roebing, who has now discontinued his support, after expending a very large sum on this and related researches.

The Smithsonian has therefore been able to continue daily observations of the variation of the sun at two exceptionally cloudless desert stations. Daily telegrams have been received within 24 hours after the observations, which indicate the independent results of the two observatories. This information has been communicated immediately to Mr. H. H. Clayton, who has continued his studies of the relations of solar variation to weather. As a test of his results, he has sent daily solar forecasts to the Institution estimating the temperature of New York City 3, 4, and 5 days in advance. He has also sent (3 days before their commencements) forecasts of temperature departures at New York for each week and month.

These results will not be made public as forecasts. They are merely to enable the Smithsonian Institution to estimate Mr. Clayton's success in these experiments. However, the results hitherto show very



FIG. 31.—Cottage for observers at the new Table Mountain, California, station of the Smithsonian Astrophysical Observatory.



FIG. 32.—Concrete observing tunnel at Table Mountain, California.

certainly real prevision on Mr. Clayton's part, and a gradual increase in the accuracy of his forecasts. That the forecasts are not even more close to the event than they are is due to several causes, not least of which is the imperfect character of the Smithsonian solar radiation observations.

Our two stations in Arizona and Chile differed on the daily average by about 0.5 per cent during the past two years. Clayton's researches seem to demand a higher degree of accuracy than this. It can only be



FIG. 33.—Mt. North Baldy from the road to the Table Mountain observing station.

attained by small improvements in various parts of the observations, by the improvement, if possible, of the existing stations, and by adding new stations of the highest merit.

All three of these improvements are in progress. A complete critical revision of methods of observation and reduction of solar radiation observations is being made. Through Mr. Roebing's generosity, the station at Harqua Hala, Arizona, is being removed to Table Mountain, California, 2,000 feet higher. A year's observations at Table Mountain prove that the sky conditions there will be decidedly better and the living conditions for observers much more comfortable.

Mr. Moore, the field director, has worked hard and successfully to make the transfer to Table Mountain which involved buildings,

road, water and sewer arrangements, etc. Still, it could not have been accomplished without the cordial cooperation of the Commissioners of the Los Angeles County Park in which the new observatory lies.

Finally, the National Geographic Society, realizing that the relations of solar radiation to weather constitute a highly important world problem, has made to Dr. Abbot a grant of \$55,000 to enable him to locate a new station in the best possible site in the Eastern Hemisphere, and in cooperation with the Smithsonian Institution to purchase the outfit and carry on the observations for several years. There should be still a fourth station, and it is hoped that eventually means may be found to erect and maintain it.

Dr. Abbot, accompanied by Mrs. Abbot, is now making the reconnaissance in Algeria, Beluchistan and Southwest Africa which seem to be the most favorable locations, considering cloudlessness, high altitudes, stable government and convenient transportation.

Four important papers on these researches have been published during the year as Numbers 3, 5, 6, and 7 of Volume 77, Smithsonian Miscellaneous Collections. In addition Dr. Abbot has given a radio talk and contributed two papers to science and one to the National Geographic Magazine giving special aspects of the matter.

BIOLOGICAL EXPLORATIONS IN WESTERN CHINA

The Rev. David C. Graham continued his natural history explorations in the province of Szechwan, China, during the year 1925, collecting material locally in the vicinity of Suifu and occasionally sending his native hunters to points at some distance from his station. He had projected a trip to the region of Moupin, a place he was unable to visit the previous year, but again the presence of bandits in that vicinity caused him to alter his plans. In fact, his movements during the year were largely dependent upon civil war and bandit conditions.

After giving up the Moupin project, Mr. Graham decided to go to Mount Omei, southeast of Kiating, and had begun to pack his outfit for this trip, when his insect netter returned from a collecting foray with the information that a band of 80 armed robbers were operating on the Min River between Suifu and Mount Omei. While again undecided as to his summer's plans, Mr. Graham was notified about the middle of June that the local military authority requested all foreigners to go to Kiating together, with a heavy escort for safety. In his diary, Mr. Graham writes: "The General says that possibly 500 soldiers will have to be sent along with us. Conditions between here

and Kiating are the worst they have been for years." In preparing for the trip to Kiating, soldiers commandeered Graham's boat, but eventually he recovered it, and on June 27 the foreign party, consisting of five boat loads, with twenty cargo boats, started on the journey.

At Sin Shih Pien, the foreigners were delayed a day or two, and the officers in charge of the escort compelled them to pay \$900.00 for protection to Kiating. On June 29 they left Sin Shih Pien and at night camped at Nang Chang, on the north side of the stream, with a band of robbers just across the river. On June 30 they made further progress, reaching Si Chi, and on July 1 went 40 li to Malintsang, where they learned that the Eighth Regiment had come out and taken Chien Way. The escort was at war with the Eighth Regiment, and did not dare go any farther. Graham writes: "We therefore arranged to allow them to depart, and for us to go on with some militia escorting."

On July 3 the party reached Ho Keo, 20 li from Chien Way, where they found that civil war had suddenly come upon them again. The party secured permission to continue on its way, though progress was rendered difficult by heavy rains, which caused the river to rise several feet. On July 5 the party sent a messenger ahead to Kiating, as they were out of money and nearly out of bread and coolies. Mr. Graham writes: "I have travelled up the Min River many times, but this has been the slowest and worst trip I have ever made. This is due to the cargo boats, to high water, and to the brigands. . . . From Suifu it has been impossible to shoot birds because of brigands and military operations." The party reached Kiating on July 7, and having gone thus far, Mr. Graham decided to try for Washan Mountain, and had actually started, when on the 12th a messenger arrived with a letter saying conditions were getting worse down the river, that many British subjects were leaving Szechwan, and that all foreigners might be ordered to leave, also advising that he abandon his plan to visit Washan. He notes: "It is a keen disappointment, but it seems unwise to go on, so to-morrow I'll go back toward Mt. Omei and spend the summer as profitably as I can." On July 14 he received a letter stating that conditions were improving and that the foreign community withdrew its request that he should not attempt the trip to Washan. He thereupon again headed for that mountain, and on July 23 reached the summit, which he says is the highest point in central Szechwan. On every side "it is a sheer cliff several thousand feet high, with only one road to the top and back. . . . The road made a few circles, and soon I found myself walking along



FIG. 34.—An idol being carried in a sedan chair in an idol procession at Ngan Lin Chiao, near Suifu, Szechwan, China. (Photograph by D. C. Graham.)

the edge across the top of that cliff, with only a foot or more of dirt and some small bushes between me and the precipice. Later the road leads a long way on the edge of a narrow ridge, on each side a sheer precipice of thousands of feet. In one spot the path is about 3 feet wide, and I think a little less. It took all the grit I had to cross that place, and I'd hate to attempt it in rainy weather when the rocks are slippery. There is one place where there is no place to get a foothold, and the precipice is bridged by poles placed side by side, under the bridge is a chasm that one does not like to look at. To cap the climax, near the top are long ladders. It is practically perpendicu-



FIG. 35.—Part of a retreating army (the whole army numbered tens of thousands of soldiers), being ferried across the river at Chien Way, near Kiating, by a steamer to which small Chinese boats are tied. (Photograph by D. C. Graham.)

lar at these points, and without the ladders no one could reach the top." He writes further: "We are in the only building on Washan, a tumbled-down temple that will leak badly if it rains. There is no one living in this temple or anywhere on the mountain."

After spending some time at the summit of the mountain in pursuit of specimens, Mr. Graham retraced his steps to the lower levels, and finding conditions further improved, turned his attention to Mt. Omei, which is a few hundred feet less in height than Washan, and is within sight of it on clear days. Mt. Omei is one of the four great sacred mountains of China, there being many smaller sacred ones, but Omei is one of the important Buddhist centers, with many temples between the top and Kiating. After beginning work on

Omei, he received a Chinese letter stating that the Buddhist society in charge of this sacred mountain had heard that he was collecting specimens here, and had sent instructions to order him to discontinue all shooting above Wan Nien Si. He met all of the priests in the temple and carefully explained his purpose in securing the specimens, but they were obdurate and there was no alternative but to comply. He says: "Instructions were definitely given for me to discontinue shooting on this holy mountain, as it would cause some to believe that the Buddhist priests were insincere, and the Buddhist society controlling the mountain would make trouble with the priests of the local temple. I therefore plan to go down the mountain to-morrow as far



FIG. 36.—Steamboat at Chien Way. Foreigners can be seen on the upper deck. The native soldiers are part of the retreating army. This is just before the great retreat began, when over 30,000 soldiers were ferried across the river by this steamboat. (Photograph by D. C. Graham.)

as possible." He adds: "the top of Mt. Omei is a rich place for collecting, and the above order is much to be regretted."

In preparing for his return journey, Mr. Graham decided to pack his summer's accumulation of specimens and mail them from the village of Shin Kai Si, to reduce the danger of loss from robbers. Over seventy parcels were packed and mailed from this place, after which he set out for Kiating, where he was to try and arrange for the safe transport of the Suifu foreigners from Kiating to Suifu.

Mr. Graham's return from Kiating to Suifu was filled with exciting incidents, due to war, brigands, and lack of food. He writes: "With over one hundred thousand troops engaged in civil war in the Province, with bands of robbers everywhere, and with the serious complications between China and the foreign powers, it may be con-

sidered a victory to have carried through the collecting trip and to have secured more specimens than were collected in any previous year."

Mr. Graham explains that there are two Washan mountains in Szechwan, one to the west and north of Mt. Omei, near Yachow, and the other south of Mt. Omei. The last Washan has precipitous sides, and is the one where his collections were made.

The illustrations show views between Kiating and Suifu, made on the last part of his journey, the negatives for the earlier parts of his expeditions not having been received in time for reproduction in this notice.



FIG. 37.—North edge of the central plain of Haiti, with the low, scrub-covered limestone mountains which bound it. Most of the caves occur at about the level of the streak of nearly bare rock seen near the middle of the mountain mass.

EXPLORATION OF HAITIAN CAVES

During March and April, 1925, I spent about six weeks in Haiti with the principal object of exploring the caves near San Michel which were visited by members of the U. S. Geological Survey in March, 1921. Soundings made in the floors of these caves in 1921 had shown the presence of rich deposits of bones of extinct vertebrates, and two short papers had been published in which some of these animals were described. The problem in hand was to determine the richness and true nature of this fauna, and to correlate it with the faunas which have been found in the cave deposits of Porto Rico, Cuba and Jamaica.

Arriving in Port-au-Prince March 3, 1925, I spent 10 days at a point about 6 miles west of the city on the coast of the southern



FIG. 38.—Artibonite River, the largest stream in Haiti, as seen from road between St. Marc and Gonaïves.



FIG. 39.—Roadside cotton buyer between Gonaïves and St. Marc. The merchant is seated under the shelter behind the pile of cotton. Peasants bring their cotton in small quantities for sale. It is weighed on the scales at the right.

peninsula near Point Lamentin. Here general collections were made chiefly of plants, reptiles, and batrachians.

Four weeks were then given to the real object of the expedition. The caves visited by the Geological Survey party in 1921 are situated in the southward facing slopes of the low mountains which border the northwestern extremity of the central plain of Haiti. The plantation of l'Atalaye, now owned and operated by the United West



FIG. 40.—Adansonia tree on plain east of San Michel. This African tree, supposed to live to an age of several thousand years, is probably a relic from the days of the slave trade.

Indies Corporation, proved to be a very convenient base from which to work. The soundings made by the Geological Survey party were enlarged and fully explored. Four untouched caves in the same neighborhood were also examined. The floors of all of these caves contained rich deposits of bones of mammals, birds, reptiles, and batrachians, occurring from practically at the surface downward for about 3 feet. Beyond a depth of 4 or 5 feet bones were not found. The material collected has not yet been critically studied, but a superficial examination shows that it consists very largely of the



FIG. 42.—Few Haitian towns lack the open square with the church at one side, and, in the middle, the symbolic palm trees and the rostrum for out-of-door speaking. Usually there is a flag pole, but it was absent here.

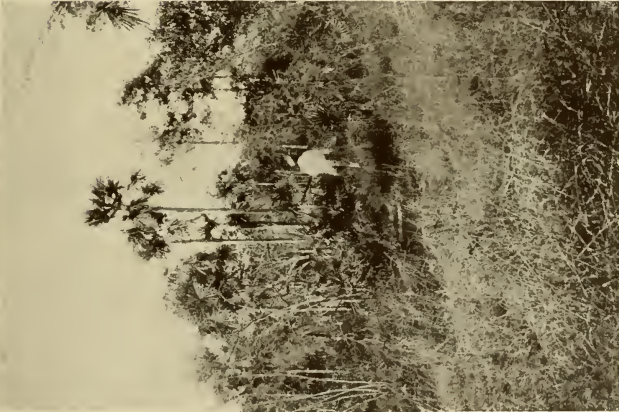


FIG. 41.—Characteristic scrub near the plantation, San Michel. Here occurs one of the few remaining stands of the almost exterminated native juniper. One of these trees is outlined against the sky at the right of the man.

remains of animals now extinct. The fact that most of the extinct species occur in the superficial layers of the cave floor, and that practically all of them were found in one or the other of the caves closely associated with human remains and artifacts which appeared to have been interred by the same natural agencies which have effected the covering of the animal bones, makes it appear probable that the dying out of this indigenous fauna is an event of no great geological antiquity.

The ease and success with which this investigation was carried on is chiefly due to the kindness of Brigadier General Ben H. Fuller, who cordially placed the transportation facilities of the Marine Corps at the disposal of the Smithsonian Institution, and of Mr. G. G. Burlingame, president of the United West Indies Corporation, who similarly extended the hospitality of the Atalaye plantation. In Mr. E. J. Sieger, manager of the plantation, I found an invaluable aid owing to his intimate knowledge of the country and the people, and above all to the intelligent interest with which he assisted me in my work.

GERRIT S. MILLER, JR.

MARINE INVERTEBRATE STUDIES AT THE TORTUGAS

Dr. Waldo L. Schmitt, curator of marine invertebrates, U. S. National Museum, spent the month of June, 1925, at the Carnegie Marine Biological Station, Tortugas, supplementing his last year's investigation of the Crustacea of the region. In collaboration with Dr. Longley, extensive studies of the food of fishes were pursued, Dr. Schmitt giving particular attention to the crustacean element of the problem. He examined about 750 fish stomachs and by this means added several species to his previous list of Crustacea. He writes, "We can already see specific feeding differences in closely related species; of the two snappers, the one feeds on the sand-dwelling Crustacea, and the other on the rock and eel-grass inhabiting forms. And these are fishes that during the day largely school together; in fact, we take them with the same shot of dynamite." About two thousand specimens of marine invertebrates were obtained through Dr. Schmitt's efforts, consisting chiefly of Crustacea, Sponges, Coelenterates, Bryozoa, Echinoderms, and marine Annelids.

STUDY OF THE CRUSTACEANS OF SOUTH AMERICA

Dr. Waldo L. Schmitt, curator of marine invertebrates, U. S. National Museum, was awarded the Walter Rathbone Bacon Scholar-



FIG. 43.—The wharf of the Carnegie Marine Biological Station, Tortugas, showing some of the laboratory buildings.



FIG. 44.—One of the collecting launches belonging to the Carnegie Marine Biological Station, Tortugas.

ship of the Smithsonian Institution for the purpose of making a study of the crustacean fauna of South America. He hoped to spend the last six months of this year investigating the fauna of the east coast of the continent, and left New York August 1, arriving at Rio de Janeiro on the 13th, where he was accorded every courtesy, both by the Brazilian officials and the American Ambassador. Much collecting was done in the Bay of Rio de Janeiro, and valuable material obtained at Paqueta Island.

Dr. Schmitt visited the Museu Nacional, examined the collections, and received much valuable information from Dr. Carlos Moreira, the Brazilian carcinologist, who was for a long time attached to the



FIG. 45.—Museum at São Paulo, Brazil.

Museum, in regard to the local marine fauna and the best collecting grounds.

