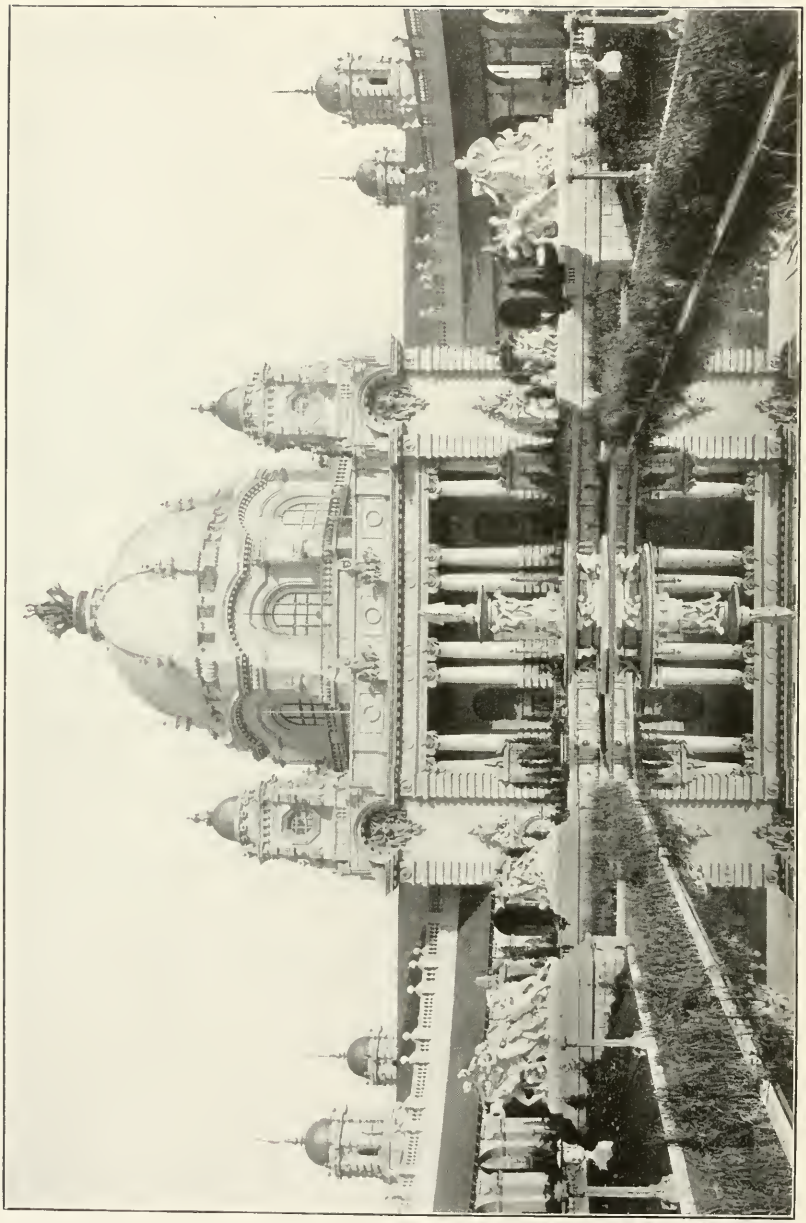

FRONT VIEW OF GOVERNMENT BUILDING, PAN-AMERICAN EXPOSITION.

REPORT

ON THE

EXHIBIT OF THE UNITED STATES NATIONAL MUSEUM

AT THE

PAN-AMERICAN EXPOSITION, BUFFALO, NEW YORK, 1901.

BY

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AND

GEORGE P. MERRILL,
Head Curator, Department of Geology.

LIST OF ILLUSTRATIONS.

REPORT ON THE EXHIBIT OF THE UNITED STATES NATIONAL MUSEUM AT THE PAN-AMERICAN EXPOSITION, BUFFALO, NEW YORK, 1901.

By Frederick W. True, William H. Holmes, and George P. Merrill.

SUMMARY.

By Frederick W. True,
Representative, Smithsonian Institution and National Museum.

The Pan-American Exposition held at Buffalo, New York, opened May 1, 1901, and closed November 2, 1901. An exhibit from the Smithsonian Institution and National Museum was provided for in the act of Congress approved March 3, 1899. The total amount appropriated for the Government exhibit was $300,000, and for a Government building, $200,000. Of the former amount the Smithsonian Institution and National Museum were allotted $50,000, in addition to which $2,500 was transferred from the allotment of the Interior Department to allow for the construction of a model of the extinct American reptile *Triceratops*, to be jointly exhibited by the National Museum and the Geological Survey. The total amount allotted was considerably below the estimate submitted to the board, which was $62,625.

On the gross sum originally available a pro rata assessment to provide for an exhibit from the outlying possessions of the United States, amounting to $1,960.79, was made by the board, and $200 were transferred to the allotment of the War Department. The net Smithsonian allotment was, therefore, $50,339.21.

The Goverment building (Plate 1) at Buffalo was on the west side of the exposition grounds. It was oblong in shape and had a length of 418 feet and a breadth of 140 feet and was surmounted by a dome 235 feet high. Two pavilions were connected with the main building on the east side by colonnades. The north pavilion was occupied by the Fish Commission and the south pavilion conjointly by the Department of Agriculture and the Philippine collection. The exterior of the building was finished in staff and tinted yellow, except the dome, which

was blue. The elaborate polychrome decoration of the other exposition buildings was not attempted.

The space in the Government building allotted to the Smithsonian Institution and National Museum was in the northwestern corner. (Plate 2.) It originally amounted to 10,108 square feet, but the size of the Government building being subsequently reduced the space was contracted. From the extreme north and south ends and from the west wall to the main aisle it measured 133 feet by 56 feet, comprising an area of about 7,500 square feet. A small area at the north end was separated from the main space by a cross aisle 8 feet wide, leading to one of the west entrances, and a similar aisle crossed the space near the south end, though this was not originally proposed, but was found necessary to allow convenient admission from the annexes. The subdivision of the space and the arrangement of cases are shown in the accompanying diagram. (Plate 3.)

The space was on the whole well lighted by a series of large windows in the west wall, supplemented by the clearstory windows above the main aisle. The west windows were stippled with white paint to obstruct the direct rays of the sun, and a series of transparencies were placed in front of them as embellishments.

As usual in most exposition buildings, the posts supporting the clearstory and aisles caused more or less inconvenience in locating the cases. In one instance it proved unavoidable to cut a standard case in pieces and rebuild it about a post in order to maintain an important aisle. In other instances posts stood immediately in front of the cases, producing a most undesirable effect. These architectural inconveniences can only be got rid of by supporting the roof by a series of arches springing from the walls.

The interior decoration of the building, as a whole, was placed in the hands of a committee of the Government board and was uniform throughout, consisting of red and green bunting supplemented by United States flags. To these, in the Museum space, were added large signs bearing the name of the Institution and Museum and a trophy, or coat of arms, with the seal and motto of the Smithsonian Institution.

The building had no basements, and empty packing cases were stored in lofts in the various towers and in the parapets constructed by the War Department to illustrate the mounting of large ordnance.

A good deal of inconvenience was experienced at the beginning by the defects in the roof of the building, on account of which certain parts of the space were flooded during heavy rains. By constant watchfulness, however, serious damage was avoided. The weather conditions immediately prior to the opening of the Exposition were extremely unfavorable. The workmen suffered much from cold, and the receipt and unloading of exhibits were greatly hampered. Nevertheless, by hard work the Museum display was opened to the public

and practically complete on the 1st of May, when many other parts of the Exposition were in a backward condition.

As in the case of previous expositions, the exhibit of the National Museum far exceeded that of the other bureaus under the direction of the Smithsonian Institution and of the Institution itself, and the greater part of the total sum allotted was expended in its preparation. The reason of this will be readily understood when it is recalled that the Museum is continuously engaged in preparing permanent exhibits for the public, and has greater responsibilities in this direction than any other bureau of the Government. The proportion of the allotment expended by the Museum can not be exactly stated, because the same mechanics and preparators who were employed in connection with its exhibits were also engaged for some time on the work of the other bureaus of the Institution. No apportionment among the several bureaus of the sum set aside by the Government board was necessary or desirable, and none was made.

The Bureau of American Ethnology made no separate exhibit on this occasion, those features of its work which lend themselves to exhibition being shown through the agency of the Department of Anthropology in the Museum.

As in previous instances, the permanent collections, cases, and fixtures of the Museum were drawn upon as far as circumstances would permit, but some new cases were found indispensable, and numerous specimens were purchased to fill out the various series which it was finally determined to exhibit at Buffalo.

The temporary cases constructed for the Exposition were of pine, painted black, and furnished with plate glass. These comprised group cases for the Department of Anthropology and wall cases and one or two special cases for the Departments of Biology and Geology. The regular mahogany Museum cases used were of the styles known as "reconstructed door screens" and "slope tops."

As may be surmised, the regular staff of the Museum can not be drawn upon beyond a certain limit to prepare collections for a temporary exposition. The regular work of the Museum goes on hand in hand with the special exposition work, and the principal officers of the Museum devote a share of their time to each, but it is necessary to augment the staff of preparators, taxidermists, etc., very considerably or the exposition collections could never be got ready on time. This necessity causes one of the principal difficulties in preparing for an exposition, as expert preparators are few, and those whose services are desirable are not always to be had at a specified time. The Museum was especially fortunate in this matter in connection with the Pan-American Exposition, and it is not too much to say that the work turned out both by the regular and temporary preparators was superior as a whole to any previous effort. The temporary preparators

consisted of sculptors, model makers, taxidermists, colorists, paleontological preparators, modelers, and preparators of "accessories," such as artificial leaves, flowers, etc.

On June 23, 1899, Mr. W. V. Cox, chief clerk of the National Museum, was designated chief special agent, Smithsonian Institution and National Museum, for the Pan-American Exposition. Mr. Cox was also elected secretary of the Government board June 13, 1899, and with the consent of the Secretary of the Smithsonian Institution served in this capacity throughout the Exposition.

The work of preparing the exhibits was begun in July, 1899, at which time a building on Tenth street S.W., Washington, was leased for temporary workshops. Another workshop and warehouse, No. 414 Tenth street N.W., was occupied from August, 1900, to April, 1901, by the Museum conjointly with several of the Executive Departments.

One of the first operations engaged in was the overhauling of the collections stored in the Museum annexes for material suitable for the Exposition. This involved considerable time and expense on account of the crowded condition of the storage quarters.

A considerable amount of field work was done in connection with the exhibits. Drs. Stejneger and Richmond visited Porto Rico, and Messrs. William Palmer and J. H. Riley explored western Cuba in February, 1900, and succeeding months in search of characteristic birds, reptiles, and batrachians. By the courtesy of the War Department the collectors were sent to their respective destinations on the transports *McPherson* and *Sedgwick*, and the collections made in Cuba were also transported to the United States through the Quartermaster's Department of the Army. Drs. Stejneger and Richmond returned April 29, 1900, and Messrs. Palmer and Riley August 14, 1900. Mr. Wirt Tassin visited Philadelphia in July, 1899, to examine collections of minerals, and a number of purchases were made. Mr. F. A. Lucas visited the vicinity of Plattekill, New York, in August, 1899, for the purpose of examining a mastodon skeleton of which some information had been received. The specimen did not, however, prove suitable for the exhibit. Another endeavor was made in the autumn of 1899 to obtain a mastodon skeleton by excavating near Monroe, New York, but this also proved unsuccessful. The same was the case with investigations in Arkansas, Oklahoma, and Indian Territory in October, 1900. Mr. Lucas went to Kiminswick, Missouri, in August, 1900, on the same mission, but without result. Dr. G. P. Merrill superintended the sawing of some fine specimens of orbicular granite in Baltimore in October, 1899. Dr. Merrill also visited several localities in North Carolina in November, 1899, and New Haven, Connecticut, Chester, Massachusetts, in March, 1901, and New York City in January, 1900, for the purpose of obtaining geological specimens. Mr. W. H. Newhall visited Point of Rocks, Maryland, for the purpose of obtaining

specimens of the conglomerate rock of that locality. Mr. Adolph Tuchband, who made an expedition to the Upper Amazon River in the spring of 1900, undertook to obtain ethnological objects, models, costumes, utensils, etc., of the Indian tribes of that region. The Museum, however, received nothing from this source.