Heavy rains and unavoidable delays prolonged his sojourn at Rio de Janeiro until September 7, when he left for Santos, arriving there the following day. The nearby Museu Paulista at São Paulo was visited and here he met Dr. H. Luderwaldt, Custodian, who for many years has been a correspondent of the U. S. National Museum. The collections of the Museum were examined and greatly admired by Dr. Schmitt. He was very much gratified at receiving from the Museu Paulista permission to work up its collection of unidentified crustacea, and for the privilege of making exchanges. The fishing grounds of Santos were visited and some material obtained from the seine hauls of the fishermen.

On September 17, accompanied by Dr. Luderwaldt, he started for São Sebastiao, arriving the next morning after a most uncomfortable night on a small boat. The collecting here was good and many varieties of crustacea were obtained. Night collecting yielded valuable tow-net hauls. Upon this island several species of fresh-water shrimps were obtained. Dr. Schmitt is of the impression that these shrimps can travel considerable distances over land through the woods should their parent stream go dry. He states that tiny Euphausids produce a magnificent phosphorescence at night in the waters around the island.



FIG. 46.—House in Blumenau similar to the one which formed the early home of Fritz Müller.

He returned to Santos September 28, where several cases of specimens were prepared for shipment to Washington.

Passing down the coast, collections were made at São Francisco Island, then at Castro where several fresh-water streams were visited. Here, amongst other things, two species of an anomuran crab of the genus *Aeglea* were obtained. These Dr. Schmitt considered a great find, as they are rather rare in collections and there has been some uncertainty as to their status.

He left Castro October 21, and traveled by auto over the mountains to Blumenau. Here he met Fritz Schmitt, son-in-law of Fritz Müller, the celebrated naturalist, visited Müller's former home and saw the very simple microscopes with which he did such excellent work.

He returned to São Francisco October 27, when several cases of specimens were packed for shipment to Washington. The weather and tides being favorable, some excellent collections of shrimps and amphipods were made at this station, and he says "I've extended the ranges of a number of species, and surely found a couple of new ones here."

He arrived off Itajahy at 8 p. m., November 2, after a cold, rainy trip, and early the next morning anchored off Florianopolis. Some tow-net hauls and shore collecting here produced excellent results.

Owing to the many unavoidable delays, Dr. Schmitt has not been able to progress as rapidly as he had hoped, but the ground has been as thoroughly worked as possible, and several cases of specimens have already been received at the Museum. His collections at this time comprise several thousand specimens and consist chiefly of Crustacea, Coelenterates, Porifera, Echinoderms, Annelids, Bryozoa, and Fishes.

EXPERIMENTS IN CERION-BREEDING AT THE TORTUGAS

Dr. Paul Bartsch, curator of mollusks, U. S. National Museum, spent the period between the last call of the "Anton Dohrn" at Key West and the closing of the laboratory of the Carnegie Marine Biological Station, August 12-24, 1925, at the Tortugas, largely upon work on his *Cerion* colonies.

The part of the *Cerion* breeding work about which the greatest interest centers, were the little islets made last year by placing concrete trenches filled with water around four 6×6 feet areas and eight 3×3 feet spaces. In the first of the larger of these areas were placed last year 25 *Cerion incanum* and 25 *Cerion* of a new species. Of these, 22 *Cerion incanum* and 18 of the new species were found dead in the inclosure this year. But, in spite of the great mortality, very small young individuals were present. It is to be hoped that some of these may reach maturity and may show crossing.

In the second inclosure had been placed 25 *Cerion incanum* and 25 *Cerion chrysalis*. Eleven of the *Cerion incanum* and 12 of the *Cerion chrysalis* were found dead, but here, too, young were in evidence.

In the third inclosure had been placed 25 *Cerion incanum* and 25 *Cerion mummia*. Of the *Cerion incanum*, 16 were found dead, and of the *Cerion mummia*, 17. Here, too, young were in evidence.

In the fourth inclosure had been placed 25 *Cerion incanum* and 25 *Cerion tridentatum*. Of the *Cerion incanum*, 13, and of the *Cerion tridentatum*, 10, were found dead. Young also were present in the inclosure.

In the eight smaller inclosures in which had been placed a young specimen of each, *Cerion incanum* and *Cerion viaregis*, it was deemed wise not to disturb the vegetation or sand to discover their fate. In some, living individuals were seen; in others, dead specimens were in evidence. Next year these islets will be examined in detail.



FIG. 47.—The west shore line of Loggerhead Key, looking from the Marine Biological Laboratory towards the lighthouse. Here many of the marine shells found in the region were gathered.

The colonies which were introduced on the top of Fort Jefferson last year also showed considerable mortality, but a number of living specimens remained. Here too it was deemed best not to disturb the ground, for very young forms have a way of burrowing just beneath the surface of the sand, and exposing them to sunlight frequently results in killing them.

This year Dr. Bartsch cut down the large cages made two years ago to the mere four-inch base boards and tops. These were buried a bit around the edge, then a narrow strip of monel wire screening was tacked to the upper edge, allowing about one and one-half inches to project inward. Seventy-five of these inclosures were made, 3 × 3 feet in size. They were provided with the usual plants, and in each

of them was placed a specimen of *Cerion incanum* and of *Cerion viaregis*. It is hoped that these plantings will at last furnish the much desired cross of individual pairs.

All the colonies of Bahama Cerions are doing well and spreading rapidly beyond their original areas, excepting the one from San Salvador, planted two years ago, in which considerable mortality has occurred. The colony of *Cerion urva* from Curacoa, however, is about gone and *Cerion crassilabre* from Porto Rico will probably not survive.



FIG. 48.—A photograph of the north end of Loggerhead Key from the lighthouse, showing the location of many *Cerion* colonies.

On August 25 Dr. Bartsch visited Newfound Harbor Key, where he found the hybrid colony of *Cerion incanum* and *Cerion viaregis* doing well. One hundred specimens, showing great diversity in size, sculpture, and coloring, were gathered for dissection at Washington, and it is to be hoped that the dissection of 70 more of these hybrids may soon be finished, 30 having already been completed, so that a report based on 100 dissections may be published. The 30 specimens already dissected show an enormous diversity and modification of the internal anatomy from the types planted, produced by hybridization.

During his stay at the Tortugas, Dr. Bartsch kept a record of the birds from day to day. This was also done on the other Keys visited. He likewise exposed sixteen hundred feet of moving picture film under sea, which he hopes will show some of the faunal associations found on the coral reefs at the Tortugas.



FIG. 49.—Young sooty and noddy terns seeking the shade of the Warden's cabin on Bird Key.



FIG. 50.—Young sooty and noddy terns in the shade of the landing slip on Bird Key.

BOTANICAL EXPEDITION TO BRAZIL

The flora of eastern Brazil is of especial interest to the student of tropical North American plants. Only a few botanical collections were made in the tropics of North America until after an important scientific expedition to Brazil had made known much of the flora of eastern Brazil and part of the valley of the Amazon. Brazil, the West Indies, and Panama have many species of plants in common.

The Brazilian expedition referred to was sent, under the leadership of Von Martius, by Francis I of Austria as an honorary escort to his daughter, Leopoldina, on her voyage to Brazil to marry the crown prince of Portugal and Brazil, the man later known as the "Liberator," Pedro I of Brazil. Martius and Spix, after a few months about Rio de Janeiro, went to São Paulo and from there made their way northward through Minas Geraes and Bahia to Piauhy and Maranhão on the north coast, crossing Rio São Francisco at Joazeiro. They then traveled up the Amazon to some distance beyond Teffe (or Ega).

The Amazon and other parts of Brazil have since been explored and the U. S. National Herbarium has, by exchange, come in for a share of the plants collected, but there was no U. S. National Herbarium at the time of Martius and but little has since been collected, at least of grasses, in the region he traversed in the interior. For this reason, it seemed important to collect material from this region, and late in 1924, Mrs. Agnes Chase, assistant agrostologist of the National Herbarium, was detailed for this purpose.

Arriving in Rio de Janeiro on November 1, Mrs. Chase first collected on Corcovado, here procuring many of the species first described from this mountain by Raddi. In spite of the dense population in the lowlands, the mountains about Rio de Janeiro have not been spoiled for the botanist. Except for the invasion in places of *Melinis minutiflora*, called "capim gordura" (molasses grass, by us), an African species early introduced into Brazil, the steep jungly slopes are probably not greatly changed from what they were a hundred years ago.

Four days after landing, Mrs. Chase left for Pernambuco in order to reach that region before the dry season was much advanced. Pernambuco, or Recife, as the city is commonly called, lies on flat ground built up by coral reefs and mangroves. The surrounding region is densely populated. Wooded hills which at a distance showed no signs of being inhabited turned out to be full of huts and goats and children. In little clearings were patches of maize and beans, and a few bananas and sometimes oranges. Vetiveria was planted about many of the



FIG. 51.—Mangrove marshes north of Recife. The coast of Pernambuco is built up by coral reefs and mangroves. In the distance are seen the ruins of an old fort and lighthouse.



FIG. 52.—Part of Paulo Affonso Falls. These falls are so broken that they form a stupendous cascade. There is no one point from which the entire falls can be seen. The canyon walls are devoid of vegetation except in a few spots watered by the spray.

huts. This is one of the oil grasses, introduced from the East Indies. In the West Indies, the roots are used to scent clothing and to keep moths away, but here it is used to thatch huts. The caju (cashew) is everywhere, a beautiful wide-spreading tree, bearing multitudes of fragrant small maroon flowers and fruit in all stages of development. The wet meadows and stream borders offered the best botanizing. Here were great *Paspalums* and *Panicums*, tangled with aroids, ferns, and brush. A quaking bog yielded some little-known grasses.

A trip was made to Bello Jardim, 186 kilometers to the west in the Serra da Genipapo, at an altitude of 600 to 650 meters. The hills are covered with scrub or low trees, the "caatinga," consisting of mimosas, acacias, and thorny shrubs and semi-arborescent cactuses, except where it has been cleared for planting. Ground is cleared by burning, and cotton, sugarcane, castor plants, mandioca, and tobacco are planted, sometimes here and there among the shrubs or tussocks of sedge that refused to burn. There seemed to be little or no cultivation. When a field becomes overgrown with weeds or brush it is abandoned and a new place is burned, land being very cheap. The result is that cultivated spots are scattered hit or miss through the scrub, which is overgrazed by cattle, horses, donkeys, sheep, and goats till only inedible shrubs and herbs, *Jatropha*, *Capparis*, and the like, flourish. No forage crops are grown in the sertão (the interior arid region) except for little patches of Pará grass here and there along a stream. In November the dry season had only begun, yet every edible plant in the sertão seemed to have been consumed, and there were still some eight months to endure before the rains.

A second journey was made to Garanhuns, 850 meters high, in the sertão to the southwest. The country here is much less barren, and more progressive, with fairly good sugarcane fields, and with bullock carts in common use.

With two women missionaries, Mrs. Chase visited Paulo Affonso Falls in Rio São Francisco, about 150 miles from Garanhuns. These falls are 610 feet in height, higher than Niagara and of greater volume. The region had not before been visited by a botanist and much was expected of it, but the desert extends to the vast river, even the canyon walls being almost devoid of vegetation.

The period from December 7 to January 5 was spent about Bahia, in the sandy savannas and marshes to the north and in the hill country across the bay, about Cachoeiro and Feira Santa Anna. A trip across the state to Joazeiro on Rio São Francisco was disappointing,



FIG. 53.—View from the summit of Agulhas Negras. This high region, Alta de Serra, is rich in grasses.



FIG. 54.—A cornfield in a palm grove, foothills of Serra de Cipó. Land is commonly cleared by burning, the trees that withstand the fire being allowed to stand.

the country here having been devastated by long-continued over-grazing. A stop at Itumerim in the Serra da Espinhaço, to the south of Joazeiro, was productive of a good collection.

Rio de Janeiro was reached a second time January 9, midsummer. Several days were spent on Corcovado, Pão de Assucar, and the other hills of the coast range; then with a party from the Jardim Botânico of Rio de Janeiro, Mrs. Chase visited Itatiaia, one of the two disputed highest points in Brazil. From the railroad the party traveled on horseback, with pack animals. A night was spent, going and returning, at the Florestal, a station where the Jardim Botânico is carrying on work on Monte Serrat, affording opportunity for collecting in this typically tropical forest country. From Monte Serrat to the summit of the mountain and for some miles beyond on the Minas Geraes side the country is a Federal reserve under the charge of the Jardim Botânico. One day was spent making the ascent from Monte Serrat to a rest house just below timber line, at an altitude of about 2,100 meters. The third day the party ascended the Agulhas Negras ("Black Needles"), the culminating point of Itatiaia. This was long known as the highest point in Brazil and was said to be 2,994 meters in altitude. Recent measurements, however, give about 2,830 meters. From the summit the three days return journey was made on foot, collecting the grasses. The high campos above timber line were covered with grasses, large and small. The trail borders and mountain slopes also yielded abundant collections.

From the end of the rainy season in early February to the end of the fall in May was spent in the State of Minas Geraes. The flora here is very different from that of the regions earlier visited. The high hills are covered to a certain extent with open or brushy campos. From about Bello Horizonte northward and eastward this campos type was seen at its best and was the richest grass country anywhere observed. Agriculture in Minas is far in advance of that in Pernambuco and Bahia. There are good roads in some parts far in the interior, and one sees clean cultivation and good-looking animals.

A few days each were spent at Lavras, Oliveira, Lagoa Santa, and Vaccaria in the Serra de Cipó, and a day each was spent in the mountains about Ouro Preto (formerly called Villa Rica) and Itacolumi. On April 10, Mrs. Chase left the Zona de Campos for Viçosa in the Zona de Matto, to the east. Here Dr. P. H. Rolfs, formerly director of the experiment station at Gainesville, Florida, is establishing a school of agriculture for the State of Minas Geraes. Of special interest was a row of thrifty little chaulmoogra trees. There is much leprosy in Brazil, hence the importance of these trees.



FIG. 55.—Ouro Preto, formerly called Villa Rica, the old capital of Minas Geraes in the days when there were important gold workings in the vicinity.



FIG. 56.—A colony of *Panicum riculare* along Rio Casca, Serra da Gramma.

With Doctor Rolfs and his daughter, Mrs. Chase visited Serra da Gramma, and with Miss Rolfs, Serra do Caparaó, high mountains in the eastern part of the State. Pico da Bandeira, the culminating point of Serra do Caparaó, is now said to be the highest point in Brazil, 2,884 meters. Owing to bad weather and a guide who did not know the way, they climbed Pontão Crystal, 2,798 meters high, instead of Pico da Bandeira. A large collection of interesting grasses was obtained.



FIG. 57.—Dr. Rolfs, Mrs. Chase, and outfit in the foothills of Serra da Gramma.

A last trip into campo country was made to Campos do Jordão, São Paulo, a region of high grassy hills divided by ravines full of *Araucaria brasiliensis*.

BOTANICAL INVESTIGATIONS AT EUROPEAN MUSEUMS

The growing interest in the botany of South America and the dispatch of several expeditions from this country to little-known parts of that continent in recent years have resulted in the accumulation of a large amount of unidentified material. In general, the work of naming these specimens is made difficult by the fact that a great proportion of the species peculiar to South America are known to botanists of this country only by description, the original specimens being deposited in European herbaria. Obviously, therefore, it is important that the new material be compared with specimens in European collections, and that the original types be sketched or photo-

graphed and thus made available for comparative studies in this country.

In view of this situation, Mr. E. P. Killip, of the division of plants, U. S. National Museum, went to Europe in the summer of 1925, taking with him some 500 specimens of South American plants. Among the groups which it was planned to study were *Passiflora*, *Pilea*, *Bomarea*, *Valeriana*, *Cordia*, *Tournefortia*, *Begonia*, and *Saurauja*. As it would not be possible in the short time at his disposal



FIG. 58.—Botany and Geology Building, Jardin des Plantes, Paris. In this building are contained the extensive botanical collections of the Muséum d' Histoire Naturelle.

to study all these groups with thoroughness, Mr. Killip planned to concentrate his studies upon a few genera, and to name by comparison as many specimens of the other groups as possible.

The Muséum d' Histoire Naturelle, at Paris, was first visited. Here are deposited the Humboldt herbarium, containing the types of a very great number of Andean plants, the Jussieu herbarium, and the Lamarck herbarium, to mention only a few of the collections of interest to the student of South American botany. These special collections are segregated from the general herbarium, and are in an excellent state of preservation. In the general herbarium are the Funck and Schlim, the Goudot, and the Triana plants from Colombia, the Ruiz and Pavon plants from Peru, Glaziou's Brazilian collection, and Richard's from the Guianas. Special interest attaches to the specimens of the Nettle family, for here Weddell conducted his critical studies. Ten days were spent in Paris, and about 85 specimens were photographed.



FIG. 59.—Herbarium building of the Jardin Botanique, Geneva, Switzerland.



FIG. 60.—Glacier on Mont Blanc.

In Geneva the work of incorporating the De Candolle herbarium with the Delessert herbarium at the Jardin Botanique is being carried on. An addition to the museum building has recently been constructed, affording ample room for the large collection and adequate working facilities for visiting botanists. The original De Candolle herbarium, that is, the part containing specimens cited in the *Prodromus* and the *Monographiae Phanerogamarum*, is maintained as a separate unit. These early collections have been supplemented in recent years



FIG. 61.—British Museum (Natural History), South Kensington. (End view.)

by much South American material, particularly from Paraguay, Argentina, and southern Brazil.

Twice during his ten days' stay in Geneva, Mr. Killip had an opportunity to do field-work. An afternoon on the Selève Mountains, overlooking the city, and a day on Mont Blanc netted interesting Alpine plants.

The Botanical Museum at Berlin is an almost ideal place at which to work, particularly for one engaged in studying South American plants. The presence of a large staff of botanists, many of them specializing in plant groups extensively represented in South America, has resulted in the naming and classifying of the specimens in accor-

dance with the most recent monographic treatments. To provide room for the rapidly growing collection and adequate office and laboratory space for members of the staff, a large building was erected a few years ago. The phanerogamic herbarium occupies three floors of one of the wings, and there is also a well-equipped photographic laboratory which is generously placed at the disposal of visiting botanists.

The Berlin herbarium contains a number of recent South American collections which are only scantily represented elsewhere. Among these are the large collections of Weberbauer in Peru, Stübel in Colombia and Ecuador, Hieronymus and Lorentz in Argentina, Fiebrig in Bolivia and Paraguay, and Stuckert and Ule in Brazil. Here also are excellent sets of the Humboldt, Lehmann, Karsten, and Sellow collections.

In the brief time that Mr. Killip was able to spend at the British Museum (Natural History) and the Royal Botanic Gardens, at Kew, England, critical study of *Passiflora* and *Bomarea* alone was attempted. These two genera are represented in both of the London collections by exceedingly rich material, which has formed the basis of important monographs. Approximately 70 specimens in various groups were photographed.

Returning from London to Paris by airplane, a single day was spent at the Muséum d'Histoire Naturelle in reexamining certain specimens.

For the privilege of going over these European collections, thanks are due Directors Le Comte, Briquet, Diels, Rendle, and Hill, of the institutions visited. This work was greatly facilitated by the aid generously given by members of the various staffs.

ANTHROPOLOGICAL STUDIES IN SOUTHERN ASIA, JAVA, AUSTRALIA, AND SOUTH AFRICA¹

In October, 1925, Dr. Aleš Hrdlička finished a seven-months' journey of some 50,000 miles in the interests of Physical Anthro-

¹Thanks for effective aid, financial and otherwise, which made this expedition feasible are due to Dr. Hermon C. Bumpus, Consulting Director, and to Mr. Seymour H. Knox, one of the Trustees, of the Buffalo Society of Natural Sciences. A grateful acknowledgment for valuable aid with introductions or in the work itself is due to the Hon. Robert Lansing, former Secretary of State; to the British Government of India, to other official authorities, scientific men and Museum officials of India, Java, Australia, and South Africa; to the United States Consulates in these countries, and to many scientific and personal friends, the list of whom would be too long to be enumerated.

pology, extending through France to India, Ceylon, Java, Australia and South Africa, with a brief final stop in England, under the joint auspices of the Smithsonian Institution and the Buffalo Society of Natural Sciences. Its objects were essentially a survey of what has been and what is being done in those far-off lands in the field of ancient man and fossil apes; to look into a number of important racial questions; to meet men previously known only by correspondence and establish closer relations; and if conditions proved propitious, to lay a foundation for future work.

In the journey through France, it was learned that no skeletal remains of great age have recently been encountered.

At Port Said and especially at Aden, it was possible to observe numerous Arabs. There is more or less of negro admixture, but evidently pure types are not infrequent and are very interesting. The pure Arab shows a lively, intelligent, white-man's (Mediterranean type) physiognomy, straight to wavy black hair, a fine black or mostly gray wavy beard if one is worn, dark brown eyes, and a body as richly brown as that of an average full-blooded American Indian. These are the workers. A higher class Arab man or woman, who has always worn protection against the sun and lives much indoors, may be nearly as light in color as many a southern European.

In India, the problems to be studied were first, the occurrence of fossil anthropoid apes in the Siwalik Hills; second, the distribution, numbers, and nature of Indian paleoliths and possible other traces of ancient man; third, the question of the racial affinity of the "Aryans"; fourth, the occurrence of American Indian-like types among the mongolic peoples of the Himalayas; and fifth, traces on the Indian mainland of the Negrito.

Bombay¹ in its living population presents a rich pasture for the anthropologist. Moreover, the city now possesses a handsome new museum which includes a hall of Prehistory. In this hall are several cases of Indian "paleoliths," most of them from Madras.

The Siwalik Hills of Northern India, it is known, have for some time past been giving us fossil remains of anthropoid apes. It was learned that the hills extend for about 600 miles along the base of the Himalayas, from Kashmir and Punjab to near Burma. In these hills have been found, within the last two years, five or six new varieties, if not species, of fossil anthropoid apes of the *Dryopithecus*

¹ For aid in this city, Dr. Hrdlička is especially grateful to Mr. A. H. Dracup, Under-Secretary of the Government, and to the local U. S. Consulate.

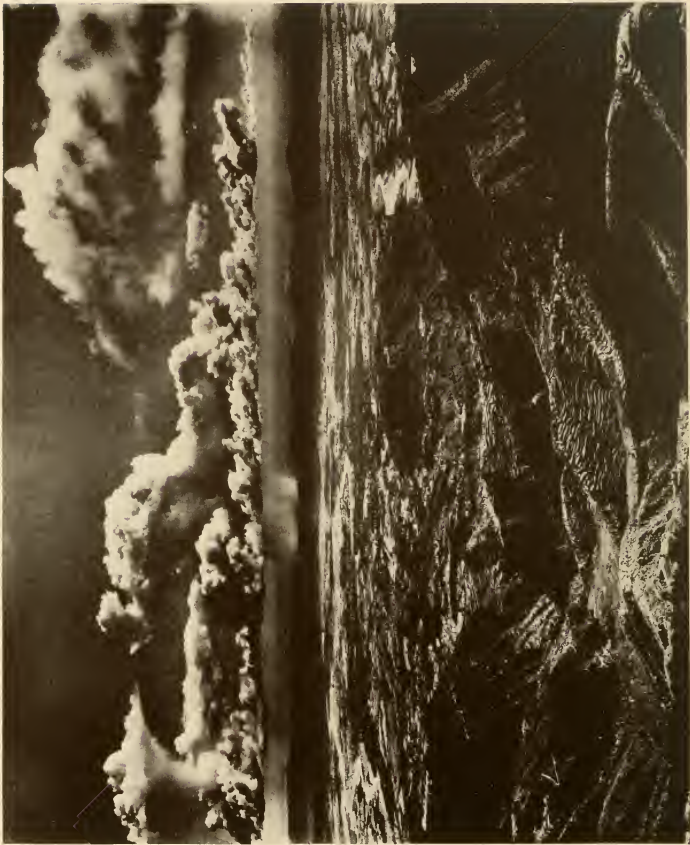


FIG. 62.—A section of the Siwaliks, India. (Photograph donated to Dr. Hrdlička by the Geological Survey of India.)

and *Sivapithecus* genera, and this with but limited scientific exploration. In former years remains of fossil anthropoids had been discovered in no less than eight other well separated localities in these hills, and it is probably safe to say that there is no region in the world richer or more promising in such remains. Yet this important field today lies fallow. The man who, in recent years, has done most of the paleontological exploration in these hills—Dr. Pilgrim, formerly a Superintendent of the Geological Survey—is returning to London, and there is no one to take his place.¹

Many other noteworthy Tertiary and Quaternary fossils besides those of apes are appearing in the Siwaliks, such as those of giant turtles, extinct proboscidea, and other animals; and the further possibilities of the region can hardly be estimated.²

From Simla Dr. Hrdlička proceeded to the Tibetan border, to observe the types of the Tibetans who make their homes in Darjeeling or its vicinity, or come there from over the mountains, and who occasionally show types that resemble most closely the American Indian. At Darjeeling, with generous help from the Government,³ it was possible in a short time to see large numbers of the native population, consisting of mongoloid tribes who have overflowed into the northernmost parts of India, and a good many Tibetans. There is seen amongst these Tibetans, Chinese admixture—for the Chinese have been lords of Tibet for a long time—yet frequently true American Indian types are also to be found, so true that if they were transplanted into America nobody could possibly take them for anything but Indian. They—men, women and children—resemble the Indians in behavior, in dress, and even in the intonations of their language.

From the Tibetan border Dr. Hrdlička returned to Calcutta to see the establishment of the Geological Survey of India and the renowned Indian Museum, where were found very valuable paleontological and archeological collections which ought to be better known.⁴ The

¹ Just as this goes to press, it is learned that, owing to a discovery of oil in the Punjab, Dr. Pilgrim is to return to that part of India, where he will be near what are perhaps the most promising parts of the Siwaliks.

² At Simla, help was received particularly from Sir Frederick White, President of the Indian Assembly, from the Military Secretary to H. E. the Viceroy, from members of the Cabinet, and from Dr. Pilgrim personally.

³ Thanks here are due especially to H. E. Sir John Kerr, Governor of Assam, at that time Acting Governor of Bengal, to Lady Kerr, and to the Governor's official family.

⁴ In Calcutta many thanks for aid extended are due particularly to the local public officials, to the excellent staff of the Geological Survey, to Mr. J. Van Mauen, Secretary of the Asiatic Society of Bengal, and to the gentlemen of the American Consulate-General.



FIG. 64.—Tibetan woman, showing type of American Indian; Darjeeling. (Photograph by local photographer.)



FIG. 63.—Tibetan man, showing type of American Indian; Darjeeling. (Photograph by local photographer.)

former include a whole series of specimens of great and lesser fossil apes from the Siwaliks some of which are not yet described; and numerous "paleolithic" stone implements from Madras. There is also now exhibited in the Museum an interesting collection of the antiquities gathered recently by the Archaeological Survey of India under Sir John Hubert Marshall, which belong to the oldest advanced culture (about 3000 B. C. ?) as yet discovered in India.

From Calcutta the journey led to Madras, where Dr. Hrdlička wished to inspect the collections, and to see what could be learned of traces of the Negrito in the Indian population. One of the biggest problems in anthropology is the presence of the Negrito in the Philippines, the Andamans, and elsewhere in the far southeast. He is there—a clear but enigmatic type, without connection now in any direction. His nearest relatives are apparently the Pygmies of Central Africa, but a great unbridged space has till now separated the two. The problem is—how did the Negrito get to his present homes? If he extended from Africa, he must have left traces of his passing in Arabia and India, from which, however, there has hitherto come no clear evidence of his presence. Such traces, so far at least as the Indian coast lands are concerned, Dr. Hrdlička became satisfied do exist. They occur in Parganas (northwest of Calcutta), in at least one area along the eastern coast, here and there among the Dravidians, and along larger parts of the western coast, more especially in the Malabar Hills. This brings unmistakable traces of the Negrito a long way farther to the westward and so much nearer to Africa, making his derivation from that continent so much the more probable.

A great collection of paleolithic implements is preserved in the Museum at Madras.¹ These implements are similar to those of other parts of India. They are all of one general class, so that there can hardly be a question as to their contemporary origin in the different parts of India, their connection with people of the same race, and belonging to the same though perhaps a long cultural period. They do not show great variety. They resemble some of the paleolithic implements of western Europe, but on the whole cannot be associated with any one of the European cultural periods. In certain parts of

¹Dr. Hrdlička's thanks for help received at Madras are due to Dr. Gravely, Superintendent of the Madras Museum; to his Assistant, Mr. P. V. Mayuranathan; to Major Dr. J. A. Cruickshank and Dr. Robert E. Wright, in charge of important Government medical establishments; and to Mr. Edward S. Parker, U. S. Vice-Consul in Charge at that city.

India, such as the Santal country north of Calcutta, such implements have been collected in thousands. In other parts, especially near Madras, they are partly on the surface soil, partly from 1 to 4 or 5 feet and even deeper below the surface. In places they occur in the alluvium of the rivers and occasionally in the "laterite", a talus-like debris resulting from the disintegration of older rocks.

In short, there are plentiful paleolithic implements over large portions of the country, but as yet they do not definitely indicate a man of geological antiquity.

With regard to the bulk of the present population of India, Dr. Hrdlička believes he can say with confidence that it is mainly composed of three ethnic elements, the Mediterranean, the Semitic, and in certain parts the "Hamitic" or North African. The "Aryans" show everywhere either the Semitic or the Mediterranean type. There was seen nothing that could be referred to the types of central or northern Europe. It would seem therefore that the Aryans came from Persia and Asia Minor rather than from or through what is now European Russia.

From India Dr. Hrdlička went to Ceylon, which is a strategic island in an anthropological sense as well as in other respects.¹ It is known that before its present population of Singhalese and Dravidians, Ceylon was peopled by an older branch of humanity, the remnant of which is represented in the Veddas.

No certain trace has been found in Ceylon as yet of geologically ancient man, but there are all over the island, generally on the tops of the hills, plentiful traces of old stone workings. These remains, mostly of quartz, some of chert, are, however, superficial and look fresh and have never been found in association with extinct animals.

The Veddas are only a remnant. They live in hardly accessible lowlands and are very seldom met with. Judging from their portraits and other information they do not appear to be of such a primitive type as has been supposed.

From Ceylon, Dr. Hrdlička proceeded to Java, touching at Sumatra and the Straits Settlements.

Sumatra is still but imperfectly known and retains the romance of such a state. As learned later, especially from Mr. L. C. Westenanck, formerly for many years Resident (local Governor) at Palom-

¹ Thanks for aid with his work in this island are due to the island authorities; to Mr. John H. Williams, the U. S. Vice-Consul in Charge at Colombo; to the authorities of the Colombo Museum; and to Dr. Andreas Nell and Judge Pieris at Kandy.



FIG. 65.—India; a Semitic type "Sheik Mahomedan."
(Photograph from Madras Museum.)



FIG. 66.—India; Mediterranean types (Sukla Yegur Vedda Brahmins).
(Photograph from Madras Museum.)



FIG. 67.—India; types approaching the Hamitic "Rangavis."
(Photograph from Madras Museum.)



FIG. 68.—Negrroids; natives of western part of Southern India.



FIG. 69.—Negritoid statuettes from Palembang District, Sumatra. (Photographs donated to Dr. Hrdlička by Mr. L. C. Westenack, former Resident of Palombong.)

bong, Sumatra, there still prevail in the island among the whites as well as the natives, beliefs in the existence of wild men. There are two varieties. The Orang Pandak (orang=man, pandak=short) is said to live in the almost impenetrable mountain forests of the central and southern parts of the island. The natives describe him as black, short, long-haired, and wild, but not unsurmountably shy—will ask the Malay natives for tobacco. The second form is the Orang Sedapak. He is said to live in the unhealthy lowlands of the southeastern parts of Sumatra. He is said to have the body of a child of about 12 and to have long red hair on head and body. He is very shy and runs but does not climb. On June 20 an expedition was to leave, in charge of Captain Bor, for the determination of what this creature really is. In addition Sumatra has been yielding for some time peculiar stone sculptures, including heads that seem to represent the Negrito.