Mr. W J McGee, ethnologist in charge, Bureau of American Ethnology, was granted a small sum to collect objects illustrating the ethnology of the Tepoka Indians of Mexico. On visiting their country, however, he found the tribe practically exterminated, and he turned his attention to the Cocopa Indians, from whom he obtained a valuable collection.

Additions to the various series which it was decided to exhibit were also made by purchase from professional collectors and dealers both in the United States and Europe.

Prof. J. B. Steere spent two months on the Amazon River in obtaining characteristic fishes and other vertebrates of that part of South America and objects illustrating the ethnology of the various Indian tribes. Messrs. Barton A. Bean and W. H. King were detailed to go to Key West, Florida, to collect fishes in formalin, for a special exhibit, to which further reference will be found on page 186.

THE EXHIBIT OF THE DEPARTMENT OF BIOLOGY.

By Frederick W. True,
Head Curator.

In planning an exhibit from the Department of Biology many points have to be taken into consideration, such as the letter and spirit of the law providing for a Government exhibit; the purpose of the exposition as a whole; the conditions existing as regards obtaining specimens suitable for exhibition; the relative significance and attractiveness of different exhibits to the general public.

In the case of the Pan-American Exposition the underlying idea was so clearly defined that no difficulty was experienced in determining the proper scope of the exhibit. The Exposition, as its name implies, was intended to represent America as a whole. It was fitting, therefore, that the animals and plants of North, South, and Central America should be represented, while a representation of the fauna and flora of the rest of the world could with propriety be omitted.

The exhibit of the Department was thus limited and only American objects were represented. From experience gained by participation in other expositions it was felt that, generally speaking, large objects would be more suitable and better appreciated than small ones, and it was decided, therefore, to confine the zoological exhibit to the vertebrates. There is no question that a representation of the invertebrate

fauna of America would have proved interesting to the public, especially such classes of animals as the insects, corals, mollusks, etc., but in proportion to the outlay of time involved in the preparation of a thoroughly attractive exhibit the vertebrates appeared to offer the best topic. A display of the flora of America was necessarily omitted because the Museum is without resources in this direction, its botanical collection consisting entirely of dried plants and specimens in alcohol, which are unsuitable for a popular exhibit. To obtain a creditable botanical exhibit by field work was impossible in the time allotted.

In order to make the exhibit of the vertebrate animals of America as significant and attractive as possible the best specimens in every class were withdrawn from the exhibition series of the Museum, and these were supplemented by specimens purchased wherever obtainable. In addition four field parties were sent out to gather material not otherwise available. Dr. L. Stejneger, curator of the Divison of Reptiles, and Dr. C. W. Richmond, assistant curator of the Division of Birds, were sent to Porto Rico and the other West Indian Islands; Mr. William Palmer, chief taxidermist, and Mr. J. H. Riley, aid in the Section of Birds' Eggs, were sent to Cuba; Mr. B. A. Bean, assistant curator, Division of Fishes, and Mr. King, to Key West, Florida, while Prof. J. B. Steere undertook to obtain fishes and other vertebrates from the Amazon River.

Drs. Stejneger and Richmond did excellent work in Porto Rico, obtaining a large collection of birds and reptiles, but were prevented by sickness and the uncertainties of transportation from visiting other West Indian Islands, as was originally intended. The operations of Messrs. Palmer and Riley were confined to western Cuba, where large collections of birds, reptiles, and mammals were made, but the collectors were prevented by lack of time from visiting the eastern end of the island.

In order to accomplish anything of importance it was necessary to send these parties out early, while the general plans of the Government board as regards buildings, allotment of space, and exhibits from the outlying possessions of the United States were still incomplete. The original plans were considerably modified before being adopted, the total amount of space in the Government building was reduced, and endeavors to form general exhibits from Cuba and Porto Rico under the Government board were abandoned on account of the action of the governors of these islands in providing separate displays. It resulted that only a portion of the material collected could be exhibited, and this was incorporated with the general Museum exhibits.

The work of Professor Steere on the Amazon resulted in our obtaining an excellent series of characteristic fresh-water fishes of this region, together with characteristic tortoises and other reptiles.

In addition to the material obtained by these collecting parties the

Museum secured many fine, characteristic North American mammals, birds, and reptiles through its correspondents and through various dealers in natural-history material.

When completed the exhibit contained a very full outline series of the vertebrate animals of North America and a smaller but still significant series from South and Central America. (Plate 4.) Among the mammals were such striking forms as the Kadiak bear, glacier bear, Alaska moose, Dall's white sheep, Stone's sheep, musk ox; such birds as the condor, California vulture, rhea or American ostrich, wild turkey, harpy eagle, various gay-colored toucans, the ara, Carolina paroquet, whooping crane, steamer duck, penguin (Plate 12), etc., together with rattlesnakes, boas, Gila monster, alligator snapper, matamata, mud eel, Cuban toad, and other characteristic American reptiles and batrachians, and a large series of useful, curious, and brilliantly colored American fishes. A more detailed account of the principal features of the exhibit will be found on a later page.

TAXIDERMY.

In connection with the Buffalo exhibit a system of accessories was adopted which, so far as I am aware, has not been attempted hitherto on a large scale. It was impracticable on account of limited space to exhibit groups showing the habits and natural surroundings of various species, while to display the specimens on plain wooden stands was thought to deprive them to a certain extent of attractiveness. A compromise was therefore effected by using small stands and suggesting the environment by the introduction of a few plants, a rock or two, a little snow, a branch of a tree, etc. Thus, the Kadiak bear was placed on a stand having on it a small section of rock, a little sloping area of sand, and a dead salmon. The fish-eating habit of this Alaskan bear was thus suggested in a very small space. The indigo snake was mounted on a base covered with sand, with a pine cone or two and a bit of palmetto to indicate that it is a denizen of the pine barrens. The condor was represented as perched on a pointed rock, suggesting its mountain habitat. This treatment was not adopted for fishes, as any endeavor to represent their environment would have caused a greater expenditure of time and money than the circumstances permitted. They were represented for the most part by painted plaster casts drawn from the Museum exhibition series. These were supplemented by the Key West collection, and by Professor Steere's collection from the Amazon River, preserved in formalin. The manner in which these two series of fishes were prepared presented some novel features and is deserving of a short explanation.

The collectors were provided with a number of shallow galvanized-iron pans, having a uniform length of 2 feet, a quantity of formalin, injecting syringes, etc. The fish were injected as soon as obtained

and placed in pans, with the fins carefully spread out in natural positions. A dilute solution of formalin was then poured into the pans and allowed to remain until the specimens hardened properly. They were then taken out and wrapped in cloth and packed with great care.

In the meantime a series of 80 square glass jars, each 2 feet long and 1 foot high, were purchased in Germany, and an equal number of plaster of paris plaques provided, 1 inch thick and exactly long and high enough to fit the jars. As soon as the fish and jars reached Buffalo the fish were attached to the plaques and placed in the jars and dilute formalin poured in. With one or two exceptions the specimens remained in excellent condition throughout the exposition. (See Plate 21.) The form of the body and fins was exactly preserved, and the color remained sufficiently to give a very good idea of the appearance of the fish when alive, though the brighter tints of many of the species were in most cases subdued or lost. No method of preserving the life colors perfectly is yet known. To a large extent they appear to be physiological phenomena. The experiment, as a whole, may be considered very successful. At the end of six months' exposure at Buffalo the collection was apparently in as good condition as at the beginning, and was transferred to the Charleston Exposition without any further preparation.

CASES AND INSTALLATION.

On account of the large size of some of the mammals, the exhibit of the Department of Biology occupied the center of the space allotted to the Museum. Two wall cases 40 feet long, 10 feet high, and 4 feet deep were constructed for the mammals at right angles with the main aisle (Plate 5), and flanking them along the west wall was a similar but shallower case for the fishes.

The birds occupied eight standard Museum screen cases, 8 feet 6 inches long, in front of the mammal cases, and in front of these were four standard Museum slope-top cases, 8 feet 6 inches long, for the reptiles and batrachians. A special case was occupied by the humming birds.

On account of the small space available, no attempt was made to assemble the different species in faunal groups, an arrangement which under proper conditions would have been very desirable. In temporary expositions the refinements of classification adopted in museums can seldom be carried out. The Government building at such expositions is generally constructed on broad architectural lines to accommodate the diverse exhibits of the several executive departments and bureaus. The lighting and interior arrangements of the portion allotted in such buildings to the National Museum rarely

permit the carrying out of any preconcerted plan rigorously. The collections are fitted to the space rather than the space to the collections. This limitation was experienced in Buffalo no less than at previous expositions. The condition, as already stated, was met by the abandonment of faunal lines and the mingling together of animals from the northern and southern parts of the American continents. The loss of faunal boundaries was probably not felt except by naturalists. The eye rested everywhere on American species and only American, and the labels indicated what particular region each animal inhabited.

All the larger mammals and all the birds, reptiles, batrachians, and fishes were furnished with descriptive labels, containing in untechnical language the most interesting facts in the natural history of the various species. The preparation of these labels involved no little labor, and amounted in effect to writing a popular treatise on the natural history of the more characteristic American vertebrates. The labels for the reptiles and batrachians were prepared by Dr. L. Stejneger, those for the birds by Dr. C. W. Richmond, for the mammals by Mr. G. S. Miller, jr., and for the fishes by Mr. B. A. Bean. Specimens of these labels are subjoined.

GLASS-SNAKE.

Ophisaurus ventralis (Linnæus).

Although without limbs, and in spite of its name, the Glass-snake is no snake at all, but a degenerate lizard, not very distinctly related to the species with four well-developed legs. The character by which it may instantly be recognized is the external ear opening, which is absent in all snakes.

The name Glass-snake refers to the brittleness of its tail, which is so extreme that a violent muscular exertion is sufficient to disarticulate the vertebræ and break the animal in two or more pieces. It lives in holes in the ground, and when caught often saves its life by disengaging the tail, and leaving the wriggling member in the hand of the confused captor. That the separate parts of the tail are able to join each other and grow together again is, of course, a fable. On the contrary, a new, short stump grows out to replace the lost portion of the tail. This reduced portion is differently colored, and such a specimen as here exhibited is often by the ignorant regarded as evidence of the existence of the fabulous "Hoop-snake," the conical stump being taken for the alleged "sting" of the latter.

The Glass-snake is common in the southern United States.

MOUNTAIN CARIBOU.

Rangifer montanus Thompson Seton.

This is the Caribou of the Rocky Mountains of Canada, southern Alaska, and Idaho. It is much darker in color than the Caribou of the Maine woods, from which it differs also in various details of structure, though its habits are similar. The Caribous are the American representative of the reindeer, but have never been domesticated by the Indians or Eskimos; and the Government has found it necessary to introduce tame reindeer from the Old World into parts of Alaska where native Caribous are abundant.

CONDOR.

Sarcorhamphus gryphus (Linnæus).

This huge American vulture is one of the largest birds of flight and probably occupies the first place among the land birds. It ranges over a large portion of South America and is restricted mainly to the Andes, where it ascends to heights not reached by any other creature. The condor is of slow growth, requiring about seven years to attain the full plumage shown by this specimen, and the young birds occupy the nest for a year or more before they are able to fly.

MAMMALS.

The largest of the North American game animals exhibited was the Alaska moose (*Alces gigas*). This has only recently been recognized as a separate species. It grows to a larger size than the moose of the Eastern States and has larger antlers, which sometimes have a spread more than 6 feet. They do not remain in herds or "yard" in winter, like the Eastern species, and the Indians are therefore unable to surround them in bands. The fine specimen exhibited was one of a small series obtained for the Museum a few years ago by Mr. Dall De Weese. It was represented as standing at the edge of a wood among fallen branches and leaves and young spruce trees.

Another interesting Alaska game animal was Dall's sheep (*Ovis dalli*). This was also obtained in the Cooks Inlet region by Mr. De Weese. It is pure white throughout, and thus distinguished from all other wild sheep. It lives among the mountain snow fields. The species was first made known by Mr. E. W. Nelson.

In contrast with this sheep was exhibited the newly discovered black sheep, or Stone's sheep, from the northern limit of the Rocky Mountains of British America. (Plate 8.) This beautiful sheep is very dark colored with numerous black markings. It was discovered by Mr. H. A. Stone in the upper part of the Stikine Valley, British Columbia, and described by Dr. J. A. Allen.