In the mountainous region of the upper parts of the Malay Peninsula, according to information given to Dr. Hrdlička, there still live thousands of negritoid people, and there are many caves waiting to be explored.

The visit to Java was made chiefly for the purpose of inspecting the site of the Pithecanthropus, but Dr. Hrdlička also desired to satisfy himself as to any possible cultural traces of early man, and as to the present population. As a result of the generous assistance given by the authorities,¹ he was able to see the natives in practically the whole of the island and especially to examine that important region which gave the precious remains of the Pithecanthropus—the valley of the Bengawan or Solo River, a fairly large river, beginning in the south of the island and running north and then east to Soerabaya. Here exists a veritable treasure-house for anthropology and paleontology, where nothing has been done since the Selenka expedition of 1910, which was the only one since the work of Dr. Dubois in 1891-'93. The lower deposits along the river are full of the fossil bones of Tertiary and Quaternary mammals, but among them at any time may be remains of greater value. Many of the fossils fall out of exposed strata every year and lie in the mud, where the natives occasionally gather them and take them to their homes.

¹ Dr. Hrdlička wishes to thank especially Dr. B. Schrieke of Veltevreden; Mr. J. Th. Jarman, the Assistant Resident at Ngawi; Mr. and Mrs. S. H. Pownall, at Banjoewangi; and Messrs. C. P. Kuykendall and R. R. Winslow, U. S. Consuls respectively at Batavia and Soerabaya.



FIG. 70.—The Dubois Monument opposite the site of the Pithecantropus. (Photograph taken for Dr. Hrdlička by Mr. J. Th. Jarman, Assistant Resident, Ngawi.)



FIG. 71.—Natives opposite the site of the Pithecantropus bringing in fossils found about that site. (Photograph by Dr. Hrdlička.)



FIG. 72.—The Pithecanthropus site from the opposite bank. (Photograph by Dr. Hrdlička, May 26, 1925.)



FIG. 73.—The Pithecanthropus site from the opposite bank. (Photograph taken for Dr. Hrdlička by Assistant Resident Jarman later in the summer.)

When the actual site of the Pithecanthropus was reached by Dr. Hrdlička, under the guidance of the Assistant Resident of Ngawi and his Chief of Police, a whole gang of natives advised by the police were already waiting there, bringing each a smaller or larger pile of fossils gathered from the muddy ledges of the river as these were exposed by the receding water. These fossils were eagerly examined but they included no remains of any Primate. A selection was made, to which the boys added a few specimens collected at that moment from about the site which gave the Pithecanthropus. On the top of the opposite bank stands a cement monument erected by Dubois and pointing to the spot which yielded what are probably the most precious remains in existence.

Further excavation here and in other localities along the river would be relatively easy and a few years of sustained work here is one of the great needs of Anthropology.

After the site of the Pithecanthropus and its neighborhood were examined, a little dug-out with two natives took Dr. Hrdlička down the river to Ngawi, a distance by river of perhaps 15 miles. During this trip both of the banks could be closely examined. They and their prolongation south-eastward are of interest geologically and there may be spots of paleontological value, but there are no other sites as promising in the latter respect as that near Trinil.

From Madioen Dr. Hrdlička's journey led to the eastern portion of Java, where it was interesting to find in spots traces of the pre-Malay Hindoo population which peopled the island in early historic times. In the central part of Java these people evidently reached a high degree of culture and left imposing ruins.

From Java Dr. Hrdlička traveled by boat along the northwestern and western Australian coast, stopping at all the little ports from Derby to Perth. This gave the opportunity to see numerous pure-blood Australians, and also some of their impressive nocturnal ceremonies. Here was encountered an exceptional type of the Australian from the Wyndham district, differing considerably from the rest of the natives. Here also were seen for the first time full-blood and otherwise full-colored Australians with tow hair; more were seen later on the Trans-Australian Railway at Ooldea. In southern Australia other aborigines were seen, particularly on the lower Murray River.

The principal Australian Museums of interest to Anthropology are located at Perth, Adelaide, Melbourne, Sydney and Brisbane. They were found to contain astonishingly rich collections, ethnological, archeological and anthropological, from Australia, Tasmania,



FIG. 75.—A full-blood Australian woman from the lower Murray River. (Photograph by Dr. Hrdlička.)



FIG. 74.—A full-blood Australian man from the lower Murray River. (Photograph by Dr. Hrdlička.)

and Melanesia, In addition there are several noteworthy private collections of this nature, two of which (Dr. Basedow's and Dr. Pulleine's, Adelaide), were seen; and important somatological collections are being built up at the Anatomical Departments in the principal cities.¹ The greatest collection of human skeletal material is that of the Museum of Adelaide. It consists of over 600 skulls of the Australian aborigines, with numerous skeletons, and it is being constantly added to under a beneficial law which obliges all the police officials of the State of which Adelaide is the capital to



FIG. 76.—Three of the tow-haired full-blood Australians of the Ilgarene Tribe. (Photograph donated to Dr. Hrdlička.)

forward to the Museum any aboriginal skeletal remains that may be found.

These precious somatological collections Dr. Hrdlička was permitted to utilize and nearly five weeks were spent in the work, resulting in securing essential measurements on 1,000 well-identified skulls of Australians, and on such of the Tasmanians as are preserved in the institutions visited.

¹For aid given in connection with his work in Australia, Dr. Hrdlička is particularly indebted and thankful to the following: Dr. I. S. Battye, Director of the Perth Museum; Mr. A. E. Morgan, U. S. Consular Agent at Perth; Dr. A. E. Waite, Director of the Museum, Adelaide; Dr. J. A. Kershaw, Curator of the National Museum, Melbourne; Dr. C. Anderson, Director of the Australian Museum, Sydney; Professors of Anatomy, R. J. A. Berry (Melbourne), F. Wood Jones and A. N. Burkitt; Drs. Herbert Basedow and R. H. Pulleine at Adelaide; and the U. S. Consul General at Melbourne.

The data obtained in Australia, supplemented by those on the Tasmanian material in the College of Surgeons, London, throw a very interesting and to some extent new light on the moot questions of both the Australian and the Tasmanian aborigines. According to these observations, the Australian aborigines deserve truly to be classed as one of the more fundamental races of mankind, and yet it is a race which shows close connections with our own ancestral stock—not with the negroes or Melanesians (except through admixture), but with the old white people of postglacial times. They carry, however, some admixtures of the Melanesian blacks, which is more pronounced in some places than in others.

As to the Tasmanians, the indications are that they are in all probability but a branch of the Australians, modified perhaps a little in their own country. Both peoples have lived, and the Australians of the northwest live largely to this day, in a paleolithic stage of stone culture. They are still making unpolished stone tools, which in instances resemble the Mousterian implements or later European paleolithic types. But they are also capable of a much higher class of work. Today, about Derby, bottles are used in making beautifully worked spear heads.

In the Anatomical Department of the University of Sydney, with the kind aid of Professor Burkitt, Dr. Hrdlička had the chance to examine several times the Talgai skull, believed to be of geological antiquity. The specimen was seen to bear undeniable affinities with the Australian cranial type, but the very large palate and the teeth need further consideration.

From Australia Dr. Hrdlička's journey led to South Africa and disembarking at Durban, Natal, the first task was to see as many as possible of the Zulu, about whose exact blood affinities there was some doubt. Large numbers were seen, and the conclusion was reached that they are unquestionably true negroes, though now and then as in other negro tribes, showing a trace of Semitic (Arab?) type due probably to old admixtures.

The two main objects of the visit to South Africa were the investigation on the spot of the important find of the Rhodesian skull, and of the recent discovery of the skull of a fossil anthropoid ape at Taungs, which had been reported as being possibly a direct link in the line of man's ascent. South Africa is a land full of anthropological interest. There is the disappearing old native population of Bushmen, Strandloopers, and Hottentots; the newer negro population which amounts already to over 7,000,000 and is steadily increasing; the almost stationary population of 1,500,000 South Af-

rican whites of Dutch and English derivation, who are blending together and producing a type of their own (as is also happening on a larger scale in Australia); and there are abundant remains of "paleolithic" cultures. Of equal interest are the great finds of the



FIG. 77.—Mr. Zwigelaar, the miner who with his "boy" discovered the Rhodesian skull, with the specimen shortly after the find was made. (Photograph loaned Dr. Hrdlička by Mr. Zwigelaar.)

Broken Hill mine, Northern Rhodesia, 2,015 miles north of Cape Town, and of the Buxton quarry, 1,000 miles further southward.

The discovery in 1921 at Broken Hill in Southern Rhodesia of the skull of the so-called "Rhodesian Man" was an event of much scientific importance. The find, moreover, is still enigmatic. The skull shows a man so primitive in many of its features that nothing like it has been seen before. The visit to the Broken Hill mine in which the skull was discovered proved a good demonstration of the

necessity of a prompt following up by scientific men of each such accidental discovery. The impracticability of such a following up in this case has resulted in a number of errors and uncertainties on important aspects of the case, some of which have already misled students of the find. It was possible to clear up some of the mooted points, but others remain obscure and can be definitely decided only by further discoveries.

As one of the results of the present visit, it was possible to save and bring for study a collection of bones of animals from the cave,



FIG. 78.—Animal and human bones secured by Dr. Hrdlička at the Broken Hill Mine; all from the Bone Cave. (Photograph by Dr. Hrdlička.)

the lower recesses of which gave the Rhodesian skull, and also two additional mineralized human bones belonging to two individuals; all of which, to facilitate the study of the whole subject, were deposited with the earlier relics in the British Museum. The mine is by no means exhausted, and since the interest of everybody on the spot is now fully aroused to these matters, there is hope that more of value may yet be given to science from this locality.

A visit to the Taungs or rather Buxton quarry which yielded, late in 1924, the high-class anthropoid ape announced in February of this year by Professor Dart (*Nature*, Feb. 7), revealed also most interesting conditions from the standpoint of geology, paleontology, and anthropology. Here are remnants of a vast plateau, eroded in the middle by a river to a shallow valley with an escarpment of long cliffs on each side. In the western escarpment, in ferruginous shales,

is an ancient basin filled with remarkably pure limestone. This limestone in turn, through water action, had become honeycombed with crevices and caves, and in these caves lived, and especially went to die, ancient baboons and also the recently found anthropoid ape the existence of which, so far south, has never been suspected. These remains became covered with sand blown in from the Kalahari Desert. This sand was in turn permeated with water carrying lime in solution, forming hard rock in which the remains of the ancient creatures are enclosed; and here they appear in the stone as this is blasted. This site is by no means exhausted, at least as far as the smaller apes are concerned. But to get to the fossils, a man must climb with the help of a rope a 60-foot vertical cliff, and thrusting his foot into crevices, must hammer off piece after piece of the hard rock which contains the remains. In this manner Dr. Hrdlička found five baboon skulls, only one of which however could be preserved. Other fossils besides those of baboons have been found in this quarry—turtles, crabs, large eggs and bones.

Dr. Hrdlička examined the large fossil skull at Johannesburg University where it is deposited in Professor Dart's laboratory.³ It belongs to a species of anthropoid ape of about the size of a chimpanzee and evidently related to this form, though there are certain differences, especially in the brain. These differences suggest that this ape may possibly have been somewhat superior to the chimpanzee and nearer to the human. But it is not necessarily a form that stood in the direct line of the human phylum.

In "paleoliths," South Africa is rich. They may be found in favorable spots along the sea shore; in the gravels, banks, and vicinity of rivers; and they are common in caves. They present forms rather more like those of India than those of old western Europe; but here and there, are also close resemblances to the earlier or later European types. The question of the antiquity of these implements has not yet been satisfactorily worked out as a great many are found on the surface and are plainly recent; others may be ancient. That not all the sites where such implements occur and have hitherto been regarded as ancient, are of that nature, was seen along the Zambesi

³ Those in South Africa whose aid in Dr. Hrdlička's work is hereby specially and thankfully acknowledged are: Professor Raymond A. Dart and many of his colleagues at the Johannesburg University; the officials of the Broken Hill Development Company, Northern Rhodesia; those of the Northern Lime Company, Bechuanaland; Mr. Neville Jones of the London Mission, near Bulawayo; Professor M. R. Drennan at the Cape Town University; and Mr. Dewitt C. Poole, U. S. Consul General at Cape Town.



FIG. 79.—The western wall of the Taungs quarry. The dark spot in the center is the opening to what remains of the stalagmite cave. On the left is the 60-foot wall of limestone, from about the middle of which came the anthropoid skull. On the extreme right is seen the semi-consolidated filling of a great old cavity in the rock.



FIG. 80.—Northern wall of the Taungs quarry. A darker patch slightly to the right of the center and mid-way between the face and top of the cliff shows the filled-in tunnel in which Dr. Hrdlička found five fossil baboon skulls.

on both sides of the river at Victoria Falls. Here stone implements were reported as occurring in the ancient gravels of the river, deposited along the sides of the stream before the formation of the falls. A three-days' examination of conditions, in company with two Americans, a South African engineer and some negroes was sufficient to show that the cultural remains here extend over a considerable distance along both sides of the river, are numerous, superficial, and in all probability not very ancient. A good-sized collection of the worked stones was secured for the National Museum.

The Bushmen and the Strandloopers whose remains are being found in shell heaps and in caves along the southern coast of Cape Colony, were apparently identical, judging from the osteological evidence that could be seen, and both show a strong affinity with the Hottentots. And all the essential characteristics of the three, outside of stature and muscular development, appear to be radically connected with the negro.

Dr. Hrdlička has returned deeply impressed with the opportunities for and the need of anthropological research offered by all these distant parts of the world, and the openings everywhere for American cooperation. The story of man's origin, differentiation, spread and struggle for survival, is evidently greater, far greater than ordinarily conceived, and a vast amount of work remains for its satisfactory solution.

A brief stop on the return journey was made in England, where, thanks to the courtesy of Sir Arthur Keith, of the Royal College of Surgeons, the precious Tasmanian cranial collection of that institution could be examined. Here also, thanks to those in charge of the Department of Geology, British Museum (Natural History), it was possible to examine once more the Rhodesian originals.

ARCHEOLOGICAL INVESTIGATIONS AT PUEBLO BONITO AND PUEBLO DEL ARROYO, NEW MEXICO

Under the auspices of the National Geographic Society, Mr. Neil M. Judd, curator of American archeology, U. S. National Museum, continued, during the summer months of 1925, his exploration¹ of Pueblo Bonito, a prehistoric communal village in northwestern New Mexico. The extensive excavations inaugurated at this particular ruin in 1921 had been concluded by the autumn of 1924. In course of the

¹ Smithsonian Misc. Coll., Vol. 72, Nos. 6 and 15; Vol. 74, No. 5; Vol. 76, No. 10; Vol. 77, No. 2.



FIG. 81.—The methods employed in excavating Pueblo Bonito varied as local conditions changed. Rooms enclosed by high walls offered greatest difficulty. In the above view, taken in August, 1924, debris first turned with hand shovels is being dragged by horse-drawn scrapers to waiting tram cars for transfer to, and deposition in, the deep arroyo visible just beyond the Expedition's camp. (Photograph by O. C. Havens. Courtesy of the National Geographic Society.)

work, however, traces of earlier structures underlying the floors of the great pueblo were frequently disclosed by the explorers. Such discoveries naturally required thorough understanding and, to this end, the studies planned for Pueblo Bonito in 1925 were intended to be mainly chronological and stratigraphical. While these technical investigations—by their very nature, slow and tedious—were in progress, most of the 25 Indian laborers employed by the expedition were put to work in the neighboring ruin, Pueblo del Arroyo.

This latter structure is severely rectangular except that its two ends are connected by an eastward curving series of low, one-story rooms. Since the south wing and the extramural habitations adjoining it had been excavated during the two previous field seasons, the efforts of the 1925 party were centered on the middle portion of the village. Some of the outward results of this investigation are apparent in the accompanying illustrations.

In accord with the original plan of procedure, the north wing of Pueblo del Arroyo and the curved series of rooms on the east have been left undisturbed. This decision was made deliberately and with realization that modern archeological research, no matter how thorough, is rarely conclusive; that the National Geographic Society or some other institution might, at some future time, wish to confirm the deductions of the current expedition.

In seeking last summer to establish a chronology for Pueblo Bonito several outstanding discoveries were made. Not all of these could have been anticipated. It was learned, for example, that the site occupied by this largest of all prehistoric villages in Chaco Canyon National Monument had been utilized long prior to construction of the great pueblo itself—a pueblo whose massive architecture has won the admiration of American antiquarians generally. Vast quantities of wind-blown detritus, floor sweepings and other refuse had accumulated during the centuries throughout which Pueblo Bonito was inhabited—accumulations on which the more recent dwellings were constructed. Ten feet below the foundations of these latter houses were the broken remains of two primitive structures erected by pre-Pueblo peoples; that is, by Indians who had not yet learned the benefits of such community enterprise as is represented by the complex dwellings and obvious civic organization of later house-building tribes. The deposits which covered these primitive structures—deposits consisting of successive layers of ash, blown sand and rubbish from razed and rebuilt dwellings—gave the long-sought stratigraphic evidence by means of which the inhabitants of Pueblo Bonito could be separated.



FIG. 82.—In May, 1877, Mr. W. H. Jackson, of the Hayden Geological Surveys, visited and described the Chaco Canyon ruins. Forty-eight years later, as a guest of the Pueblo Bonito Expedition, he examined those same ancient pueblos with Mr. Judd. (Photograph by O. C. Havens. Courtesy of the National Geographic Society.)



FIG. 83.—Two venerable Navaho who, risking serious illness through telling stories before the first snow of winter, related to Mr. Judd their observations and experiences in Chaco Canyon, 70 years ago. (Photograph by O. C. Havens. Courtesy of the National Geographic Society.)

Pueblo Bonito was occupied contemporaneously by two distinct groups of prehistoric agriculturists. The explorations of the preceding four summers had established this fact beyond question. Their dwellings, their ceremonial chambers, their cultural remains were alike divisible into two classes. One of these was early; the other, late. And yet, throughout a considerable period the two were co-existent. As the evidence accumulated with each successive expedition it became the more certain that Pueblo Bonito, as it stood



FIG. 84.—From the north rim of Chaco Canyon one looked down upon a veritable maze of foundation walls that emerged from beneath the outer rooms of Pueblo Bonito and continued eastward more than 500 feet. (Photograph by O. C. Havens. Courtesy of the National Geographic Society.)

at the time of its abandonment, represented the individual and yet cooperative efforts of these two distinct peoples. Their clan organizations were obviously similar; their daily activities were probably identical; the utensils they used daily in their several households, while exhibiting no marked difference to the untrained eye, showed to the archeologist dissimilarities that could only have resulted from the industry of separate groups, each trained to its own mode of thought and self expression. The researches of the expedition during 1925 fixed beyond reasonable conjecture the truth of these earlier deductions.

Two members of Mr. Judd's scientific staff devoted their undivided attention last summer to examination of the pottery fragments collected from the individual rooms explored during the previous four seasons. These sherds were separable into various types, based on the stratigraphic evidence above mentioned. As an indication of the vast number of vessels fashioned by prehistoric potters, final tabulation of the fragments from Pueblo Bonito alone, after eliminating all possible duplicates, shows over two hundred thousand



FIG. 85.—Not the least puzzling of the many riddles connected with the foundations above pictured was the purpose served by this group of seven huge, ash-filled ovens. (Photograph by O. C. Havens. Courtesy of the National Geographic Society.)

individual pieces. These represent successive periods of occupancy as well as variations in design and technique for each such period. In assembling the information conveyed by these fragments of broken pottery more than two million sherds were handled at least twice. Lesser ceramic collections from Pueblo del Arroyo were studied with equal devotion to detail.

By a series of four great trenches the site occupied by Pueblo Bonito, together with its immediate surroundings, was laid bare. Each trench provided a cross section by means of which the Expedition staff was enabled to visualize the successive changes which



FIG. 87.—The Expedition's third exploratory trench bisected the east refuse mound and ended against the outer south wall of Pueblo Bonito. More than 5 feet beneath the latter and overlain by successive strata of man-made rubbish was a huge fireplace. (Photograph by O. C. Havens. Courtesy of the National Geographic Society.)



FIG. 86.—A great trench through the west court of Pueblo Bonito revealed deeply buried walls, a partially razed kiva over 50 feet in diameter and stratified accumulations of household refuse. Herein was pictured the domestic history of this ancient village. (Photograph by O. C. Havens. Courtesy of the National Geographic Society.)

occurred throughout the entire period of human occupancy. Hearths were encountered eight feet, and more, below the surface; evidence of frequent reconstruction, of alterations in the grouping of dwellings, of destructive conflagrations were disclosed by these cross sections.

In addition, a former channel for the diversion of flood waters—mud-laden floods that refused to stay within the man-made banks intended for them—to cultivated fields below the village was brought to light for the first time since abandonment of Pueblo Bonito a thousand years or more ago. No trace of small irrigation ditches has yet been found in Chaco Canyon and the diversion channel just mentioned tends, therefore, to confirm the opinion of the Expedition's staff and technical advisers that the ancient Bonitians practiced a system of flood irrigation not unlike that employed today by certain of the more successful Navaho farmers of northwestern New Mexico or, on a larger scale, by the Hopi, Pima and Papago Indians of Arizona.

During the course of the National Geographic Society's explorations at Pueblo Bonito and Pueblo del Arroyo, indisputable evidence of the former presence of human beings, semi-sedentary in habit, has been observed as much as 20 feet below the present valley surface. These ancient folk were far less civilized than the Bonitians but, owing to the depth at which their infrequent remains lie buried, we may not hope to learn much about them. Fragmentary remains are there but the limits of the crude culture to which they belong are still indeterminable.

There are factors that point to certain changes in the geophysical appearance of Chaco Canyon since the period of Pueblo Bonito's greatest prestige; there is accumulative evidence in support of possible climatic changes during or since that same period. The former existence of a prehistoric arroyo, 18 feet deep immediately in front of Pueblo Bonito, was finally established by the Expedition of 1925. The data already assembled suggest that this ancient water course, now completely filled and leveled over, may have rendered the cultivated fields of the Bonitians unproductive, thus forcing abandonment of this, at one time the most influential and powerful of all prehistoric pueblos in the southwestern United States.



FIG. 88.—In excavating the central portion of Pueblo del Arroyo, debris from the individual rooms was wheeled in barrows to accessible points and dragged thence to an elevated trap through which it was poured into steel tram cars. (Photograph by O. C. Havens. Courtesy of the National Geographic Society.)



FIG. 89.—By September, 1925, exploration of Pueblo del Arroyo had been completed but the original court pavement still lay several feet below the last level of human occupancy. (Photograph by O. C. Havens. Courtesy of the National Geographic Society.)

ARCHEOLOGICAL AND ANTHROPOMETRICAL WORK IN
MISSISSIPPI

Henry B. Collins, Jr., assistant curator of ethnology, U. S. National Museum, was engaged during the summer of 1925 in an archeological reconnoissance and exploration of the ancient Choctaw territory in Mississippi for the Bureau of American Ethnology. In cooperation with the Bureau, the Mississippi Department of Archives and History detailed Mr. H. H. Knoblock, assistant in the department, to participate in the work.

The region selected for investigation was the eastern part of the state, the former center of the Choctaw tribe. Here are found not only the village sites known to have been occupied by the Choctaw within historic times, but also a number of prehistoric mounds similar to those found throughout the Mississippi Valley and in other parts of the South and East, denoting a still earlier occupancy of this region by either the Choctaw themselves or by related tribes.

At the time of first contact with Europeans, the Choctaw were the most numerous of all the southern Indians. They are also generally regarded as a basic type, culturally and physically, of the great Muskogean linguistic stock. In any consideration of the ethnic problems of the South, therefore, the Choctaw must assume a place of importance, but as yet very little work has been done among them. It was decided, therefore, that operations for the summer should be confined to definitely-known Choctaw territory, devoting part of the time to exploration of historic village sites and part to the excavation of prehistoric mounds, in an attempt to establish as far as possible the relation of the two.

Mr. Collins left Jackson, May 24, to make a reconnoissance of the field and to select sites for exploration. Mounds were examined in the counties of Hinds, Lowndes, Winston, Neshoba, Kemper, Newton, Lauderdale, Clarke, and Wayne. Perhaps the most important earthwork examined was Nanih Waiya, the sacred mound of the Choctaws, in the southern part of Winston County, shown in figure 90. This famous mound, one of the largest and best preserved in Mississippi, is regarded by the Choctaw as their place of origin, and figures prominently in their legendary history.

The historic village sites visited were Holitasha, Yanabi, East Yazoo, Shomo Takali, and Ibetap Okla Iskitini, all in Kemper County; Halunlawasha and Kastasha in Neshoba County; Coatraw in Newton; Coosha in Lauderdale; and Yowanne in Wayne County.

The work of reconnoissance was concluded early in June and excavations were begun on a group of eight small burial mounds on the farm of Mr. Lawrence Slay near Crandall, in Clarke County. These mounds averaged about 30 feet in diameter and were for the most part unstratified. Skeletal remains, ranging in number from one individual to fifteen or more, were found in each mound. Evidences of cremation were observed in several of the mounds and in one of them, resting on a thick layer of charcoal, was found a compact mass of broken and calcined bones, representing the remains of a dozen or more individuals. As is usual in mounds of this type, the bones were in a very poor state of preservation even



FIG. 90.—Nanih Waiya, sacred mound of the Choctaw, in Winston County, Mississippi. According to Choctaw tradition, Nanih Waiya is the birth place of the tribe, the first man and woman having come up from the underworld through the mound.

where they had not been subjected to fire. Figure 91, showing the bone layer in one of the mounds, will afford some idea of the condition in which the bones were found. From the few accounts we have of the early explorations into the Choctaw country, it is known that the burial customs of this tribe during the eighteenth century and earlier were different from those practiced at a later date. The dead were formerly placed on a platform erected for the purpose, from which, some months later, they were removed by the "bone-pickers," whose official duty it was to carefully scrape and clean the bones. These were then placed in cane hampers and deposited in the bone house, one or more of which was to be found in each Choctaw village. The bones were later taken from the bone house and carried some distance from the village, where

they were finally buried in a promiscuous heap and a mound of earth erected over them. This custom was not confined to the Choctaw alone but was quite widespread as is evidenced by the presence of similar mounds or ossuaries in many localities of the eastern United States and Canada.

Following the excavation of the Crandall mounds, work was begun on a much larger mound of a different type on the property of Dr. B. J. and Mr. R. L. McRae, near the town of Increase. Approximately one third of the mound was excavated by trenching, and while no skeletal material and only a few artifacts were found,



FIG. 91.—Layer of human bones in small sand mound near Crandall, Clarke County, Mississippi.

the peculiar stratification seemed to warrant as thorough an examination as was made (see fig. 92). This stratification consisted of a series of brilliantly colored sand layers, yellow, brown, orange, blue-gray, and pure white, from which, at the center of the mound, there suddenly arose a dome-shaped structure of compact yellow clay. This clay dome and the succession of colored sand strata probably had a ceremonial significance, having been placed on the floor of what had very likely been a temple, the site of which was later covered over with a mound of earth, on the top of which, still later, there probably stood a temple or council house. Colored sand strata in much the same arrangement have also been found in the effigy mounds of Wisconsin.

Within this small inner mound or clay dome was found a rectangular ornament of sheet copper and silver enclosing a core of wood, shown *in situ* in figure 93. Both copper and silver are shown by analysis to be native American, probably from the Lake Superior region. Silver and copper ornaments practically identical to this have been found in small numbers in Florida, Tennessee, Ohio, and Michigan.

Thin, flaked knives, struck with a single blow from flint cores, were found both in the mound and in the adjoining field. These

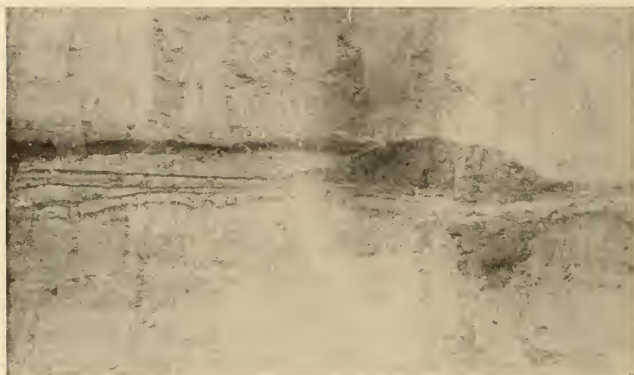


FIG. 92.—Stratification of colored sand and clay in McRae mound, near Increase, Clarke County, Mississippi.

are identical in every respect with the flaked knives from Flint Ridge in Ohio which, while abundant in the Ohio mounds, are rarely found in other localities.

With the most significant features of the McRae mound so strongly suggesting northern influence, we must conclude that the builders of this Mississippi mound maintained at least a close trade relationship with the northern tribes. While undoubtedly the many mounds and various other earthworks of North America were built by Indian tribes of diverse stocks, there are certain resemblances between even the most distant of them which suggest a contact something more than sporadic.

Work was next begun on a group of seven small mounds on the property of Mr. J. M. Kettler near Hiwannee, in Wayne County.

In size, construction, and contents they were similar to those previously excavated at Crandall.

With the completion of the mounds at Hiwannee in early July, explorations were started on the site of the historic Choctaw village of Coosha, near Lockhart in Lauderdale County, on the property of Mr. W. E. Frederickson. The cemetery was located and ex-



FIG. 93.—Ornament of sheet copper and silver in McRae mound, Clarke County, Mississippi.

amined, but the burials were comparatively recent, dating probably between 1800 and 1830, by which time the Choctaw had lost much of their native culture. Except for the presence of mortuary offerings, consisting for the most part of beads, porcelain, and cooking utensils, the burials were typical of those of the whites.

It is believed that the archeological work described above reveals something in the nature of chronological cross section of the three most important phases of Choctaw culture history. At the Coosha village, conditions were found which were typical of the last phase

of Choctaw history, when their native culture was rapidly breaking down and assuming the essential features of the dominant white civilization. The small burial mounds at Crandall and Hiwannee, dating perhaps from the first half of the eighteenth century, belong in all probability to the period immediately preceding, when mounds were still built, but only for purposes of burial. The earliest of the three stages, perhaps antedating by centuries the smaller burial mounds, is represented in the McRae mound.



FIG. 94.—Choctaw Indians engaged in a game of native ball at Philadelphia, Mississippi. There are at the present time about 1,100 Choctaws in the state.

The explorations at Coosha brought to a close the archeological work of the summer, and Mr. Collins and Mr. Knoblock proceeded to Philadelphia, Miss., where measurements and observations were made on the living Choctaw, of whom there are still about a thousand in the state. Measurements were secured on 58 adults, some of which undoubtedly have white or negro blood.¹ The cooperation of Mr. T. M. Scott, of the Indian Agency at Philadelphia, was very helpful in this work. Particular thanks are also due to Mr. Weaver Bridges of Philadelphia and to Mr. H. B. Cole, of Quitman, both of whom rendered valuable assistance in many ways.

¹ The results of this study have been published in the *American Journal of Physical Anthropology*, Vol. 8, No. 4, 1925.



FIG. 95.—Group of Choctaw Indians assembled for a game of native ball at Philadelphia, Mississippi, July, 1925. Measurements and physiological observations were taken on a number of the Indians in this group. (Photograph by Knoblock.)

ARCHEOLOGICAL STUDIES OF THE WUPATKI NATIONAL
MONUMENT

So little was known in 1853 of the physical features of the region between the Zuñi and the Colorado Rivers, that in that year Captain Sitgreaves, of the U. S. Corps of Topographical Engineers, was sent by the Secretary of War to follow the Zuñi River to its junction with the Little Colorado and on to Yuma. One object of this trip, which now seems almost ludicrous, was to determine the "navigable properties" of the two rivers. It did not take long to determine this. Captain Sitgreaves records that between Camps 13 and 14, near the Great Falls of the Little Colorado, "all the prominent points [were] occupied by the ruins of stone houses of considerable size, and in some instances of three stories in height. They are evidently," he writes, "the remains of a large town, as they occurred at intervals for an extent of eight or nine miles, and the ground was thickly strewn with fragments of pottery in all directions."