Two other large Alaskan mammals deserve special notice. The larger of these is the Kadiak bear (*Ursus middendorffi*). This is the largest of existing bears and the largest of carnivorous animals. (Plate 7.) It far exceeds the lion in height and weight, adults probably not falling short of a ton. The specimen exhibited weighed about 1,200 pounds. This huge bear occurs, so far as known, only on Kadiak Island at the mouth of Cooks Inlet. It feeds on salmon and on grasses, berries, and other vegetable matter. The species was only recently founded by Dr. C. H. Merriam, who separated it from the grizzly bear and from other bears with long claws inhabiting the northwestern section of the continent.

The other Alaskan species above mentioned was the glacier bear (*Ursus emmonsi*). This is a small bear of the black-bear group, but, unlike its congeners, it is gray in color, a very unusual tint among

bears, and probably only found elsewhere in the bear of the mountain ranges of Tibet. (Plate 9.) Its home is among the snow fields and glaciers back of Mount St. Elias. Little is known of its habits, and but few specimens have ever reached museums. It is among the rarest of American mammals. Its existence was vaguely known to hunters and explorers for a considerable time, but the species was not established until 1895. It was described by Mr. William H. Dall and named in honor of Lieutenant Emmons, U. S. Army.

Another recently known mammal of the Northwest which was included in the exhibit was the caribou of the northern Rocky Mountains, known as the "mountain caribou." It was first made known to science in 1899 by Mr. Thompson Seton, who obtained specimens from the Selkirk Ranges, British Columbia. Like Stone's sheep, it is very dark in color—much more so than the well-known caribou of Maine.

The series of large American arctic and subarctic mammals included also the musk ox of the barren grounds of Canada, the white goat (or goat antelope) (Plate 10), and the fur seal.

As characteristic large mammals of the United States were exhibited the prong-horn (head), the puma or cougar, the gray wolf (Plate 11), Virginia deer (head), Columbia deer (head), wapiti, and bison.[a]

Of Central American mammals the most interesting exhibited was the Caribbean seal (*Monachus tropicalis*). This seal was formerly very abundant in the Gulf of Mexico, but is now confined to the Gulf of Campeachy, where an excellent series was recently obtained for the Museum by Mr. E. W. Nelson. This was one of the first American animals seen by Columbus.

The South American mammals had as prominent representatives the vicuña, a relative of the well-known llama; the jaguar; the kinkajou, allied to the raccoon; the coati or coatimondi; the giant armadillo, the largest of these typical South American mammals; the coypu, one of the largest of rodent mammals; Azara's dog, one of the fox-like small wild dogs which replace the true foxes in South America; the chestnut-headed sloth; the chinchilla; the Chilean guemal, a characteristic deer of the southern Andes; the great ant-eater; the viscacha, a rodent not unlike the prairie dog, very abundant on the Pampas; the Patagonian cavy; the white-tipped peccary, and various monkeys, such as the tufted Capuchin monkey, mantled howler, long-haired spider monkey, etc.

A very interesting small mammal was the Cuban hutia rat. Three species of these rats are peculiar to Cuba, the indigenous mammal fauna of which consists in addition only of certain bats and an insectivore known as the almiqui (*Solenodon*). In spite of persistent efforts specimens of the last could not be obtained for the Exposition.

[a] Of this only a head was exhibited. Two paintings, representing the reckless slaughter of the bison which led to its extermination, were also displayed.

BIRDS.

The collection of birds shown at Buffalo consisted of 416 specimens, representing the most striking native forms of the Western Hemisphere. It contained representatives of the largest as well as the smallest of the birds of this region. Prominent among the species of special interest was the condor (*Sarcorhamphus gryphus*) of the Andes of South America. (Plate 13.) The specimen exhibited was a male in fully adult plumage, which is attained only after the bird is 6 or 7 years old. As an example of the best style of taxidermy the specimen was not surpassed by any other in the collection. With the condor was exhibited the California vulture (*Gymnogyps californianus*), a near relative and one which rivals it in size. It was once common on the Pacific coast of the United States, but it is now confined to the less accessible mountains of California.

The harpy eagle (*Thrasaetos harpyia*), a bird of great strength and cruel aspect, living in the dense lowland forests of tropical America, was represented by a fine adult specimen. Both the golden and the bald eagles (the latter being the American "bird of freedom)" were represented by well-mounted specimens. The largest bird shown was the rhea (*Rhea americana*), the New World representative of the African ostrich. It lives on the grassy plains of southern South America. The prince of American game birds, the wild turkey (*Meleagris gallopavo fera*), was shown in its characteristic attitude of strutting. In this specimen the naked parts about the head and neck were colored as in life. Elsewhere in the collection an effort was also made to render the natural colors of faded parts by painting. The necessity of so doing is strongly felt in such birds as the toucans, whose most striking characteristic is the brilliant coloration of the enormous bill. These bright tints disappear at death and in museum specimens must be reproduced by pigments. Several specimens of these toucans were exhibited, each one differing from its fellows in tints and pattern of color of its bill. Among the species shown were Cuvier's toucan (*Ramphastos cuvieri*), the Tocard toucan (*R. tocard*), the toco (*R. toco*), the red-billed toucan (*R. erythrorhynchus*), etc. Of the parrots exhibited the hawk parrot (*Deroptyus accipitrinus*) deserves special notice. It is remarkable for its tiara-like crest of bright colors, and is an uncommon species, native of the Amazon region. From the mountains of the small island of Dominica was shown the rare imperial parrot (*Amazona imperialis*), conspicuous for its unusual purple coloring. Of equal interest was the St. Vincent parrot (*Amazona guildingi*), which is noted for the yellow markings on its wings. Other noteworthy species of parrots exhibited were the grass-green paroquet of Brazil, a vivid green bird scarcely as large as a sparrow and one of the smallest members of this family; and the Carolina paroquet (*Conu-*

rus carolinensis), formerly common in many parts of the eastern half of the United States, but now restricted to parts of Florida and Arkansas.

Two of the most gorgeous species of macaws were exhibited—the blue-and-yellow macaw (*Ara ararauna*), and the red-blue-and-yellow macaw (*A. macao*). They are large birds with very long tails and richly colored, as their names indicate. Both species inhabit tropical America and are commonly kept in zoological gardens.

One of the most interesting small birds in the collection was a crowned tyrant (*Oncorhynchus regius*), a South American flycatcher, of dull coloration generally, but with a brightly colored, transverse crest of unusual size. The tyrant can erect its crest at will, but in a state of rest it is folded inconspicuously on the bird's back.

Among the most remarkable birds in the collection was the king vulture (*Gypagus papa*), native of the warmer parts of America. It is of a creamy white and black color, with a hairy, featherless head and neck, the skin of which is decorated with most of the colors of the rainbow.

The steamer duck (*Tachyeres cinereus*) of Patagonia, a large gray bird, is remarkable in possessing the power of flight only while young, adults being too heavy to fly, on account of the small size of the wings. This is one of the characteristic birds of the Southern Hemisphere. The specimen exhibited was not as good as could be desired, but it was found impossible to obtain a better one in time for the Exposition. Several handsome Arctic ducks were shown, such as the Harlequin (*Histrionicus histrionicus*), spectacled eider (*Arctonetta fischeri*), Steller's duck (*Eniconetta stelleri*), and the king eider (*Somateria spectabilis*), all noted for their bright colors. The most beautiful American species is the wood duck (*Aix sponsa*), a specimen of which was included in the exhibit.

The great whooping crane (*Grus americana*) of our western prairies was represented by an excellent specimen from Manitoba. It is one of the most striking members of its family and stands about 4 feet high. (Plate 14.)

A strange pheasant-like bird from the Orinoco region is the Hoatzin (*Opisthocomus hoatzin*), an adult example of which was exhibited. This species is of sombre coloring, but is of interest on account of its isolated position in the avian world. Although superficially similar to some of the gallinaceous birds, it has no very near relatives. The young Hoatzins are armed with double claws at the bend of the wing and climb about in trees overhanging the water after the manner of bats.

A bird which attracted much attention was the barn owl (*Strix pratincola*), also known as the monkey-faced owl. This species, on account of its strictly nocturnal habits, is little known to the general public,

although it is rather common over a wide area in the United States. Its curious visage stamps it as a bird of great rarity in the minds of the laymen.

Of almost equal interest to the people at large are two other common American birds, the night hawk and the whip-poor-will, which by many are thought to be one and the same species. These two species were exhibited side by side, and accompanied by explanatory labels, pointing out the differences in structure and habits of the two birds.

Two birds of singular appearance included in the collection were the roseate spoonbill (*Ajaja ajaja*), a bright-plumaged bird of tropical America, remarkable for its flattened spoon-shaped bill and crimson shoulder patches; and the boatbill (*Cochlearius zeledoni*), a nocturnal variety of heron from tropical America, named from its bill, which bears a striking resemblance to the upturned surface of a boat.

Of Arctic birds the exhibit included, among others, the tufted puffin (*Lunda cirrhata*), a member of the auk family, of plain black plumage, peculiar for its high, laterally compressed, bright-colored bill, and curly tufts of white hairy feathers springing from the sides of its head; and the snowy owl (*Nyctea nyctea*), one of the largest species of the owl tribe. This bird is dressed in pure white, relieved here and there by a few black spots. Its plumage is very thick, even the bill and feet being hidden in a dense covering of hairy feathers to protect them from the Arctic cold.

Very owl-like in appearance is the grand potoo (*Nyctibius grandis*), a bird belonging to the whip-poor-will family. It is of a mottled gray and black color, and has an enormous mouth. It inhabits the northern half of South America. The specimen exhibited was of large size, but hardly in so good plumage as many of the North American birds. The oil bird (*Steatornis steatornis*) is related to the goat suckers. It dwells in caverns in the northern part of South America, and was discovered by Humboldt during his travels in that region. It lives upon fruits and berries. An adult specimen was exhibited. A bird which attracted the attention of many visitors was the man-o'-war bird, whose abnormally long, folded wings project far beyond its body. In flight it is one of the most active and graceful of all birds. It is a native of all tropical seas. Of the commoner birds exhibited one of the most curious was the anhinga (*Anhinga anhinga*) or snake bird, a native of Florida and tropical America, where it haunts sluggish streams and wooded swamps, usually perching upon snags or stumps projecting from the water. It has a very small head and long, narrow neck, whence the name "snake bird."

Among the woodpeckers exhibited at Buffalo may be mentioned two species mounted upon one perch and labeled "giant and pygmy woodpeckers." The giant is the imperial woodpecker (*Campephilus impe-*

rialis) of the pine forests of northern Mexico, the largest known member of its family. The other species is the pygmy woodpecker (*Picumnus pygmaeus*), from Brazil, one of the smallest of all woodpeckers. Several other species of woodpeckers were shown, including two bright-colored species from Cuba.

The avian fauna of Central America was prominently represented by the resplendent trogon, or quezal (*Pharomachrus mocinno*), the most gorgeous example of its family. It is a native of certain high mountains of Central America, and is the national bird of Guatemala. It is of a brilliant metallic green above and crimson below, with a flattened crest and long streaming tail coverts extending 2½ feet beyond the body. The Cuban trogon (*Priotelus temnurus*), which was also shown, is confined to the island of Cuba and is noted for the peculiar shape of the tail feathers, which look as if they had been notched at the end with a pair of scissors. A small, plain-colored species, which might easily be overlooked in a collection of this kind, is the crested ovenbird of Brazil (*Homorus cristatus*), which is, however, noteworthy on account of its remarkable nest-building habits. These nests are composed largely of sticks, some of them as thick as one's little finger and 2 feet long, the whole structure resembling a barrel lying upon its side. The nests are about the size of an ordinary flour barrel, while the bird is no larger than our catbird. The jacamars constitute a family of brilliantly colored tropical American species, related to the kingfishers. The species, several of which were represented at Buffalo, are all inhabitants of dense forest recesses, where they pass much of their time perched on dead twigs near the ground. The most striking species is the grand jacamar (*Jacamaropsaurea*), of which several specimens were shown. The motmots, represented by several species, are less gorgeous than the jacamars, but have similar habits. They are noted particularly for their habit of trimming their tails, the two central feathers of which are denuded of the webs for a distance of about an inch at the ends.

Among the numerous bright-colored members of the Tanager family may be mentioned the callistes (genus *Calospiza*), some of which are exquisitely colored, the seven-colored calliste (*Calospiza tatao*) being one of the most tastefully decorated. The red-eared calliste (*Chlorochrysa phaenicotis*) is unique in having on its shoulders a patch of color not to be matched in any other bird.