In 1900 these ruins, then locally called the Black Falls ruins, were described and first figured by the present Chief of the Bureau of American Ethnology, Dr. J. Walter Fewkes, who was so much impressed by their magnitude that he recommended they should be preserved by the National Government.¹ In 1925, his hope was realized and they were declared a National Monument by Presidential proclamation.

Other literature on this monument is meagre, but the archeology of the Flagstaff region has lately been studied by Professor and Mrs. Colton, who have published valuable material on the "small houses" of this region.² The construction of a road recently laid bare a prehistoric cemetery at Young's Canyon, 18½ miles east of Flagstaff, and the objects there brought to light have been acquired and a description of them published.³

At least two types of large ruins occur in this area, the former of which is represented by the Citadel, figures 96 and 97. The second

¹ A cluster of Arizona ruins which should be preserved. Records of the Past, Vol. III, Pt. 1, pp. 3-19, Washington, 1904.

² The little known small house ruins in the Coconino forest. Mem. Am. Anthropol. Assn., Vol. V, No. 4, 1918.

Did the so-called cliff dwellers of central Arizona also build hogans? Am. Anthropol., Vol. 22, 1920.

³ An archeological collection from Young's Canyon, near Flagstaff, Arizona. Smithsonian Misc. Coll., Vol. 77, No. 10.



FIG. 96.—The Citadel and terraced gardens, and small ruins near them.



FIG. 97.—Rooms and fallen walls on top of Citadel.

type, figure 101, contains rectangular ruins of slabs of stone masonry erected on the rims of shallow canyons, which were apparently used as habitations.

The most imposing ruin is the so-called Citadel, which from a distance resembles a volcanic peak, the cone of which is capped with walls made of sandstone and lava rocks, the sides of the elevation being strewn with these blocks which have fallen from the walls at the apex. Figure 96 shows this Citadel from the side, and figure 97 indicates the broken-down walls and the general character of the fallen masonry on the surface. The Citadel had many rooms apparently built around a central open space or plaza, the masonry being composed of lava blocks and sandstone slabs. The numerous stones down the sides of the Citadel now and then are arranged in rows, calling to mind retaining walls or trincheras so common on hillsides of southern Arizona and the northern states of Mexico.

Tcuaki (Snake House). The ruin here first called Tcuaki (figs. 98, 99), is situated about 30 miles from Flagstaff, Arizona, and is in reality composed of two clusters of rooms connected by a long wall, possibly modern, which follows the summit of a sandstone ridge.¹ The corners of the walls have fallen down the sides of the ridge, covering the roofs of the subterranean rooms at the base of the cliffs. In the year 1900, rafters and remains of these roofs were well shown and a few fragments of roofs still remain *in situ*, as if lately abandoned. As in all these ruins, there were numerous basal rooms from which many specimens were obtained, but the best objects were found in the rooms above the surface or those on the summit of the ridge. The rooms were two stories high, the floors of the lowest story being generally buried under fallen debris.

Alaki (Horn House). The ruin called Alaki or Horn House, also of the Great House dormitory type, is characteristic of the Wupatki monument. It is shown in figure 101. There are massive buildings above and the subterranean basal walls below. In the neighborhood of Alaki there are several small stone subterranean houses, each generally with a single room, possibly pit dwellings.

The canyon on the rim of which Alaki stands becomes "blind" a few hundred feet from the ruin and is exceptional in having excavated in its walls small rectangular cubby holes formerly closed by slabs of stone, all of which have been broken and many have been destroyed. These recesses were apparently used for storage cysts, and are not confined to this canyon.

¹ Records of the Past, *op. cit.*



FIG. 98.—Tcuaki, showing the two large buildings and connecting wall, which was possibly constructed by sheep herders. These and neighboring buildings are called Wupatki in the President's proclamation.



FIG. 99.—Tcuaki.



FIG. 100.—Typical one-room house.



FIG. 101.—Alaki.



FIG. 102.—Ruin near Alaki.

These ruins are referred to in the map in the President's proclamation as belonging to the Citadel group.

Wukoki. Wukoki, figure 103, the tallest building of the Black Falls buildings, belongs to the second type and is the highest and best preserved of these buildings. It presents some of the finest masonry on the monument, and almost entirely covers the top of the small mesa. From a distance across the sands, its prominent walls resemble a castle, its base rising about 15 feet above the neighboring plain.

General features of the walls. The walls of the large buildings that form the most striking feature of the Wupatki monument



FIG. 103.—Wukoki (near Wupatki Monument). It is hoped that Wukoki may later be included in the Monument.

belong to the fine masonry of the Southwest. They are constructed of a filling faced on both surfaces with slabs of dressed stone, often more or less artificially worked and laid in courses. But, as in the construction of all masonry in the Southwest, some of the first principles of masonry are neglected. For instance, the corner binding of stones is neglected and there is seldom an overlapping of the same in order to tie the component stones of the wall together. The corners especially show weakness in this particular for they are seldom fitted together. The stones are sometimes roughly hewn, the alternating courses being often pitted on the surfaces, but also occasionally decorated with incised geometrical designs. The doors and en-

trances to the rooms are generally lateral and the few windows are small, circular or rectangular. Two or three of these buildings contain but a single room, others are multi-chambered, and in the largest buildings three stories can be distinguished.

The roofs of all the rooms are simple, flat coverings, supported by several large logs extending from one wall to its opposite, across which are laid willow twigs supporting a layer of cedar bark, the whole being covered with clay. There are evidences of fireplaces centrally placed, and in a few instances ashes were found in one corner. In one room there is an elaborate chimney, possibly modern, communicating through the walls with a fireplace, extending a few feet above the highest masonry. Although the walls are generally constructed of sandstone, they also show alternate layers of lava rock which, contrasted with the intervening courses of red sandstone, add a picturesque appearance to the whole. As is customary in pueblo construction the stones are laid in adobe in which often occur imbedded pottery shards and fragments of stones. The marks of human fingers also appear in the mud plastering, especially where the walls are protected by overhanging cliffs. The walls of the rooms were seen in one case to be plastered on the inside with adobe decorated with red pigment, like the dadoes of the modern Hopi houses.

At the base of the cliffs there are several walled-in shrines or rude rock inclosures, generally containing water-worn pebbles or fossil shells which were no doubt religious offerings. These also contained prayer sticks, figure 105, *b*, *b'*, and in one instance a wooden image of human form, figure 105, quite unlike, however, any idols which have previously been described. Clusters of pictographs generally of geometrical forms adorn the walls of the canyons on which the larger buildings have been built.

The characteristic features of the Wupatki buildings are the small rectangular stone-walled rooms of good masonry and the subterranean rooms at the base of the low cliffs on which they stand. No kivas have yet been excavated; those shown on the map are doubtful ceremonial rooms.

Typical specimens of Wupatki Monument pottery resemble those found in the cemetery at Young's Canyon.¹ They belong to a pre-puebloan type found throughout Arizona underlying the more brilliant Sikyatki ware and the related Homolobi-Chevron forms. The

¹ Smithsonian Misc. Coll., Vol. 77, No. 10.

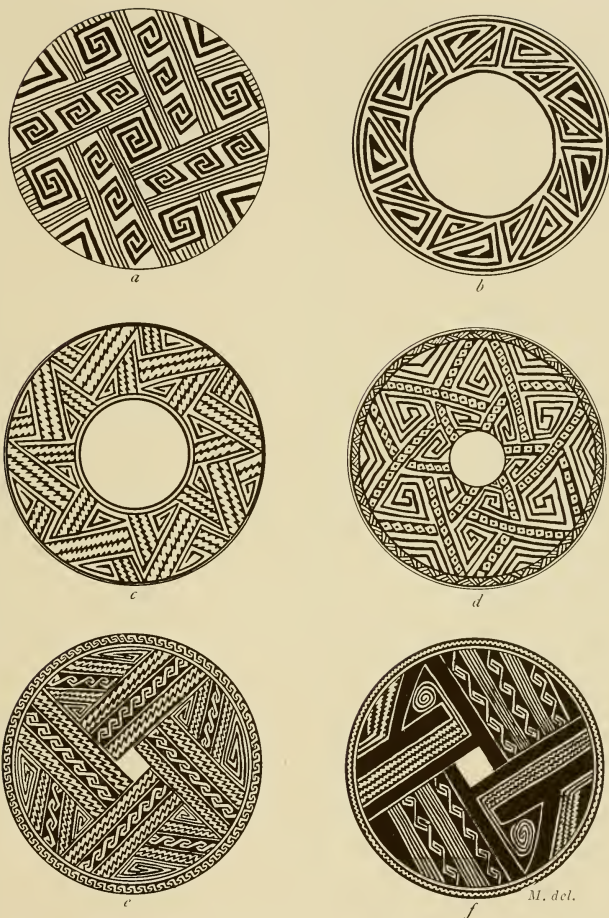


FIG. 104.—Type designs on inside of bowls from Wupatki, southern Tokonabi ceramic culture.

- a.* Key figures covering whole inside area.
b. Alien designs.
c. Central unfilled space surrounded by serrated bands.
d. Central unoccupied space and peripheral border. Quadrate design in which square white figures with black dots predominate.
e. Typical quadrate design with Greek fret border.
f. Quadrate design in white on a black background. The square central figure is characteristic of Wupatki ware.

M. del.

prevailing ceramic types are corrugated, black on white, and polychrome, dull red with shiny black interiors. The food bowls often have out-curve rims and single loop handles. The colander form, or food bowl perforated with holes, occurs both at Wupatki and at Marsh Pass.

The designs on the well decorated pottery, both black on white and polychrome, figure 104, are similar to those from Tokonabi. These decorations cover the whole interior of the bowls except the very center, and have a quadrate arrangement, in some examples of which rows of white squares with black dots predominate. The flaring rims of food bowls are adorned with special geometrical patterns forming the framework of the main interior design.

The dead were inhumated or cremated. A typical human interment found in the sands near the ruin, Wukoki, was enclosed in a cyst made of stone slabs set on edge, covered with another slab of rock, resembling those in the Marsh Pass region. In one of these graves was a skeleton with two pendants made of lignite and turquoise mosaic like Hopi ear rings, figure 105, *c*, as fine specimens of jewelry as any known from the Little Colorado region. Several mortuary vessels were found with the dead, and also remains of fabrics, apparently kilts or garments.

Additional facts of a comparative nature are much needed in order to explain the difference between decorations on the Wupatki pottery and the beautiful designs on the Homolobi-Chevron ceramics from ruins higher up on the Little Colorado. There is also a difference between the pottery and architecture of this region and those of Young's Canyon a few miles away. So far as known it would appear that the Homolobi-Chevron culture, which is allied to that of the Hopi ruins, Awatobi and Sikyatki, and to that of the Jeddito and Bitarhootci valleys, although late prehistoric, was more modern than that of Wupatki.

As elsewhere suggested, both architecture and ceramic designs from Wupatki are practically the same as those from Marsh Pass, probably indicating that the latter is an identical and synchronous culture area which in Hopi Snake legends is called Tokonabi (Kayenta). This far-flung culture area is quite unlike that which occurs higher up on the Little Colorado at Homolobi and Chevron, the artifacts of which are more closely related to the Sikyatki and Awatobi and probably is more modern, as Hopi migration legends state.

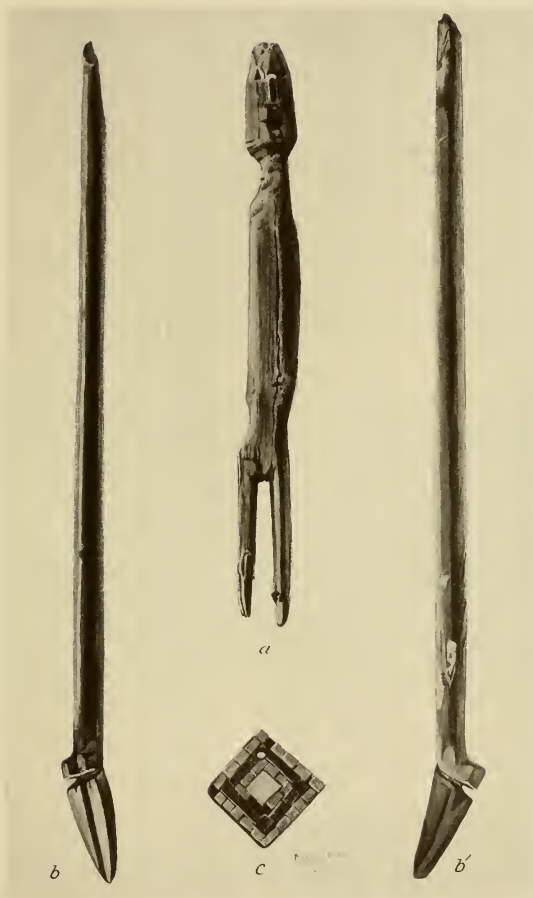


FIG. 105.—*a*, Wooden image from shrine near Tcuaki. *b*, *b'*, Possible shaft of throwing stick from near Tcuaki. *c*, One of two mosaic ear pendants made of turquoise and lignite set on lignite base from stone grave near Wukoki. The grave contained a large decorated black and white vase and fragments of cloth.

RESEARCHES ON THE ARCHEOLOGY OF SOUTHERN CALIFORNIA

At the close of June, 1925, Mr. J. P. Harrington, ethnologist of the Bureau of American Ethnology, proceeded to Santa Barbara, California, to continue his researches on the Mission Indians. Many Indian rancheria sites of this region were visited in the course of his work. In the Santa Ynez valley alone, more than 40 ruined villages were inspected, and in the Otay and Simi valleys some 30 more, at several of which extensive excavations were made.

Pictographs were discovered and photographed; also many rocks which represent mythological personages or form the crucial land-



FIG. 106.—Medicine rock surrounded with cacti.

mark of ancient legends. Spirit footprints on the rocks, of gigantic size, were said to have been made by the "first people" when the earth was still soft and muddy.

At San Marcos the boulders on a hillside represent the warriors of a mythic battle; some are standing with the blood from wounds running down their sides, seen as stains on the rock. A site was also visited where two boulders are situated six feet apart. Indian boys used to attempt to jump from one to the other, and if they succeeded it was a sign that they would be able to jump around the mountains in later years without skinning their legs. A medicine rock (fig. 106) was also visited, a symmetrical pinnacle of stone surrounded with a

circle of cacti in such a way as quite effectually to keep away intruders.

At the Rincon, Mr. Harrington discovered the ruins of a medicine house formerly used by the island wizards for secret ceremonies. This remarkable structure consists of a natural cave chamber, blackened with the smoke of former fires. On the east side is a circular enclosure 18 feet in diameter, the walls of which, made by piling up rocks to a height of about three feet, are still partly standing. Pine trees were formerly laid across from the top of this wall to the roof of the cave, and on these thatch was placed. An extended study was made of this temple, and the cave floor was excavated. There was a tradition that if a common Indian came on this place by mistake he would be struck dead and that if an innocent person happened to stroll near, thunder, lightning and rain would immediately result.

Since little is known of the California Indian house of this section, it was thought desirable to construct a replica of a native wigwam and to photograph step by step the building of it (fig. 107). In all more than 40 exposures were made as the work progressed, thus securing a record for future description. The wigwam is circular and about 13 feet in diameter and 7 feet high. The site for the house was selected and the ground cleared and leveled. Using a short bar of willow for digging the post holes and the hand for scooping out the earth, eight slender willow poles, 15 to 20 feet high, were erected in the form of a Greek cross. The pairs of poles opposite each other were then lashed together to form arches 7 feet high. Other uprights were then added until the poles formed a complete wall and were only "a short step apart." Smaller poles, called "latas" in Spanish, were then lashed on the outside of the uprights at intervals of about a foot (fig. 108). The thatching material—tule, carrizo, brakes, or grass—was laid on in tiers, the lowest tier standing upright with the butt end in the ground to form a firm base for the wall and subsequent tiers upside down, as the inverted leaves shed water better. The material used for lashing this house was mescal fiber. Outer "latas," opposite the inner ones, hold the thatch firm, and it is sewed in place by means of a great needle of willow wood which is poked through the thatch, two workers being required at this stage of the construction. The thatching, when compressed, is only four inches thick, and is impervious to wind and rain. At the top of the house an ample hole is left for the exit of smoke. A fire place with pot-resting stone occupies the center of the earth floor.



FIG. 107.—Modern wigwam of Southern Californian Indians; constructed under Mr. Harrington's direction.



FIG. 108.—Framework of wigwam of Southern Californian Indians; constructed under Mr. Harrington's direction.

The doorway of the house is only a yard high and about two feet wide. It is closed by a door made by tying together an oblong frame of willow poles and weaving small willow twigs to fill this frame. Another type of door is a tule mat, stood on end. The Indian word "to lock the door" really says "to tie the door," for the only protection from intruders when Indians went away and left the house was such a mat or frame, carelessly tied—and Indian etiquette, which said that a stranger should not enter. Similar mats were used for sleeping and for sitting on the floor, and are surprisingly warm when used for such purposes. The Indians slept with nothing between themselves and the cold earth but one of these "petates de tule."

Some of the Indians had their houses lined on the inside with similar tule mats, much as we use wallpaper, but in the poorer houses, thatch and twigs showed on the inside. Between the poles and thatching, all kinds of Indian utensils and furnishings were stored out of the reach of children and in sight when needed for use.

On completing the Indian house, Mr. Harrington started in the latter part of October on an expedition to the Cañada de las Uvas. This trip proved rich in discovery along several different lines. Many of the archeological sites visited had not been touched since Indian times, and Mr. Harrington found without difficulty the old hut circles on the surface of the ground, either marked by rings of rocks, formed by the Indians clearing the surface for the hut, or by rings of raised earth which mark the former walls.

The first work was at the village of Sikutip, where the Indian huts were formerly clustered at the southwest border of the cienega. There are many interesting rocks and caves in the neighborhood, and four minor springs were located. Only a mile away is Chori, another large village.

The largest village discovered was that known as Milyahu (fig. 109). This differed from the other sites in being located on a detached rocky hill which has the appearance of a great towering citadel when seen from the arroyo. The little Indian wigwam circles, varying in diameter from 12 to 20 feet, were found all over the summit of this hill. The water used by the people of Milyahu is supplied by a spring which gushes forth from the sandy bed of the dry arroyo opposite the middle of the Indian town. All the water had to be carried up a cliff 75 feet or more in height, reminding one of the practice at some of the Pueblos. Figure 110



FIG. 109.—The great citadel of Milyahu, viewed from downstream. The spring is in the bed of the arroyo at the left. The entire top of the hill was covered with thatched jacales, the pits for which have not been disturbed to any extent since the time the village was occupied.



FIG. 110.—A wigwam circle at Milyahu, perfectly preserved except that a rock or two has rolled inside. These circles were easy to trace and will throw much light on the average size of the California Indian jacal.

shows a typical wigwam circle on top of Milyahu. The Milyahu cemetery has unfortunately been washed away by the arroyo.

On a hill on the Santa Maria ranch, Mr. Harrington discovered an Indian fortification wall (fig. 111) which is evidently in much the same condition as when it was abandoned. The rocks have been piled to form a parapet five feet or more in height, the wall forming a corral around the top of the hill. It was used for outlook purposes.



FIG. 111.—Old Indian fortification works on the crest of the hill west of the Santa Maria ranch house. The wall of piled up rocks forms a parapet around the top of the hill, and was used as a lookout by the ancient Indian inhabitants.

Besides obtaining many unique traditional songs, Mr. Harrington devoted special attention to pictographs, both photographing them and tracing them off full size on thin paper, so that they can be reproduced in their natural colors.

STUDIES OF THE FOX AND OJIBWA INDIANS

Dr. Truman Michelson, ethnologist, Bureau of American Ethnology, left Washington about the middle of June, 1925, to renew his researches among the Fox Indians near Tama, Iowa. There he verified a number of texts previously obtained on various ceremonies; he also procured additional information on several sacred

packs, as that of Pyätwäyā, belonging to the Thunder gens, and that called ke'tcimī'cam^m in Tepashit's care belonging to the Thunder gens; and the one called Sāgimā kwāwa, which belongs to the Bear gens, formerly in the possession of Pushitonequa, the last recognized chief of the Foxes. He obtained also much information on two other sacred packs, one belonging to the Thunder gens, the other to the Bear gens, the existence of which were hitherto unknown. The information on all these packs was obtained mainly



FIG. 112.—Da lo tti wa, a Fox woman, gathering flags to make mats. (Photograph by Grace Scott.)

in the current Fox syllabary and English paraphrases secured from Horace Poweshiek and Harry Lincoln. During his visit, a Winnebago enrolled among the Foxes was injured in an automobile accident, and Dr. Michelson had the rare opportunity of witnessing a sweat-lodge performance and listening to the Winnebago prayers and songs accompanying it.

Dr. Michelson proceeded on August 21 to Odanah, Wisconsin, to obtain some first-hand information on Ojibwa gentes. The follow-

ing live at or near Odanah: Marten, Loon, Eagle, Bull Head, Bear, Sturgeon, Great Lynx, Crane, Lynx, and Chicken. The chief belongs to the Loon gens; a "head-man" to the Bear gens; and the messenger to the Marten gens. In sharp contrast with the Foxes, the gentes apparently have no special rituals. Exogamy is still practiced for the most part. It may be noted that cross-cousins as well as parallel cousins are not allowed to marry. It should be stated that, as with the Menomini, the offspring of a white man and an Ojibwa woman belongs to the Chicken gens. Although almost all of the Ojibwa at Odanah are Christians, Dr. Michelson found



FIG. 113.—Some birch-bark dwellings of the Ojibwa. From a postal card purchased at Ashland, Wisconsin. The scene obviously is at the pageant held at Apostles' Islands.

that they have a vivid recollection of their ancient religious rites, and he obtained detailed information on some of these. On September 2, Dr. Michelson proceeded to the vicinity of L'Anse, Michigan, where he located a family of Stockbridge Indians, but none spoke their own language. He observed that the Ojibwa dialects spoken at Odanah and in the vicinity of L'Anse differs markedly in some respects from the western dialects, to judge from Jones' Ojibwa Texts. On September 12, Dr. Michelson went to Mt. Pleasant, Michigan, where he began a preliminary survey of the Ojibwa, Ottawa, and Potawatomi of the neighborhood.

ETHNOLOGICAL RESEARCHES AMONG THE IROQUOIS AND
CHIPPEWA

Mr. J. N. B. Hewitt, ethnologist, Bureau of American Ethnology, left Washington in May, 1925, for field duty and resumed his studies among the Six Iroquois Nations or Tribes, namely, the Mohawk, Seneca, Onondaga, Oneida, Cayuga, and the Tuscarora, all dwelling on the Haldimand Grant on the Grand River in Ontario, Canada.

In previous years Mr. Hewitt had recorded with great care from the dictation of the most intelligent living statesmen, ritualists, and counsellors, voluminous texts relating to the complex institutions of the League. Because the war of the American Revolution had badly disrupted the tribes of the League and the League itself, Mr. Hewitt inevitably encountered variant versions of many portions of the traditions, rituals, chants, and addresses relating to the organization, constitution, ordinances, and regulations of the League, and recorded these variant versions. In the furtherance of this task, Mr. Hewitt again took up the literary study, interpretation, and translation of the texts embodying the laws, ordinances, and the regulations, the chants and the rituals of condolence for the dead *rotiyaner* and *koñtiyaner* (the native name of the federal counsellors), and the installation of the *rotiyaner* and the *koñtiyaner* (elect) (who constituted the councils of the tribe and of the League, in addition to the chiefs). The first is the masculine, and the second the feminine, form of the noun.

The organic institutions of the League of the Iroquois for over one hundred and fifty years have been subject to the action of various destructive external and internal forces, and so it is that many of the most distinctive institutions of the League have long been inoperative through the failure of the leaders to execute them.

The Governor General in Council by an Order in Council on September 17, 1924, abrogated the organic institutions of the Canadian part of the League. This crisis in the affairs of these tribes arose because the government of the League of the Iroquois had become such a travesty of the complex institution established by the great prophet-statesman, Deganawida, and his astute collaborators, that it failed to function organically.

By the aid of Mohawk informants, Mr. Hewitt was enabled to resolve the lexical and the grammatic difficulties of the Mohawk texts of certain important rituals of the Council of Condolence for deceased *rotiyaner* and the installation of the *rotiyaner* elect

and to translate into free English speech one of these rituals and to discover the reason for its most peculiar name. The title of this ritual is *Ka'rhawe' hrā'to'* in Mohawk, and *Ga' hawe' hū' d'* in Onondaga, meaning "Cast or Thrown Over the Grand Forest." To learn the cause of giving so peculiar a name is to learn one of the processes of constructing rituals.

Legislative or ceremonial action is taken by the tribe only through the orderly cooperation of the two constitutive Sisterhoods of clans, commonly called Phratries in early ethnologic writings. This dualism in the highest units of organization was based originally on definite mythic concepts. Briefly, the one Sisterhood of tribes symbolized the Female Principle or Motherhood in Nature, and the other, the Male Principle or Fatherhood in Nature.

The Sisterhood of tribes functioned by the independent action of its constituent institutional units—every several tribe. In turn, every tribe functioned through the units of its own internal organization—each several clan, to execute its prescribed part in the larger federal action, which otherwise could not be authentic and authoritative; so that a clan, or an individual in a clan, in special cases involving personal rights, might prevent vital federal action. So personal rights were abundantly safeguarded.

In addition to the chant called "Cast Over the Grand Forest" mentioned above, the most distinctive one of the Council of Condolence and Installation of the League of the Iroquois is that which is designated as "The Seven Songs of Farewell." This is intoned in behalf of the deceased member of the Federal Council which, as a Council of Condolence and Installation, has met to condole his death with his kinsmen and to install his successor. These two chants are respectively divided into two portions. The first six of the "Seven Songs of Farewell" are followed by the first five paragraphs of the chant "Cast Over the Grand Forest." A veil of skins divides the Mother from the Father Side during the chanting of the "Farewell Chant."

By a searching study of all symbolic terms and phrases occurring in the chants of these rituals, Mr. Hewitt was able to identify the phrase, "the veil of skins" with the other phrase "the Grand Forest." The "Grand Forest" represents ritualistically the totality of the forests which intervene between the lands of the Mourning Side of the League and those of the other side. Mr. Hewitt also made a free English translation of the chants, "Cast Over the Grand Forest," and "The Seven Songs of Farewell."

Mr. Hewitt made a reconnaissance trip to the Chippewa of Garden River, Canada, for the purpose of expanding his knowledge of certain Chippewa texts, recorded in 1921 by him from the dictation of Mr. George Gabaoosa of Garden River, Canada, and also to obtain data in regard to the derivation of two very important proper names, namely, Chippewa and Nanabozho (appearing in literature also as Nenabojo, Menaboju, and Wenaboju).

The name Chippewa is the generic designation of a historically important group of Algonquian tribes of the northwestern United States. Various unsatisfactory derivations have been given to it, and it appears in literature with no less than 97 variant spellings.

For two years Mr. Hewitt has had in mind a definition of the name Chippewa which brings out one of the distinctive arts of these people, just as the Ottawa received their name of "The Traders" because for the moment the business of trading was then ethnically distinctive. To those who first gave the name Chippewa to these people, picture-writing was their preeminent characteristic. And the birch bark records of the Chippewa are sufficiently prominent in their culture to be noteworthy. The stem of the term may be found in the Chippewa expression, *nind ojibiwa*, meaning "I mark, write, on some object." The form *ojibiwa* used as an appellative in the plural would become *ojibweg*, which used as an ethnic appellation signifies "those who make pictographs." Mr. George Gabaoosa, of Garden River, Canada, a most intelligent Chippewa, collaborated in the derivation of this tribal name.

The present writer is not aware that any consistent meaning has been given by any other student to the proper name Nanabozho (Wenaboju, Menaboju, etc., being other spellings of it) of the Algonquian biogenetic myth. Briefly, it is the Myth of Mudjikewis, the First Born on Earth, commonly called The Story of Inābi'-oji'o' (*i. e.*, Nanabozho.) This story, which is remarkable for beauty and comprehensiveness, relates that on the shore of the great primal sea dwelt Misakamigokwe (*i. e.*, The Entire Earth Mother) and her Daughter. This Entire Earth Woman is the impersonation of the inert earth, while the daughter is the life-increasing power of the earth—the Life Mother—the Mother of all Living Things. These two personages were of the super-race of the "first people" who lived when the earth was yet new.

The Entire Earth Woman cautioned her daughter, saying, "Daughter, bend not yourself against the sun at noon-tide, because the Great Father Spirit at that time looks on you. Remember,

I command you, not to forget my words, for surely if you do, evil will befall us; since our time to increase the number of living things on the earth on which we live, is not yet fully come."

But there came an evil day when, very busy with her mat-making, and with her back unconsciously turned sunward at noon-tide, she dropped her mat-gauge on the ground and unwittingly stooped forward to pick it up. Instantly, she was seized with exhausting pains after the manner of women.

So, in due time, the daughter gave birth to a son, whom she named Inābi'oji'o' (*i. e.*, Formed, Created, by a Look). She continued bearing offspring until four other sons were born to her—all brothers of Inābi'oji'o'. In order of their birth these brothers were named Ningabeon (The West), Kiwedinese (The North), Wabanese (The East), and Shawanese (The South). After this time Misakamigokwe became Nokomis, the grandmother of all living things.

In this highly condensed and abbreviated recital of the common Algonquian myth of the Beginnings is given the key to the literal signification of the name Nanabozho (Wenabozho, etc.), or Inābi'oji'o'. This name is based on the common Algonquian verb *w ā b*, "to see, to look," which with associated elements, expressed and understood, gives the literal meaning "created, conceived, made, through the look, the gaze (of the Great Father Spirit).

ETHNOLOGICAL WORK AMONG THE OSAGE OF OKLAHOMA

In May, 1925, Mr. Francis La Flesche, ethnologist, of the Bureau of American Ethnology, visited the Osage Reservation, Oklahoma, to continue his work among the Indians of that reservation. He was met at Nelogany station by his friend, Ku-zhi-si-e, in his big automobile and driven to his house in the Indian village about a mile from the town of Pawhuska.

The afternoon was passed by Mr. La Flesche and Ku-zhi-si-e in planning the work they were to do together. They agreed to do first that part which promised to be the most laborious, that of recording and classifying the personal names of the members of the tribe according to gentes and sub-gentes, and of giving where possible, the meaning of each name. To avoid confusion in the performance of the work, Ku-zhi-si-e suggested the use of the early annuity pay rolls which contained the names of every man, woman, and child.

Early the following morning, Mr. La Flesche and his assistant appeared before Superintendent J. George Wright of the Agency and made known to him the purpose of their visit. The Superintendent immediately put one of his clerks to work to find the record wanted. The clerk found a roll for the year 1877, which he placed in Mr. La Flesche's hands. Then he and his friend sped back to the little cottage where they began this work.



FIG. 114.—1, Coneflower, life emblem of the Peacemaker gens. 2, Haircut of the children of that gens to resemble the flower.

The two put about three weeks of steady work on the revision of the roll. The spelling of nearly all of the 1991 names found on the roll had to be corrected, and to the name of each annuitant was added the name of the gens to which he or she belonged, as, for example, Ku-zhi-si-e, Wa-tse-tsi gens, They Who Came from the Stars.

When the work on the gentile personal names of the members of the tribe was completed, Mr. La Flesche and Ku-zhi-si-e took up the

task of recording the names of the wild plants known to the Osage and their uses where they could be ascertained. This was out-door work and more agreeable than the other. One day as the two were driving over the hills, Ku-zhi-si-e called to his driver to stop. He pointed to a patch of yellow flowers which he said were called "ba-shta," hair-cut (Cone-Flower). This was the flower chosen by the people of the Peacemaker gens to be their life and peace emblem. The hair of the children of this gens was cut to resemble the sacred flower as the sign of a petition to the Power that brought it into existence, to grant the little one a long and fruitful life (see fig. 114). They drove on to a small-wooded stream where there were many aquatic plants. The *ci*ⁿ (*Sagittaria latifolia*), Ku-zhi-si-e pointed out as a food plant; the *Mi-ke-the* (cattail), the leaves of which he said were used to thatch houses as well as for medicine; the *ça-zhiⁿ-ga*, rush, (*Eleocharis interstincta*), which was used for making mats to sit upon in the house, and for making the inner shrine of the sacred hawk. As the two drove along the border of a small lake, Ku-zhi-si-e also pointed out the *tse'wa-the* (water chinkapin), as a food plant.