Of more brilliant colors, and in many ways the most remarkable assemblage of birds to be found in the Western Hemisphere, is the group known collectively as cotingas. In this family, grouped by certain peculiarities of structure, may be found such singular birds as the umbrella bird (*Cephalopterus ornatus*), the bell bird (*Casmorhynchos tricarunculatus*), the bald fruit crow (*Gymnocephalus calvus*), the cock of the rock (*Rupicola rupicola*), etc., all remarkable for richness

of coloring or some bizarre style of plumage or ornamental appendages. The holy-ghost bird (*Carpodectes nitidus*), of the same family, is almost pure white, with a delicate wash of blue on the upper surface, and an innocent, dove-like expression. Examples of these and many other striking forms of the cotinga family were exhibited.

About 150 specimens of hummingbirds were shown in a special case, representing many of the more interesting species of this exclusively American family. Though diminutive in size and occupying but little space, the gem-like brilliancy of their plumage outshone the larger birds.

REPTILES AND BATRACHIANS.

The exhibit of these classes of American animals included the largest and most characteristic species of which specimens could be obtained. The series consisted entirely of painted plaster casts on bases, with accessories, suggesting the natural environment or habits of the various species.

One of the largest and most interesting specimens was the turtle known as the alligator snapper. This turtle is found in the Southwestern United States. It is the largest species of fresh-water turtle now existing, and is only surpassed in the class Testudinata by the giant tortoises of the Galapagos Islands. The specimen exhibited is the largest one of the species of which there is any record, and hence the largest American fresh-water turtle thus far known. (Plate 18.) The shell is 29½ inches long and 34 inches wide. It was obtained in southern Texas. Other interesting American turtles exhibited were the snapping turtle, the curious soft-shelled turtle, the box tortoise, etc. A very good specimen of one of the large Galapagos Island land tortoises was also exhibited. Specimens of the mata-mata of Brazil, the most grotesque turtle known, and the large Amazon River turtle were also prepared, but could not be exhibited for lack of space.

The poisonous snakes of North America were represented by the diamond rattlesnake (*Crotalus adamanteus*), the largest and most poisonous American species; the well-known copperhead, and the water moccasin, or cotton mouth, which is much dreaded in the Southern States.

The larger but nonpoisonous snakes of tropical America were represented by the boas. (Plate 16.) The Museum was fortunate enough to obtain specimens of the yellow boa of Jamaica, the Cuban boa (known as the *Maja de Santa Maria*), which is the largest snake of the West Indies, and the well-known boa constrictor of South America. Of the last, a beautiful cast of a specimen 12 feet long and also a cast of a young individual were exhibited. The Cuban and Jamaica boas could not be exhibited on account of reduction of space. Several of

the characteristic small harmless snakes were also displayed, and with them a very instructive preparation representing the nest and eggs of the curious hog-nosed snake and the newly hatched young snakes. (Plate 17.)

The American lizards are for the most part too small to be attractive at an exposition, but the Pan-American exhibit included a fine cast of the so-called Gila monster, which is the only known poisonous lizard. It inhabits the arid regions of the Southwestern United States and adjacent parts of Mexico. Its venom is powerful and may cause death, but as it is a very sluggish creature cases of poison are not frequent.

Two large Cuban lizards found a place in the exhibit, the Cuban iguana (Plate 15), one of the largest of American lizards, reaching a length of 5 feet, and the Cuban chameleon, which, like the Old World chameleons, can change its color, though it is not allied to them, but belongs to the American family of Anolis lizards. The cast of the Cuban iguana in its pose and coloring was one of the most satisfactory and lifelike pieces prepared for the Exposition.

The curious lizard known as the "glass snake" was also included in the exhibit. This is a lizard without limbs, and hence resembles a snake. It has the power of detaching its tail by powerful muscular contractions, and as in this case a new short pointed tail grows out, it has formed the basis of the stories of the mythical "hoop snake."

The exhibit of batrachians was smaller than that of reptiles, but included the more characteristic American forms, such as the mud eel, tiger salamander, etc., and several kinds of toads and frogs. Among the latter was the Cuban toad, remarkable for its large size, and the large Cuban tree frog.

FISHES.

The exhibit of fishes comprised more than 100 specimens, of which the majority were painted casts. The object of the exhibit was to represent as fully as space would permit the larger, more characteristic, and more important American species. It was found impracticable to make a satisfactory exhibit of West coast species, but the most important forms on the Atlantic coast and the fresh waters were well represented. (Plate 6.)

The series included many of the most important game and food fishes, such as the sheepshead, Spanish mackerel, striped bass, tarpon, bluefish, croaker, mullet, and menhaden. Tarpon, which is well known as one of the largest American game fishes, was represented by a stuffed skin from Florida, presented by Bennett H. Young, esq.

The Museum was fortunate in obtaining for this exhibit a good cast of the man-eater, or great white, shark, 13½ feet in length. Specimens of the dusky shark and shovel-nose shark were also exhibited, the former with the curious remora, or sucking fish, attached. The allied

skates were represented by a common species which reaches a length of 2 feet, and the arraya, or stingray, of the coast of Brazil, which enters the Amazon and other rivers.

Several of the largest species of the true fishes were included in the exhibit, such as the horse mackerel, which reaches a length of 10 feet or more, with a weight of 1,500 pounds; the barracuda of the tropical Atlantic, which reaches a length of 6 feet; and the wolf fishes, found in the deep waters of both the Atlantic and the Pacific.

The exhibit included many curious and grotesque marine fishes, such as the sea bat, a small species often sold in curiosity shops; four-eyed fishes, so named on account of the dark horizontal line crossing the eyes; the poison toad of the tropical Atlantic, which is much feared by the fishermen, who say that its spines inflict very painful wounds. Besides these are included the well-known flying fish, the large sail-fish, remarkable for the development of the dorsal fin, a portion of which extends above the surface of the water when the fish is swimming; the beautiful thread-fish, with its thread-like fins, and many others.

The exhibit of tropical Atlantic fishes included many of the larger characteristic species found in Key West and in the West Indies, including some used as food in Cuba. Among these were the lane snapper, the most important food fish of the Havana markets; the dog snapper; the Margate fish, an important food-fish in Key West, Nassau, and Havana; several other species of grunts, among which the common or white grunt is the most abundant food-fish at Key West. The groupers, one of the most characteristic groups of tropical fishes, were represented by numerous species, such as the rock hind, the Nassau grouper, one of the most attractive of its tribe and of large size, reaching a weight of 50 pounds; the red grouper, a common species of the Gulf of Mexico; and most remarkable of all, the jewfish, which is perhaps the largest of the tribe; it reaches a weight of 500 pounds. Specimens weighing from 150 to 250 pounds are sold in pieces in the market like halibut.

Other especially interesting species were the beautiful angel fishes (Plate 20), some of which stray northward as far as the coast of New Jersey, but are characteristic of the tropical Atlantic; and the rose fish, remarkable for its brilliant colors; the red drum (Plate 19), etc.

In addition to the marine fishes it was considered especially desirable to display the more characteristic fresh-water species of North and South America. The latter series was necessarily confined to species inhabiting the Amazon and its tributaries, as opportunities were not afforded to obtain specimens from the southern rivers. Among the North American forms were such well-known game fishes as the grayling, remarkable for its large dorsal fin; the pickerel, etc. The fishes

of the Great Lakes were represented by the fresh-water drum, white fish, and large catfish, which reaches a weight of 100 pounds or more, the moon eye and the red-horse mullet. The series also included specimens of the buffalo fish, the largest of the suckers, reaching a weight of 50 pounds or more, found mainly in the Mississippi River and its tributaries. Species peculiar to the fresh waters of North America were the gar pike and mud fish, two very old types of fishes, and the singular paddle fish of the Southern and Western rivers.

Among the most abundant and characteristic fresh-water fishes of South America are the catfishes, of which there are many species, some of which are extremely interesting on account of their curious mail-like scales and large spines. Among those exhibited was the small acary caciraba, in which the body and head are entirely covered with a coat of mail, made up of interlocking, bony plates. It is typical of the large group comprising more than a hundred species. Several other species of acary are included in the series. Another characteristic group of fresh-water fishes of South America are the characins. They are carnivorous fishes, feeding on various aquatic animals, including members of their own class. Several representative forms of this characteristic group were included in the exhibit, such as peixe cachowo, one of the most formidable of the characins, reaching a length of 4 feet; the jeju and the agulha, which are valued as food fishes. Specimens of the electric eel could not be obtained, but it was represented by an allied form, the itui, a common species of tropical America.

At an early stage in the development of plans, it was proposed to add to the exhibit of fishes characteristic of American waters a series of enlarged models of fishes of the deep sea. It proved, impossible, however, to construct these in the time available, but a single example was prepared. The species chosen was one known as *Ethoprora effulgens*, belonging to a characteristic family of deep-sea fishes, many of which are remarkable for their phosphorescent organs. In the species exhibited there is in addition the luminous spots on the sides found in many deep-sea fishes, a large luminous area like a lantern on the top of the head. This extraordinary creature must present a remarkable appearance when swimming in the dark abysses of the ocean. The model shown at Buffalo was eight times natural size and had a length of 4 feet (Plate 22). The luminous spots on the sides were represented by buttons of glass connected with the interior by tubes. The luminous protuberance on the head was modeled in gelatine and tinted. The model was so connected with the electric-lighting system in the building that a gentle glow appeared in the side spots and frontal protuberance, producing a very striking and it is believed a quite accurate notion of the appearance of a living phosphorescent deep-sea fish.

THE EXHIBIT OF THE DEPARTMENT OF ANTHROPOLOGY.

By William H. Holmes,
Head Curator.

When plans were required for an anthropological exhibit to form part of the Government's display at the Pan-American Exposition in Buffalo, 1901, it was not difficult to decide as to what portion of the very wide field included in the Museum department should be selected. The Pan-American concept furnished the suggestion, and it was arranged to present in the most striking manner possible a synopsis of the Pan-American aborigines, the native peoples of America, from the Eskimo of North Greenland to the wild tribes of Tierra del Fuego. The most salient ideas or features available for exposition presentation in this field are (1) the peoples themselves, and (2) the material products of their varied activities.

GROUPS OF LAY FIGURES.

The most important unit available for illustrating a people is the family group—the men, women, and children, with their costumes, personal adornments, and general belongings. It was therefore decided to undertake the preparation of 12 lay-figure family groups, illustrating such tribes as would serve best as types of the ethnic provinces distributed between the northern and southern extremes. With such a set of groups geographically arranged upon the exhibition space it was conceived that the student, and even the ordinary visitor, might, by passing from north to south or from south to north through the series, form a vivid and definite notion of the appearance, condition, and culture of the race or peoples called American Indians, the race so rudely and completely supplanted by the nations of the Old World. Each lay-figure group comprises from four to seven individuals, selected to best convey an idea of the various members of a typical family, old and young of both sexes.

Two of these groups, the Greenland Eskimo and the Patagonian, occupy cases 8 by 12 feet in horizontal dimensions and stand at the northern and southern extremities of the exhibit. The other cases are smaller and accommodate from three to six figures. Each member of a group is represented as engaged in some suitable occupation. The activities of the people are thus illustrated and the various products of industry are, as far as possible, brought together in consistent relations with the group.

In building these figures the closest possible approach to accuracy was sought, but satisfactory costumes were not always available, and collections illustrating arts and industries were found to be deficient,

save in a few cases. It is therefore felt that the exhibit is not yet complete and that many changes will be necessary to bring it up to a satisfactory standard. It was impossible, in the short time allotted for the work, to secure life masks of the people, save in a very few cases, but the sculptors were required to reproduce the physical type in each instance as accurately as the available drawings and photographs would permit. Especial effort was made to give a correct impression of the group as a whole, rather than to present portraits of individuals, which can be better presented in other ways. Life masks, as ordinarily taken, convey no clear notion of the people. The faces are distorted and expressionless, the eyes are closed, and the lips compressed. Like the ordinary studio photograph of primitive sitters, the mask serves chiefly to misrepresent the native countenance and disposition; besides, the individual face is not necessarily a good type of a group. Good types may, however, be worked out by the skilful artist and sculptor, who alone can adequately present these little-understood people as they really are and with reasonable unity in pose and expression.

The lack of appropriate and complete costumes, especially for the women and children, proved the most serious drawback. An attempt was made to remedy this by sending collectors to the field, but only one of four expeditions sent out returned in time to be of service in the preparation of this exhibit.

It is well understood that for exposition purposes the assemblage of family groups—or larger units—of the living peoples would be far superior to lay-figure exhibits. The real family, clothed in its own costumes, engaged in its own occupations, and surrounded by its actual belongings, would form the best possible illustration of a people; but such an exhibit, covering the whole American field, would require much time for its preparation as well as the expenditure of large sums of money. Furthermore, from the museum point of view, the creation of a set of adequate and artistic lay-figure groups forms a permanent exhibit which, set up in the museum, continues to please and instruct for generations; whereas the real people, howsoever well assembled, must scatter at the close of the exposition, and nothing is left for future museum display. Such assemblages of our native peoples as those of the World's Columbian, the Trans-Mississippi, and the Pan-American expositions are highly interesting and instructive, but their influence is soon lost, since they reach only the audience of the season.

Future expositions may essay the bringing together of living representatives of type tribes, scientifically presented and free from the commercial incubus, but to secure satisfactory results the work must needs begin not less than two years before the opening of the exposition.

The family groups and other lay figures included in the present exhibit are such as could be brought together in the short period allotted for preparation, and represent the following tribes:

1. North Greenland Eskimo.
2. Eastern Eskimo.
3. Alaskan Eskimo.
4. Chilkat Indians, Alaska.
5. Hupa Indians, California.
6. Sioux Indians, the Great Plains.
7. Navaho Indians, the arid region.
8. Zuñi Indians, the arid region.
9. Cocopa Indians, Sonora, Mexico.
10. Maya-Quiche Indians, Guatemala.
11*a*. Zapotec Indian woman, Oaxaca, Mexico.
11*b*. Jivaro Indian man, Brazil.
11*c*. Piro Indian man, Brazil.
12. Tehuelche Indians, Patagonia.

Exhibits 2, 3, and 11 of this series were not completed as family groups and remain assemblages of independent figures simply.

DESCRIPTION OF THE GROUPS.

The first exhibit of the series (Plate 23), beginning at the north, shows an Eskimo family of Smith Sound, northwestern Greenland. These are the most northern inhabitants of the world known. On account of the prevalence of ice the year round they make little use of the kaiak, or skin boat, employed so constantly by the more southern Eskimo, using the dog sled for transportation. Their clothing is of skins of the seal, reindeer, birds, and dogs, and their houses are often built of snow. Their activities are nearly all associated with the mere struggle for existence.

This group represents a family as it might appear in the spring, moving across the ice fields. The young man has succeeded in clubbing a small seal, and having called on the sledge party to haul it home is laughed at by the elder man, who tells him he should have carried it on his back.

This episode is chosen with the view of illustrating the noteworthy fact that these farthest-north people are exceptionally cheerful in disposition, notwithstanding the rigor of the climate and the hardships of their life. The woman, who carries a babe in her hood, is about to help attach the seal to the sledge, and the girl, who plays with the dogs, and the boy, who clings to the back of the sledge, are not insensible to the pleasantries of the occasion.

In the second exhibit (Plate 24) three south Greenland figures take the place of the family group, which could not be completed in time.

They represent the Eskimo who inhabit Greenland, the shores of northern Labrador, and Hudson Bay adjoining. The figure at the right is that of a young woman of southwestern Greenland, her dress resembling that of a Lapp. Her people have been under instruction of Moravian missionaries for generations. The middle figure represents the native right-hand man of the intrepid whalers, who before the discovery of coal oil ransacked Hudson Bay for oil and baleen. The woman at the left is from Ungava Bay, and is dressed in aboriginal costume of reindeer fur, little modified by outside influences. Her loose, roomy garments correspond with those figured by the early voyagers. In her left hand she carries a large wooden plate, while the right is lifted to ease the headband which passes around the forehead, sustaining the babe held in the hood behind. The eastern Eskimo are especially interesting on account of their association with the exploring expeditions sent out in the last century to search for the northwest passage and the North Pole.

The third case (Plate 25) contains three lay figures of the western Eskimo, who inhabit the shores of the northwestern seas from the mouth of the Mackenzie River around Alaska to Mount St. Elias. Their mode of dress and living varies according to the animals on which they depend and the contact they have had with other races. In this group will be seen a woman and child from the Mackenzie River district dressed in caribou skins, a man from about Norton Sound holding his barbed harpoon, and a woman from Bristol Bay clad in marmot skins. The Mackenzie and Bristol Bay people are out of touch with the great fleet of whalers, and their arts are not greatly modified, but the Norton Sound Eskimo have been under instruction of Russians and Americans for more than a hundred years.

The fourth group (Plate 26) illustrates the Chilkat Indian family of the North Pacific ethnic province. They live on Lynn Canal, or channel, in southeastern Alaska, and belong to the same family as the better-known Tlinkits. They are selected to stand as a type of the region because they are the only tribe that still retains in a measure the aboriginal costume. They are in commercial contact with the Athapascan family over the mountains to the east, from whom they obtain horns and wool of the arctic goat. The wool is used in making the famous Chilkat blankets, which are not woven in a loom, but the foundation strands are suspended from a bar of wood and fall free at the ends or are tied up in bundles. The figures of the design are inserted separately, as in a gobelin tapestry. The men of the tribe carve the utensils and ceremonial objects from wood and horn. In this group we see, sitting on the floor, a man carving a wooden mask. He is dressed in a buckskin suit, whose decorations show contact with the Tinné tribes over the mountains. The woman opposite is engaged in making a basket, with her babe in its cradle by her side. Standing

behind is a young girl offering food in a carved wooden dish to a man who wears one of the fine Chilkat blankets over his shoulders. Usually the food dish is placed on the ground and the men sit or squat about it, the women eating separately. The costumes are of buckskin made in the primitive style, and numerous articles pertaining to the household or employed in the arts are scattered about the group.

The Hupa Indians (Plate 27), shown in the fifth group, inhabit the valley of the same name in northwestern California. They represent in this series of family groups the mixed tribes of California and Oregon. Physically the Hupa stand between the large-bodied Sioux and the under-sized Pueblo Indians. In language they belong to the Athapascan family in common with the Tinné of Canada and the Apache and Navaho of Arizona. They live on a mixed diet of meat, fish, and acorns; dress in deerskin, and are fond of personal ornament. Their better houses are of cedar planks and the floor is slightly sunken beneath the surface of the ground. An important industry among them is the harvesting, transporting, storing, and milling of acorns, together with the preparation of food from the meal.

In this group the man is making fire with the twirling drill, the standing woman carries a load of acorns just gathered, and the sitting woman is pulverizing acorns in a stone mortar surmounted by a basket hopper held in place by the miller's knees.

Group 6 (Plate 28) illustrates a Sioux family, which is taken as a type of the inhabitants of the Great Plains ethnic province. It is on these plains that the Sioux, Algonkin, and Kiowa developed their peculiar culture. The activities of all these tribes were created and fostered by the buffalo—including their food, dress, tents, tools, utensils, arts, industries, social life, lore, and religion. In the group appear the man, who is the hunter, returning with a trophy of the chase; the wife, who is butcher, tanner, clothier, purveyor, pack animal, and general drudge, is dressing a hide; the young girl is beading a moccasin for her sister, who is interested in the work. The smaller boy, with bow and arrow, welcomes the father. The tribes of the Great Plains are thought to have been in early times sedentary, but the acquisition of the horse and the gun fostered a more roving life.

Group 7 (Plate 29) illustrates a Navaho Indian family of the Pueblo province. They belong to the Athapascan family, whose home is in northwestern Canada and central Alaska. They are among the most interesting tribes of the United States since, under Spanish direction, they laid aside their wild hunting habits, becoming herdsmen of sheep and other domestic animals and learning to weave and to work in metals. Their kinsmen, the Apache, on the other hand, fled from the conquerors and remained little affected by civilization down to the present time.

The group includes three figures. The man is at work with modern

implements of iron, shaping the silver ornaments so skilfully wrought by the workmen of his tribe. Two women are engaged in the most notable industry of this people, the spinning of yarn from native wool and the weaving of blankets.

The Zuñi Indians, represented in the eighth family group (Plate 30), live in pueblos on the table lands of western New Mexico and stand for the sedentary town-building type of the Pueblo region. They were visited at the beginning of the 16th century by the earliest Spanish explorers, and have been a subject of study by ethnologists for many years. They dress in woolen clothing, are agriculturists as well as herdsmen, and make excellent belts, blankets, and pottery. At the same time they are devoted to their ancient religion.

This group includes in the foreground a young woman engaged in weaving one of the artistic belts used for the waist. At the right is seated an old man occupied in drilling a bit of stone with the ordinary pump drill. His dress is that worn during the Spanish period. Near the middle of the group stands a young girl in the usual costume, who has just returned from the spring, bearing upon her head a water vessel. On the right are two children interested in their frugal meal.

The Cocopa Indian family, shown in group 9 (Plate 31), represents the Sonoran ethnic province. They occupy the lower valley of the Colorado River, Mexico, from the international boundary to the head of the Gulf of California. Although they were visited by Spaniards in 1540, and have been in contact with the Caucasian race for two hundred years, they retained their primitive traits up to about 1890. They subsist largely by means of agriculture, feeding partly on game and fish, with various seeds, roots, and fruits. They dwell in scattered settlements, usually of one to half a dozen houses, which pertain to a family or clan. Little costume is used, the men until recently habitually wearing skins and the women petticoats of the inner bark of willow, as seen in the illustration. Their faces are habitually painted, and they are tattooed moderately.

The group includes five figures. A young man with bow and arrow is engaged in teaching a boy to shoot; the woman is pounding corn in a wooden mortar, and the young girl carries the babe and concerns herself with the bow practice of the boy.

The tenth family group (Plate 32) shows the Maya-Quiché of Guatemala. These people occupy also parts of Chiapas and a small area in western Honduras; at one time they were the most highly cultured of all the native peoples of the Western Hemisphere. They had an artificial basis of food supply, dressed in delicate fabrics, and were capable of erecting vast terraces and stepped pyramids surmounted with buildings adorned with sculptures and paintings. They were of moderate stature, not warlike, but industrial, and the sculptures and paintings revealing their religion are remarkably free from bloody scenes. They

number in Central America, at present, several hundreds of thousands. The family group here presented includes the man with staff and bearing a net filled with fruit, one woman working at the mill, a second woman carrying a basket of fruit in her right hand and a gourd bowl in the left, while the girl walks by her mother, and holds a decorated globular, gourd vessel.

The eleventh group (Plate 33) consists of three figures, a woman of Oaxaca, southern Mexico, and two men, representing the Piro and Jivaro tribes of the headwaters of the Amazon. The Oaxacan woman is dressed in a skirt of striped native-woven cloth, held by a belt. The upper part of the body is covered with a tastefully decorated tunic. The head is protected by a long sash or rebozo. She carries in her left hand a red earthen drinking cup and in her right two gourd vessels. The third figure is a Piro man, Arawakan family, headquarters of the Ucayle, interesting because tribes speaking the same language were met with by Columbus on his first voyage to America. He wears a tunic of native make, embellished with artistic patterns, and confined only by a sash of beads decorated with skins of birds passing over the right shoulder and beneath the left arm. The headdress consists of a bark band in which are set three bird plumes. He holds in both hands a ceremonial baton.

The Jivaro man lives on the headwaters of the river Marañon. He wears a tasteful and brilliant feather skirt and headdress, ornaments of teeth, beetle wings, and seeds. This tribe, one of the most forceful and independent in South America, preserve the dried heads of their enemies.

The Patagonians, group 12 (Plate 34), taken as a type of the far southern tribes, apply to themselves the name Tzoneca, but their neighbors call them Tehuelche, or southerners. They live on the plains and desert areas of southern Patagonia, and all of the arts of their lives grow out of the region. They dress in the skins of animals. Their rude tents, or toldos are made from the hides of the same animals. Their furniture, food, and arts are occasioned by the same environment. Living on animal diet, they resemble the Plains Indians of the United States, being tall, bony, and athletic. When the Spaniards had introduced the horse into America it took kindly to these grassy plains, and the Indians changed their arts to adapt them to this new domestic animal. On horseback they hunt the guanaco, the American ostrich, and various other animals.