On the last day of the exploration, the two drove to the top of a high hill where they stopped and got out of the car. After a moment's silence, Ku-zhi-si-e gave a wide sweep of his right arm and said, "All the grasses, weeds, shrubs, and trees that we see around us as far as the eye can reach, are medicine, but we know the qualities of only a few. Some plants like the *çta-in-ga-hi* (persimmon tree) serve as medicine and food. There is life in all plants and all are active. There are medicines for horses as well as for human beings."

STUDIES OF INDIAN MUSIC AMONG THE MENOMINI OF WISCONSIN

In July and August, 1925, Miss Frances Densmore, collaborator of the Bureau of American Ethnology, recorded the songs and studied the musical customs of the Menomini Indians in Wisconsin. Three classes of songs recorded among the Menomini have not been found in other tribes. These are the songs connected with games played as a "dream obligation," the songs of "adoption dances," and the songs connected with the use of packs or bundles, by individuals, for the purpose of securing success on the hunt or war path.



FIG. 115.—James Pigeon-hawk. (Photograph by Miss Densmore.)



FIG. 117.—Agnes Sullivan. (Photograph by Miss Densmore.)



FIG. 116.—John Shawunopinas. (Photograph by Miss Densmore.)

The two games played in order to secure benefits promised in dreams are the "bowl and dice game," played by women who have dreamed of the "four spirit women in the east," and the lacrosse game, played by men who have dreamed of the "thunderers." The manner of playing the first game was demonstrated by Catherine Laughery, whose dream requires that she play the game once every summer. She also recorded the song given her by the spirit women when, in her dream, she visited their lodge. A lacrosse game was thus played at a gathering attended by Miss Densmore. It is believed that a sick person will be benefited by attending a lacrosse game played in a ceremonial manner, and a song used on such an occasion was recorded by James Pigeon-Hawk (fig. 115). An adoption dance is held when a family wishes to adopt someone in place of a member of the family who has died. Two sets of songs are used at these dances, one attributed to the east and the other to the south god. The family select the songs to be used, the songs from the east god being chosen if the adoption is to be an important, dignified occasion. These are the more highly regarded as the east god is supposed to be the greater. Songs of both sorts were recorded, together with a description of the ceremonial action attending the adoption.

The individual war and hunting packs of the Menomini consist of certain articles wrapped in tanned hide. Under certain conditions the owner opens the pack in a ceremonial manner and exposes the contents, singing certain songs. A description of the bundles and manner of their use was obtained, together with the songs which are sung to make them effective.

The songs of the Dream dance formed a subject of special study, as Miss Densmore had attended this dance when held by the Chippewa and Menomini in 1910. (See Bull. 53, Bur. Amer. Ethn., pp. 142-180.) A few songs were sung by both tribes at certain points in the ceremony, and a comparison of the two renditions was desired. The "Pipe song" showed the same rhythmic phrase in the two renditions, and a somewhat similar duplication was found in the "Drum song." Thirty-three Menomini songs of the Dream dance were recorded, and the place where the dance is held was visited and photographed.

Songs used in the treatment of the sick were, as usual, an important phase of the research. Among those recording such songs was James Pigeon-Hawk, who, in treating the sick, uses songs which he received from his uncle and grandfather. One of these songs

is sung when digging medicinal roots in order to make them effective. The Menomini differ from the Chippewa and Sioux in that they employ a "diagnostician" who decides whether a sick person shall be treated by a doctor giving material remedies or shall be taken to an exhibition of magic power by a "juggler." A description of the performances of the latter, with several of their songs, was obtained from a man familiar with their practices.

War songs received attention, about 25 of this class being recorded. Several war songs were connected with the Black Hawk war, which took place about 1832, while others were connected with the enlistment and service of Menomini Indians in the Civil War. John Shawunopinas (fig. 116) is a member of the G. A. R.



FIG. 118.—Exterior of medicine lodge.

and recorded a song with the words "The white man points his pipe at me," meaning "The white man asks me to join him in war." Agnes Sullivan recorded five old, vigorous war songs and asked to be photographed wearing her badge as a member of the Auxiliary to the American Legion. Among the miscellaneous songs obtained were those of the moccasin game, several social dances, the legends of Manabus, and the lullaby sung to little children, the latter being a variant of the Chippewa lullaby. Four melodies played on a cedar flute were recorded.

The Menomini Medicine Society, corresponding to the Chippewa Mide' wîwîn, held a meeting in July which was attended by Miss Densmore. This was an interesting opportunity, as the society meets only once or twice a year to initiate members, and was particularly valuable, as Miss Densmore had recorded the songs of the



FIG. 119.—Interior of medicine lodge.



FIG. 120.—Women sitting in medicine lodge, their medicine bags hanging on the framework behind them.

Mide'wîwin. Remaining at the Menomini ceremony about four hours she found that the songs used were chiefly Chippewa songs, with words in that language. She witnessed the "shooting with spirit power," in which members of the society thrust their medicine bags toward others with deep ejaculations. These persons "become unconscious" for a time and the performance is continued until all the members have thus "received spirit power." The meeting was held in a long lodge (fig. 118), and the members sat on the ground or danced in a line around the lodge, the songs being accompanied by a "water drum" and three gourd rattles (fig. 119). At the right of this illustration may be seen the top of the "water drum;" the dancers, including a little child; and the gifts for the leaders which are hung from a horizontal pole. The man near the drum is carrying his medicine bag, probably made of weasel skin. Many medicine bags were made of otter and were elaborately decorated, the material indicating the owner's rank in the society (fig. 120).

Continuing her study of Chippewa customs, especially those connected with the treatment of the sick, Miss Densmore visited the Cass Lake and Mille Lac reservations in Minnesota, in June, 1925, obtaining additional specimens of medicinal plants with descriptions of their uses. At Mille Lac she witnessed the making of two native dwellings of bark and rushes, and took photographs at various stages of the construction. Specimens of native implements made of wood were also obtained.

INVESTIGATION OF SHELL AND SAND MOUNDS ON PINELLAS PENINSULA, FLORIDA

Mr. David I. Bushnell, Jr., collaborator of the Bureau of American Ethnology, while on the west coast of Florida during the present year, visited various shell and sand mounds on Pinellas Peninsula. The peninsula extends southward into Tampa Bay and is of irregular form. On the northeast it is bounded by Old Tampa Bay, on the southeast and south by Tampa Bay, and on the west by Boca Ciega Bay, the latter being separated from the Gulf of Mexico by low, sand keys. Part of the peninsula is quite low and the entire region is infested with mosquitoes and other insects in vast quantities. Much of the shore is bordered by a broad stretch of marsh, with a dense growth of semi-tropical vegetation, but some of this marshy expanse has recently been reclaimed in the endeavor to make it suitable for building sites.

The shores of Tampa Bay—Espiritu Santo Bay of earlier maps—are interesting as having been the landing place of DeSoto and his numerous party in the year 1539, when "On Friday the 30th of May they landed in Florida, two leagues from a towne of an Indian lord, called Ucita." Unfortunately, the exact position of this ancient settlement is not known, but from the manner in which it was approached from the Gulf, as told in the Spanish narratives, it must have stood near the deeper channel which is found on the east and south sides of Tampa Bay, away from Pinellas Peninsula.



FIG. 121.—Large mound, formed of shells and sand, standing about midway between Maximo Point and Point Pinelos. The graded way, or approach to the summit, is on the left. Camera pointed northeast.

Three classes of works can be distinguished on the peninsula, all of which were erected near the shore. First are the large mounds, of a definite form, composed of shells and sand; second are the sand mounds; and third are the shellheaps, of no clearly defined shape, which resulted from the extensive use of shellfish for food.

Nearly a half century has passed since these mounds were visited by S. T. Walker, of Clearwater, Florida, at that time connected with the U. S. Fish Commission, and by whom they were briefly described in the Report of the Smithsonian Institution for the year 1879. The most important work is in the extreme southern part

of the region, about midway between Maximo Point on the west and Point Pinelos a little south of east. It stands about four hundred yards from the water and the greater part of the intervening area is a marsh with a thick, matted growth of low vegetation. This mound, viewed from the southwest, is shown in figure 121. It was visited by Walker in 1879 who referred to it as "the most beautiful mound that I have seen in South Florida." And he continued, "The mound is situated in a 'rosemary scrub,' and rises to an imposing height above the low trees in its vicinity. Its outlines are beautifully regular . . . with a beautiful inclined roadway leading up to its western side." During past years excavations have been made in the structure by persons seeking hidden treasure, and consequently the surface is now quite irregular but it is possible to follow the original lines. The mound is about two hundred feet in length and twenty feet in height. It is composed of shells and sand, and the following shells were collected from the several excavations: *Fasciolaria tulipa*; *Macrocallista gigantea*; *Busycon canaliculata*; *Pecten irradians*; *Strombus pugilis*; *Venus mercenaria mortoni*; *Fulgur perversa*.¹ No fragments of pottery were discovered although known to occur in the mound.

A symmetrical mound stands near the shore of Big Bayou, some two and one half miles east of north of the work just described. It appears to be formed entirely of sand, is a hundred feet or more in diameter and rises about ten feet above the original surface. It is owned by Mr. Glen Taylor, to whom I am indebted for much assistance during visits made to the scattered sites on the peninsula. About four hundred yards northeast of this mound were two large shell mounds, now destroyed. They are said to have been formed for the greater part of large oyster shells, and fragmentary pottery was found throughout the mass. When the site was examined large shells of the *Ostrea virginica* were discovered, some being seven inches in length. These were in the lowest and consequently oldest part of the mound or mounds.

Next to be considered are works on the west side of the peninsula, south of the railroad bridge across Four Mile Bayou. On the shore, opposite the mouth of the bayou, is an extensive shell-heap, part of which is shown in figure 122, a view looking southwest, over the waters of Boca Ciega Bay to the low keys beyond. About one thousand feet inland from the shellheap is a large shell and

¹ All shells have been identified by Dr. Paul Bartsch, of the U. S. National Museum.



FIG. 122.—Shellheap on the west side of the peninsula at the mouth of Long or Four Mile Bayou. The view is looking southwest showing the waters of Boca Ciega Bay.



FIG. 123.—Compact mass of shells exposed near the summit of a large mound standing about three hundred yards inland, east, from the mouth of Four Mile Bayou.

sand mound, quite similar in appearance to the great mound in the southern part of the peninsula. A small part of the southern section of the work has been removed and the upper portion, thus exposed to view, is shown in figure 123. This reveals a compact mass of shells, usually of small size. The shells collected from this exposed portion of the mound were: *Venus mercenaria mortoni*; *Cardium robustum*; *Fulgur perversa*; *Fasciolaria tulipa*; *Arca ponderoso*; *Ostrea virginica*; *Pecten irradians*; *Melongena corona*; *Chione cancellata*; *Cardita floridana*. Fragments of pottery were mingled with the shells, all having stamped designs over the entire surface. Many bits of human bones, indicating burials, were found near the summit. One fragment of a human skull revealed traces of a red pigment with which it had probably been covered.

Southward from the preceding site, at the end of the electric line running to St. Petersburg, and on the shore of Boca Ciega Bay, is a shellheap having a diameter of a hundred yards and an elevation of approximately ten feet. It extends eastward from the edge of the water to the road which has cut through the eastern portion, exposing the interior of the mass as shown in figure 124. The shells gathered here were: *Fasciolaria gigantea*; *Fulgur perversa*; *Strombus pugilis*; *Fasciolaria tulipa*; *Venus mercenaria mortoni*; *Pecten irradians*; *Ostrea virginica*; *Spicula similis*; *Cardium isocardia*. A closer view of the mass of shells in this exposure is given in figure 125. All fragments of pottery discovered mingled with the shells and decomposed vegetal matter were smooth on both surfaces, entirely undecorated.

On the eastern side of the peninsula, north of east from the several mounds just mentioned, is another ancient site. It is near the narrowest part of the bay, south of the bridge over Old Tampa Bay, and exactly west of Port Tampa on the opposite shore. However, the water is not visible from the site on account of the very dense vegetation. Here are shellheaps, low and spreading and less clearly defined than others already mentioned. They extend in a general course from southeast to northwest and terminate abruptly at a sand mound. The latter is about one hundred and twenty feet in diameter, although it is difficult to distinguish where the artificial work actually begins; its elevation is approximately seven feet. This appears to have been the burial place which belonged to the nearby settlement. Many burials were discovered by Dr. J. W. Fewkes in the eastern part of this mound during the winter of 1923-1924, at which time about one quarter of the structure was examined. Fragments of pottery, decorated with designs in incised



FIG. 124.—Section of a spreading shell mound in a region known as "The Jungle," on the west side of Pinellas Peninsula, at the end of the electric line running to St. Petersburg.



FIG. 125.—A closer view of the mass of shells forming the mound in "The Jungle."

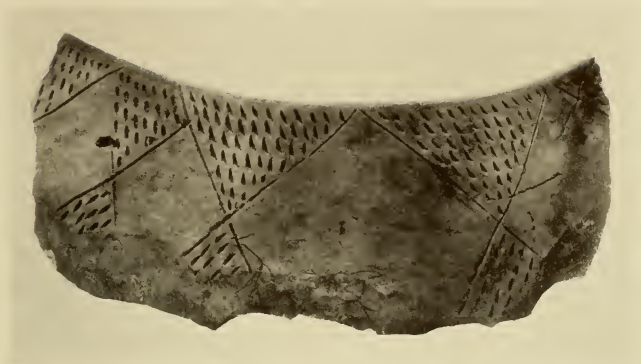


FIG. 126.—Fragment of a large pottery vessel from the burial mound on Weeden Island. One-half natural size.

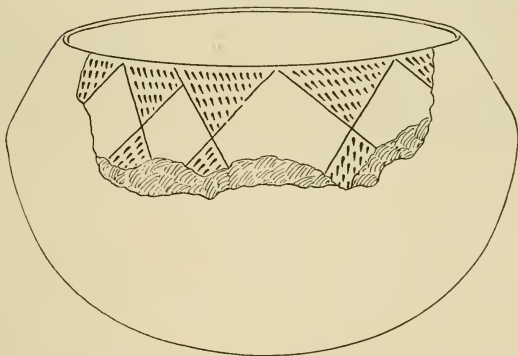


FIG. 127.—The probable form of the vessel, suggested by the shape of the fragment. (Drawn by DeLancey Gill.)

lines, were recovered from parts of the excavation, and although this is considered typical of the west coast of Florida no examples were found by the writer on other sites on the peninsula. In addition Dr. Fewkes encountered many fragments bearing the usual stamped design, and exactly like that recovered from the large mound on the west side of the peninsula, but it was not determined conclusively whether the two types were intermingled or whether they occurred in two distinct layers one above the other. A careful examination of the mound, especially the central portion, would undoubtedly make it possible to discover which of the two forms of pottery



FIG. 128.—The low, spreading burial mound on Weeden Island. The large cabbage palmetto, to which the sign is attached, stands very near the center of the mound.

is the older, if a difference actually exists. A photograph of the mound is reproduced in figure 128. On the right is the end of the excavation made by Dr. Fewkes, the large marker being attached to a tree near the center of the work. A fragment of the rim of a large earthen vessel, found by the writer in the excavation, is shown in figure 126, and a sketch of the probable shape of the vessel in figure 127. It was a well-made vessel, thin, and of a yellowish-brown tint. The opening was about ten inches in diameter.

Other large mounds occur on other parts of the peninsula, and all are of the greatest interest at this time. As yet it is not possible to identify the tribe or tribes by whom the ancient settlements were occupied.