In the group the family is on the point of breaking camp. The man, wearing a skunk-skin robe, with bolas in hand, is ready to mount his horse. One woman has already mounted, and the boy assists in completing her outfit. The second woman is rolling up skin robes of the household, while the little girl halters the pet ostrich, and the babe sleeps in its novel cradle.

DWELLING GROUP MODELS.

The second most important concept available for Pan-American presentation embraces the arts and industries of the people. First in order among these is architecture—the building arts—represented by the dwelling or the cluster of houses and outbuildings occupied by a family or communal group. On account of the lack of room these subjects had to be presented by models on a small scale—one twenty-fourth actual size—but it was found that all essential details could be reproduced and that something of the people and their occupations could be shown. The subjects were selected, as were the lay-figure family groups, to represent type peoples distributed at intervals between the far north and the far south. The series begins with the snow house of north Greenland and ends with the skin-covered windbreak of southern Patagonia.

The list of dwelling group models completed for the Exposition is as follows:

1. Snow houses of the Greenland Eskimo.
2. Earth house of the Alaskan Eskimo.
3. Wooden dwellings of the Haida, representing the Northwest coast tribes.
4. Skin and bark-covered lodges of the Montagnais Indians, Labrador.
5. Dwellings of the Sierra (Digger) Indians, California.
6. Skin lodges of the Great Plains Indians.
7. Grass houses of the Wichita Indians, Indian Territory.
8. Earth lodges of the Pawnee Indians, Dakota.
9. Cliff dwellings (ruins), Arizona.
10. Grass and adobe houses of the Papago Indians, old style, Arizona.
11. Pile dwellings of the Venezuela tribes, South America.
12. Skin shelters of the Patagonians, South America.

The series was intended to include sixteen groups, but in the limited time allowed the work could not be completed.

The first model of the series (Plate 35) shows a dwelling group of Central Eskimo. These people live on the area between Hudson Strait and Baffin Bay. Their winter houses are built of blocks of compacted snow laid up in a spiral manner, forming a dome. The blocks are some 3 feet long, 2 feet high, and 6 inches thick. The main chamber of the house varies from 5 to 12 feet in height and from 7 to 15 feet in diameter. Over the entrance a square is cut out and covered with seal intestine for a window. The main domed chamber is connected by passageways with one or more subordinate chambers which serve as storerooms. In the summer the natives fish in the open water; in winter seals are taken by cutting

holes in the ice. The clothing of the men and women is made from skins of seals and deer, and consists of outside and inside trousers, jackets—those of the women having hoods—boots, and inside boots or socks made of light deerskin or birdskin.

In the second model of the series (Plate 36) we have a dwelling of the Kinugmut Eskimo, taken as a type of the Alaskan region. The Kings Island people are Kinugmut Eskimo, the same as at Port Clarence and Bering Strait. Their island has steep shores and their houses often resemble cliff structures. The structures here shown include the large communal house and the frame for keeping food out of the reach of the dogs. The house is built of logs set on end and a cob-work of logs resting on these. The whole is covered with earth and moss. Entrance is at the outer end of a long gallery and ventilation is through the roof. A portion has been cut out of one face of the model to expose to view the interior arrangements of the dwellings. There are side rooms for storage. The Port Clarence Eskimo live by hunting sea mammals and by fishing. This special locality is now interesting, since the United States is there making the experiment of introducing the domesticated reindeer.

The third model (Plate 37) illustrates a dwelling group of the Montagnais Indians, a type of the eastern Canadian province. The Montagnais are of Algonquin stock, and were distributed formerly throughout Labrador as far north as Ungava Bay. They lived by hunting and fishing. Their dwellings are of skins laid on a frame-work of poles, not sewed together, but held down by trunks of small trees leaned against the outside and stones piled around the base. The group includes finished tents, wood pile, staging filled with skins and robes, men painting a robe, women drying skins, and birch-bark canoes. The Montagnais dress in deerskin robes, quite like those of the Eskimo, their neighbors, but well made and decorated with paint rather than embroidery. Their canoes are of bark, and not of skins, as are those of their neighbors in the north.

The fourth model (Plate 38) represents a dwelling group of the Haida Indians, a type of the north Pacific ethnic region. The Haida Indians inhabit the Queen Charlotte Islands, lying in the Pacific Ocean 75 miles north of Vancouver Island. They are a separate linguistic family. Their houses are in the form of a regular parallelogram, averaging 50 feet in width and 35 feet in depth. Posts were planted in the ground, joined by means of timber, and these were covered on the roof and sides anciently with hewn planks. In front are planted totem poles, upon which are carved animal totems representing the crests of the different clans inhabiting the house. Entrance is often by means of a low doorway cut in the base of the totem post. All over the front also are painted heraldic emblems connected with their family symbolism. The Haida tattoo their bodies with various designs, and now clothe themselves largely after the manner of the whites.

The fifth model (Plate 39) illustrates a dwelling group of the so-called Digger Indians of the Californian region. The numerous tribes belong to several linguistic families, and occupy an extensive area in California, Utah, and Nevada. They received their name from the use of roots in their arts. Their dwellings are primitive, but modified by contact with the whites. This group includes the communal house, built of boards and shingles; the mill shelter; the summer house, where the household arts are carried on; the storage platform, and the granary. As these people subsist largely on acorns, the greater part of the woman's life is spent in gathering the nuts, carrying them home in a conical basket suspended on the back by a band passing across the forehead, drying and hulling them, grinding them in stone mortars, sifting, cooking, and serving the meal in the form of mush or bread. The men are hunters, fishers, and laborers.

The sixth model (Plate 40) is that of a dwelling group of the Great Plains Indians. Here dwelt formerly Siouan, Algonquian, Kiowan, and Shoshonean tribes in tents of buffalo and deer hide. A set of poles lashed together at the top, a cone-shaped covering over that, held down by pegs driven into the ground about the edge, constituted the dwelling. The fireplace was in the center, and the furniture consisted of abundance of skins for beds and a few ladles or spoons of wood or horn for dishes. Cooking was done by roasting and stone boiling, and pemmican or dried buffalo meat was laid up for time of need. The men were hunters and warriors, and the women were skilled in all the peaceful arts that grew out of the chase.

A dwelling of the Wichita Indians is the subject of the seventh model (Plate 41). This tribe is of Caddoan stock, and formerly inhabited northern Texas. Their dwellings are generally cone shaped and dome shaped. The frame is of poles tied together, like latticework. Into this bundles of grass are woven in rows, imbricated so as to shed the rain. The group shows a finished house, one in process of erection, and a communal shelter supported on poles. The Wichita have become agriculturists, and dry their corn on hides or frames. They have also adopted the metal cooking vessels of the whites. The method of thatching is to be compared with that of the Papago in Sonora, Mexico.

The eighth model (Plate 42) represents a dwelling group of the Pawnee Indians, a type of the Missouri Valley region. The Pawnee formerly lived in Nebraska, on the Platte River. They belong to the same family as the Arikarees in North Dakota and the Caddoes in Louisiana and eastern Texas. Although their home was in the country of the skin-tent dwellers, they continued to build the ancient northern type of earth-covered abode with slightly sunken floor. The frame consists of logs set on end in a circle and connected with other timbers. The roof is of radiating poles, rafters covered with brush and then with a thick layer of earth and sod. From the circular chamber a

passage several feet in length leads outward, forming the doorway. This type of dwelling is also interesting in that it is suggestive of the origin of many of the smaller mounds in different parts of the Mississippi Valley.

The ninth model of the series (Plate 43) represents an ancient cliff dwelling of the Pueblo country. The arid region of Colorado, Utah, Arizona, and New Mexico abounds in canyons and plateaus, and the rocky walls have been carved by the elements into many fanciful shapes. Here also were formed shelves, shelters, and caverns, and these were extensively utilized by the ancient tribes for dwelling purposes, from which circumstances they derive their name—Cliff Dwellers. The fronts of the recesses were closed with stone walls, and partition walls divided the space into rooms of various sizes. These houses were reached by natural pathways, by steps cut into the rock, and by wooden ladders, and they served for defense as well as for abode. By the remains of industrial arts found in the cliff structures, their builders are shown to have been the ancestors of part or all of the modern Pueblo tribes.

A dwelling group of the Papago Indians is shown in the tenth model (Plate 44). The type is that of the Sonoran region. The Papago Indians are of Piman stock, inhabiting Pima County, Arizona, and the State of Sonora, Mexico. They dwell in dome-shaped grass houses, in which a frame of mesquite poles is fastened together with yucca twine, covered with long grass and mud, and protected with stalks of the ocotilla. Other outbuildings are the kitchen circle, the pole-supported shelter, and the ruined house showing structural features. The food of the Papago is chiefly vegetal, the staple being the beans and pods of the mesquite tree. They are clever potters. The Papago wear little costume, the modern dress being of European or modified European pattern. The men formerly wrapped skins about their loins, and the women were clad in fringed petticoats of shredded bark and leaves.

The eleventh model (Plate 45) illustrates the home of the Goajiros Indians of Venezuela, a type of the Orinoco ethnic province. The discoverers of the coast of South America were astonished to find tribes living in huts built out over the water, and so they gave to this region the name of Venezuela, or Little Venice. The huts, only a few feet square, stood among the trees, on platforms constructed by interlacing the stems. The houses later were supported on piles or trunks of trees, sunk in the water and standing 5 or 6 feet high. In the center of each platform was a pile of earth, and on this the fire was built and kept continually burning. Over the platform was suspended a low roof thatched with palm leaves. Access to the house was had by means of a notched tree trunk. The natives moved about in dugout canoes, and when the water was high one of these could be seen tied

to every notched ladder. Little clothing was worn, but there was much decoration of the person with feathers and seeds, and the bones and teeth of small animals.

The twelfth model (Plate 46) illustrates the houses and human life of the Tehuelche tribe of Patagonia.

Fabulous stories are told of their stature. They are, in fact, among the tallest people in the world. Their food is derived mainly from the chase. They clothe themselves in skins of animals, and their women are expert not only in dressing hides, but also in decorating them with patterns of various colors.

For a house the Tehuelches cover a framework of sticks with a number of skins sewed together. These shelters, generally open in front, are called toldos, and the furniture consists of only a few rude appliances.

In this exhibition are shown a tent in process of construction, a finished tent, and a temporary shelter. Men and women are engaged in the various industrial activities of the tribe—dressing hides, curing meat, and erecting the tent.

This group forms one of a series designed to set forth the dwelling and home life of native tribes in the Western Hemisphere.

EXHIBITS ILLUSTRATING LEADING ARTS AND INDUSTRIES OF THE NATIVE AMERICANS.[a]

Thirteen series of exhibits illustrating native handicraft were presented, each with as much elaboration as the subject and the space would permit. They represent those activities that seem best qualified to convey an idea of the culture status of the American race. Each series of products is made to cover the full range of native achievement in the branch illustrated.

The exhibits include the following subjects:

1. Fire-making apparatus.
2. Bows and arrows.
3. Throwing sticks.
4. Harpoons.
5. Water craft.
6. Basketry.
7. Woven fabrics.
8. Pottery.
9. Sculpture.
10. Personal ornaments.
11. Tobacco pipes.
12. Musical instruments.
13. Pictography and writing.

[a] The majority of these exhibits were arranged under the direct supervision of Prof. Otis T. Mason.

The first of these exhibits (Plate 47) illustrates the important art of fire making. The fire drill was in almost universal use. It consists essentially of two parts, the vertical drill of hard wood and the horizontal socket piece of soft, dry wood. The drill is rotated by the hands, by a strap, or with a bow. The fire is produced by the friction of the drill in the socket piece, the wood dust in which the fire arises falling out of a notch in the side of the socket and igniting. With a reasonable amount of experience fire may be made by almost anyone using the specimens shown in this series.

The second exhibit (Plate 48) shows the chief types of bows and arrows for the several culture regions of the American continent, beginning with the Arctic province at the north and ending with the Fuegian at the Straits of Magellan. The eastern Eskimo, on account of the poverty of material, make a compound bow of whale's rib, formerly lashed together with sinew, but now riveted and wrapped. The western Eskimo bow is backed with sinew, and in many examples is indistinguishable in shape from the Tartar bow on the Asiatic side. Sinew backing continues down the Pacific side of the continent to the Pueblo region, where the material is shredded and mixed with glue. Over all other parts of America the bow is a simple piece of wood in various forms, according to locality.

The arrow furnishes one of the best bases for classifying peoples, its feathering, shaft, and head being subject to modifications of material, size, number of parts, and shape of parts in endless variety.

The third exhibit (Plate 49) shows the distribution of the projectile apparatus called "atlatl" by the ancient Mexicans, and throwing stick, or dart thrower, in ethnological literature. The apparatus consists of a shaft of wood, either a round stick or a flat board, with a groove on top. At the manual end or base may be seen one or more pegs, notches, or perforations designed to receive the thumb or one or more fingers of the right hand. At the working or outer end is a hook of some kind to fit into a hollow at the end of the harpoon, dart, or other projectile. The throwing stick is universal among the Eskimo; occurs also on the north Pacific coast, and here and there among the tribes southward; in the Pueblo country; in Sonora, in Mexico; in great numbers throughout southern Mexico and Central America; in southern Florida; along the Cordilleras to the borders of Peru; at various places on the Amazon, and in the Mato Grosso. Here for the first time a series of these interesting projectile devices are brought together and exhibited in geographic order.

The fourth exhibit (Plate 50) sets forth the different forms of harpoons throughout the Western Hemisphere. It is the universal hunting device among the maritime aborigines, being found all the way from the farthest north to the Straits of Magellan. A harpoon is a spear with a movable head attached to the shaft by a line, for the

purpose of retrieving the game. There are two varieties, the barbed and the toggle harpoon. The barbed harpoon is simply the head of a barbed spear, having a short line attaching it to the front end of the shaft. It is impelled from the hand, from a bow, or from a throwing stick. The toggle harpoon has its head hinged on the end of a thong, and when it is driven into an animal turns and forms a T-shaped attachment, as on the end of a trace chain. The simplest form of the harpoon is found at the Straits of Magellan, and for this reason the series begins with the most southern example and proceeds northward to the Arctic region, where the Eskimo, assisted by the fishermen and the whalers of the world, have perfected the toggle variety. The harpoon is used almost entirely in hunting animals by water, although there are harpoon arrows, used for birds. This will be plain when it is remembered that all harpoons are made for the purpose of securing the game after it is struck. When an animal is lanced on the land the hunter has an opportunity of following up his effort, but in the water the whale, walrus, seal, fish, otter, or turtle usually disappears, and the float, shaft, bladder, or some such light attachment enables the hunter not only to secure his game, but to recover the precious head of his weapon.

The fifth exhibit (Plate 51) consists of boat models and shows the remarkable connection between environment, materials, and inventions in navigation. Beginning with the Arctic shores, the Eskimo rides in a skin-covered kaiak and carries freight in a skin-covered scow, or women's boat. All over Canada and northern United States the riding boat and freight boat are made of a light framework covered with birch bark. It was possible in one of these, by paddling and by carrying across portages, to pass into any tributary of the Yukon, Mackenzie, and St. Lawrence rivers—the longest inland journey by water possible in the world. One could even cross the watershed between the Great Lakes and the Mississippi, and pass on to New Orleans. In eastern United States only poor dugouts were known. On the Missouri River a crate of sticks was covered with hide of the buffalo, and called a bull boat. On the Pacific coast of North America canoes capable of making sea voyages of 500 miles were dug out from the stem of a single tree. The same is true of the Caribbean area, where the Caribs, in similar craft, visited every land around the borders of that sheet of water. On the shores of Brazil fishing parties went out of sight of the land in sangadas of light logs, which were fitted with sails. Floats of reed were known in the southern States of the Union and on the west coast all the way from middle California to southern Peru. In central Brazil a "wood skin," cut from the bark of a tree in a few minutes, was a common means of transportation, and the Fuegians made seaworthy craft by sewing three pieces of bark together, one forming the bottom and the other two the sides.

The parts were sewed with baleen and made water-tight by means of gum.

It is the design of the sixth exhibit to show the types of basketry for the whole American continent. The series begins in the upper left-hand corner of the case with the coiled basket of the Eskimo; then follow Tinné basketry, from interior Alaska; bark work, from Canada; cane work, from the Gulf States; twined work, from southeastern Alaska; checker, diagonal, twined, and coiled work, from the Pacific States of the Union; coiled and diagonal work, from Mexico; wicker work, from Central America; diagonal work, from Guiana; and coiled work, from Magellan Straits. The species of plants used, and the annual rainfall, which determines the toughness and pliability of the material, govern largely the technic and the quality of basketry in the several culture regions.

Exhibit No. 7 (Plate 52) is designed to show the chief types of textile fabrics in various culture regions of the two Americas. The general term weaving is sometimes applied also to basketry and matting, but here the material is first made into yarn or twine by primitive modes of spinning, either in the fingers, on the thigh, or with a spindle. The frames on which the weaving was done range in complexity from a mere bar or yarn beam, over which the warp was hung, to a rude loom in which harness was employed to shift the warp. There were also battens with which to force home the weft. In the Central American and Peruvian weaving an additional shifting of warp was effected by simple mechanical devices. The llama furnished one of the finest staples in the world, and the delicate spindles found in ancient graves of Peruvian women show that the art of working in the wool of this animal had been highly developed.

The specimens shown in group 8 (Plate 53) are type forms of the pottery of the aborigines. This art flourished among the more cultured, sedentary tribes and was unknown, or but crudely practiced, in the far north and south, and where nomadic life was the rule. The mound-building people of the Mississippi Valley, and various tribes in the southern States farther east, were skilful potters, fashioning varied and artistic forms and excelling in the simpler modes of decoration. The Pueblo peoples of the arid Southwest were, and still are, expert potters, but the art was carried to its highest stage by the more cultured nations of Mexico, Central and South America. Pottery was manufactured mainly for domestic uses, but ceremonial purposes were also subserved. The strong native love of symbolism led to most varied and elaborate utilization of life forms, both in modeling and in surface decoration. The wheel as a means of throwing forms was unknown, and the art of glazing had not been discovered.

The ninth exhibit (Plate 54) shows in brief how far the aboriginal tribes of the Western Hemisphere had progressed in sculpture, or

the representation of natural forms in stone, wood, bone, etc., in the round or in relief. In the extreme North, beyond the limit of tree growth, drift-wood and walrus ivory were and are the materials used. On the north Pacific coast horn, slate, and wood are utilized to excellent advantage, but in other regions the art is not extensively practiced at the present time. Formerly many of the American tribes excelled in carving, especially in stone, which material was shaped to represent man, animals, and fanciful creatures in endless variety. The inspiration for this work was furnished by the religious symbolism of the people. Statuary as a purely aesthetic art was unknown to the aborigines, and they had not advanced to the stage where accurate portraiture was appreciated.

Shaping implements were made of stone, copper, bone, wood, etc. The hammer stone served for breaking, flaking, and pecking, the saw for dividing, the drill for boring, the grinding stone for shaping and smoothing, and the knife and chisel for cutting.

The tenth exhibit (Plate 55) shows how, throughout the entire American continent, adornment of the person gathers its materials from the most beautiful and durable of the native products. The necklace is worn always for jewelry, and is made up of those objects which are considered precious in their several localities. In the Arctic province it is ivory, bone, and wood; on the Pacific coast, dentalium, abalone, and other shells; in the interior basin, the seeds of plants; in the tropical regions, teeth of animals, wings of insects, feathers of birds; and in the Straits of Magellan, where the Fuegian tribes can scarcely be said to wear clothing, they gather the pretty little shells from the beach and string them on thongs of sinew for the adornment of the person. In the codices and sculptures of the more cultivated races this same passion for adorning the neck and breast is exhibited, but with them stone of rare colors and varieties, and copper, silver, and gold were in favor.

In the eleventh series (Plate 56) is assembled a collection of apparatus illustrating smoking and snuffing customs of the aborigines of America. Instead of being counted luxuries, the customs connected with these practices were associated with their civil, military, and religious life. In aboriginal times these practices were not universal throughout the Western Hemisphere; they were more in vogue in North and Central America than in South America. The western Eskimo pipes show Asiatic influence. Mackenzie says that the Athapascan tribes did not know the use of tobacco; but the forms of pipes found in various regions of North America are so highly specialized and so intimately associated with other classes of antiquities, assuredly pre-Columbian, that we must conclude that the tobacco pipe was of native origin. Stone was a favorite material for its manufacture,

but wood, bone, and pottery were in common use. The exhibit will convey a good idea of the range of form and material, and of the geographical distribution.

In a limited manner the specimens in the twelfth group (Plate 57) illustrate the attempts of the aboriginal Americans to record their thoughts in symbols. Save in the making of calendars the art of expressing concrete thoughts in syllabic or phonetic symbols had not been reached anywhere, even among the barbaric tribes of Mexico, Central America, and Peru. Writing was by means of pictures, parts of pictures, and rebuses. The Eskimo etched long prompters for stories on ivory, the forest tribes carved them on wood or scratched them on bark, the Plains Indians painted them on robes, while the Mexicans and Mayans sculptured them in stone or painted them on codices of native paper. The originals of the writings, called codices, were painted on cotton cloth, skins, or paper made from the maguey plant, by native artists, long before the conquest by Spain. They contain histories, genealogical tables, tribute rolls, land titles, laws, calendars, and minute instructions concerning matters of religion. Hundreds of them were ruthlessly destroyed by the Spaniards, but a few were preserved and are now kept with strictest care in the great libraries of Europe. By the munificence of His Excellency, Duke de Loubat, copies of existing specimens are being made in the highest style of modern reproduction, so that scholars may have the opportunity of studying them. In this exhibit will be seen facsimilies of the Codex Vaticanus, 3773, and the Codex de Rios, now in the Vatican Library; Codex Cospianus, library of the University of Bologna; and Codex Borbonicus, in the Palais Bourbon, Paris.

The thirteenth exhibit is designed to show the distribution of time-marking musical devices among the aboriginal Americans. There was entire absence of attempts at harmonics among the native tribes of the Western Hemisphere. Their melodic scale has not been determined. No mention of stringed musical instruments is found in any early writer, and all such found in the hands of Indians now are of foreign patterns. The whistle, the flageolet, and the simple conch-shell horn were in vogue in many places, but the universal musical instrument was for rhythm alone, in the form of the drum or the rattle. The Eskimo made his time-marking instrument of skin, the West Coast tribes of wood, the Indians of the plains of hoofs of animals, the Pueblo Indians of gourds, the coast tribes of shells, those of British Columbia of wood and basketry. In each region the time-keeper found some natural object ready at hand to do him service.

EXHIBITS REPRESENTING THE ART COLLECTIONS.

Distinct from the above groups of ethnological material are two series of exhibits representing the art collections of the Smithsonian

Institution and installed with the special exhibit of the Institution. They are (1) engravings of twenty-four masterpieces of portraiture; and (2) reproductions of twenty-four masterpieces of landscape and figure painting.

In addition to the exhibits displayed in the systematic series along with the other National Museum exhibits in the Government building, the following exhibits were prepared for other departments of the Exposition and lent to them during the continuance of the fair:

1. Series of trephined skulls from Peru, lent to the Division of Ethnology and Archæology of the Exposition.

2. Ten plaster busts of American Indians and Eskimo, lent to the Division of Ethnology and Archæology of the Exposition.

3. Series of casts of type forms of Indian stone implements, lent to the Division of Ethnology and Archæology of the Exposition.

4. Two lay figures of Sioux Indians, lent to the Indian Office Exhibit, Interior Department.

5. Lay figure of a Filipino girl, weaving at a loom, lent to the Government Commission of the Exposition and installed in the Philippine exhibit, Government Building.

It is not assumed that the exhibits described in the preceding pages are completed. They are merely such as could be assembled, on the plan adopted, within the six months allowed for the work. Many changes and additions will be made when they are finally set up in the National Museum. The lay figure groups will be enlarged to a uniform size, a series of casts illustrating physical types of the people will be added, pictures will aid in completing the exhibit, and several new series of objects will serve to widen the field covered.

It is confidently expected that the completed exhibit will come more nearly bringing within reach of the average person a full conception of the native American race and its culture than any assemblage of museum material yet made.

Credit is due to a number of collaborators in the preparation of this exhibit, to Prof. O. T. Mason, curator of ethnology, for his energy in selecting and arranging the ethnological material and in the preparation of the series of labels, embodied largely in the present text; and to Dr. Walter Hough, assistant ethnologist; to T. W. Sweeny for competent service in arranging and mounting the several series of artifacts; to C. R. Luscombe, modeler of the dwelling groups; to Frank Lemon, H. J. Ellicott, and U. S. J. Dunbar, sculptors, for skilful work in modeling the life-size figures; to Mrs. Kate C. Holmes for lifelike coloration of the figures; to H. W. Hendley and C. E. Johnson, builders of the lay figures, and especially to Mr. Hendley for valued aid in setting up the groups.

I was fortunate in securing a set of views of the lay figure groups and of nearly all the other exhibits. The work was done by two of

our foremost photographers, Mr. T. W. Smillie, photographer of the Smithsonian Institution and National Museum, and Miss Frances B. Johnston, an artist of international reputation. The difficulties in the case were very great. The exhibits were installed in the darkest section of the Government building, and owing to the interference of timbers and drapery were very unevenly lighted. The glass fronts of the cases were so inserted that they could not be removed, and the reflections proved extremely troublesome. Selecting a Sunday morning for the work, we avoided the crowds that filled the building during the week days. Two sheets of dark cloth were secured, each about 14 feet square, and while one of these was tacked over the back of the case as a background for the group, the other, held by two men on step-ladders behind the camera, served to prevent reflections in the glass. The woodwork of the cases interfered somewhat with the view in several cases, but by painting out and retouching the parts have been restored, and a reasonably uniform result has been secured.

It may be noted that at the time of the handing in of this paper the exhibit is on view, about one-half in the Charleston Exposition and the remainder in the halls of the National Museum.

THE EXHIBIT MADE BY THE DEPARTMENT OF GEOLOGY.

By George P. Merrill,
Head Curator.

The exhibit made by the Department of Geology at Buffalo was directly in line with that in the Museum at Washington, differing only in that special series were selected which seemed best suited to the purpose, when the place, time, character of the Exposition, and limited amount of space (1,520 sq. ft.) were taken into consideration. (See Plates 58 and 59.)

The work of preparation was begun early in the year and continued until the installation was completed at Buffalo on May 1. While by no means the entire force of the Department was thus occupied, nevertheless, the matter was always uppermost and interfered seriously with the ordinary routine work of the Museum.

An attempt was made to procure for the Exposition a fairly complete skeleton of a mastodon, and Messrs. Lucas and Stewart made several excursions for the purpose of investigating reported finds of such remains; but the results were in all cases unsatisfactory. As will be noted later, however, a small series of more or less fragmentary material was obtained.

Through a joint arrangement with the United States Geological Survey, sufficient funds were obtained for a model of a skeleton of *Triceratops prorsus*, the work of preparation of which occupied one preparator

and one or more modelers, besides the attention of the curator of the section, for a large part of the time until the final installation at Buffalo.

The details of the exhibits of the various divisions are given below. No exhibit was made by the section of paleobotany.

I.—DIVISION OF GEOLOGY.

The exhibit for the Division of Geology proper comprised five wall and one special case, four of the wall cases being occupied by cave, hot-spring, and geyser deposits, concretions, and silicified woods. One case was set aside for an exhibit of the rocks of the Hawaiian Islands, the recent annexation of which rendered a special exhibit at this time appropriate. The following transcript of the label which accompanied this last collection is sufficiently descriptive for present purposes:

ROCKS FROM THE HAWAIIAN ISLANDS.

The Hawaiian Islands are eight in number, lying near the north tropic between the parallels of latitude 19° and 22½°. They are of volcanic origin, but volcanic activity has ceased on all except the island of Hawaii, the largest and most southern of the group. The rocks of the islands are therefore all of an igneous nature, with the exception of the limestones of the coral reefs which were formed along the shores. The collection here shown consists of a series of specimens collected mainly from the islands Oahu and Hawaii by members of the Wilkes Exploring Expedition in 1840, by A. B. Lyons in 1892, and Prof. C. H. Hitchcock in 1899. It is intended to show the characteristic forms of the lavas and the ordinary rock types, as well as the soils resulting from their decomposition.

Perhaps the most unique exhibit pertaining to this division was a collection of such of the elements, exclusive of the gaseous forms, as are found in an uncombined or free state in nature. The transcript of the general label for this exhibit is given below:

THE NATIVE ELEMENTS.

Of the seventy-two known elements, there are, with the exception of certain gaseous forms, but sixteen which have thus far been found in the earth's crust in a native or uncombined state. These sixteen are as follows:

1. Carbon.	9. Silver.
2. Sulphur.	10. Copper.
3. Selenium.	11. Lead.
4. Tellurium.	12. Mercury.
5. Arsenic.	13. Platinum.
6. Antimony.	14. Iridium } Iridosmine.
7. Bismuth.	15. Osmium }
8. Gold.	16. Iron.

So far as possible these are shown in the accompanying collection. Iridium and osmium are shown only in the form of the natural alloy iridosmine, and selenium as selen-sulphur. Lead occurs native in but minute quantities. Palladium has been reported native, but is extremely rare.

The most striking of the objects here brought together were a small but very perfect octahedral crystal of a diamond from South Africa; a fine large mass of native arsenic from the Hartz Mountains, Germany; a like mass of antimony from New Brunswick; beautiful examples of wire and moss gold from California; branching crystals of silver and copper from the Lake Superior mines; thin films of native lead from Sweden; tellurium from Nevada; iridosmine from the Pacific coast of Oregon; native iron from Greenland, and a fine water-worn nugget of platinum weighing 444 grams from the Nijni Tagilsk district, Russia.

There was also a case of striking concretionary forms, including examples of the so-called "kugel" or orbicular granites from Sweden, Finland, and Rhode Island, and of the septarian concretions of clay ironstone from Weymouth, England; New York; Kansas, and other localities. Examples of the individual specimens are shown on Plates 60 and 61.

II.—DIVISION OF MINERALOGY.

The exhibit of the Division of Mineralogy was arranged with the following objects in view: To make as attractive a display as possible with the material and space available; to illustrate methods of arrangement and installation used by the division; to be self-explanatory and complete in itself. In the carrying out of this a systematic arrangement of minerals was planned which should show specimens of the more important minerals and their arrangement in accordance with the general scheme of classification, as outlined in the label, a transcript of which is given below:

A SYSTEMATIC ARRANGEMENT OF MINERALS.

The chemical composition of the mineral determines its position in the several classes. These classes, which are arranged in accordance with certain chemical laws having the periodic arrangement of the elements as a basis, are made up of those minerals having the same dominant negative chemical radical from which the class name is derived, as sulphide, silicate, etc. The whole is divided into two general groups—native elements and compounds of the elements. The compounds of the elements are further divided and grouped under certain classes according to, and which take their names from, their more negative constituents, as follows: Compounds of the halogens, fluorides, chlorides, bromides, and iodides. Compounds of sulphur, selenium, and tellurium; also arsenic and antimony, including sulphides, selenides, and tellurides; arsenides, antimonides, sulpharsenides, and sulphantimonides; also sulphosalts. Oxygen compounds, including oxides and the oxygen salts, borates, aluminates, chromites, ferrites, manganites, plumbates, arsenites and antimonites, selenites and tellurites, carbonates, silicates, titanates, columbates and tantalates, nitrates, vanadates, phosphates, arsenates and antimonates, sulphates, selenates and tellurates, chromates, molybdates and tungstates, iodates, and uranates. Compounds of organic origin, including salts of organic acids and carbon compounds.

Each of these classes was preceded by a general label giving a short statement of its more important chemical characters, as illustrated by the following example:

CLASS—SILICATES.

The silicates, derivatives of the several silicic acids H_4SiO_4, H_2SiO_3, $H_6Si_2O_7$, $H_2Si_2O_5$, and $H_4Si_3O_8$, or compounds of silicon oxide with other oxides, constitute about nine-tenths of the known crust of the earth and more than one-fourth of the known kinds of minerals. Isomorphic combinations are the rule, and the class exhibits great diversity of composition. For example, the ratio of oxygen in silica to that in combined oxide may vary for monad and dyad elements, such as potassium or calcium, between 2:4 and 4:1; and for silicates of triad elements, such as aluminum or iron, between 2:6 and 12:3. Again, it is not unusual to find a silicate containing both potassium and calcium, or the oxides of iron and aluminum, or of calcium and aluminum, and that not necessarily in atomic proportion. But although certain oxides are capable of mutual replacement in any and all proportions, such as the sesquioxide of iron or aluminum, or the monoxide of calcium, magnesium, iron, manganese, sodium, or lithium; and though a silicate may contain at once a mixture of sesquioxides and monoxides in combination with silica, the place of a monoxide is not taken by a sesquioxide, nor that of a sesquioxide by a monoxide.

Following the class label, arranged in order from left to right, were placed the several members of the class, selected to illustrate as completely as possible their occurrences, associations, and variety in form and color. Each specimen was mounted on a block and accompanied by a small label giving the name of the mineral, its associations, if any, and its locality.

Conspicuous among the several classes were the fluorides, carbonates, silicates, and chromates, the individuals comprising them being especially notable for their beauty and vivid coloring. Among the fluorides were shown a magnificent series of German, English, and American fluors having an extensive color range, including white, yellow, green, violet, sky, and amethystine blue, rose red, and lilac. Among the carbonates were the minerals malachite and azurite, the former bright green in color, the latter a fine Berlin blue. In addition a botryoidal mass of these two minerals was shown in which the malachite and azurite are in alternate concentric layers, giving rise to a strong and pleasing contrast of color.

The display feature was well developed in the class silicates where the green of microcline was contrasted with the rich blue of sodalite. Among the tourmalines was shown the cross section of a crystal red internally, passing into a lighter hue, and finally green; there was also a fine mass of California rubellite of a delicate pink color on a groundmass of lilac-colored lepidolite. Play of color was well illustrated by a fine cleavage mass of labradorite from Isle of Paul, in which blue and green predominate.

The series as a whole comprised some 500 specimens and 47 group labels installed in 4 slope-top cases, as shown in Plates 58 and 59.

III.—DIVISION OF STRATIGRAPHIC PALEONTOLOGY.

A. Section of Invertebrate Fossils.

The exhibit of the section of invertebrate fossils formed two series comprising the more interesting crinoids and cephalopods, the first being illustrated by 94 and the second by 156 genera. The object of the collections was to illustrate by specimens and descriptive labels the anatomy and generic characters of the hard parts of these animals as known to paleontologists, and incidentally to illustrate the methods of installation practiced in this section.

Each series began with an introductory label defining the essential characters of each class of organisms. As many technical words were involved in the description, a second series of labels was prepared, in which the terms were defined and which were accompanied by specimens on which the parts referred to were artificially colored. As it may be desirable to build up similar series for other exhibits, sometime in the future, the transcript of the introductory and explanatory labels is given below. Plates 62–69 show the character of the material comprised in the crinoid series.

This exhibit was comprised in the five screen cases indistinctly shown at the left in Plate 58.

INTRODUCTORY LABEL.

CLASS CRINOIDEA.

Crinoids, or sea lilies or stone lilies, are marine animals related to the starfishes, and like them have in the outer integument a skeleton of calcareous ossicles. A normal crinoid consists of a *crown* attached by its dorsal or aboral extremity to a *stem*, which is fixed to the sea floor or to some solid body by a *root*. They are gregarious, locally restricted, animals, have existed since Cambrian time, and live in the seas, ranging from shallow water down to about 3 miles beneath the ocean surface. In Paleozoic time they had greatest development, and their separated ossicles occasionally form beds of limestone of considerable thickness. In the Carboniferous rocks of the Mississippi Valley crinoids are often well preserved and good crowns are not rare. More than 300 species are known from the vicinity of Burlington, Iowa.

The crinoids, from a phylogenetic standpoint, are divided into the subclasses Monocyclica and Dicyclica, and these divisions are again separated into six orders, five suborders, and two grades, all of which are here illustrated by specimens. Of recognized genera there are upward of 240.

SPECIAL EXPLANATORY LABELS.

THE CROWN.

(See Plate 62.)

The crown consists of the *dorsal cup* or shortly *cup* (colored blue), the *tegmen*, sometimes called disk or vault (red), and the *brachia* or arms (yellow), which are generally provided with *pinnules* (black), and often there is an *anal tube* (brown).

24185. Platycrinus hemisphericus. Lower Carbonic.

24191. Cyathocrinus multibrachiatus. Lower Carbonic.

24163. Batocrinus wachsmuthi. Lower Carbonic. The brachia are removed to show the tegmen and anal tube.

THE DORSAL CUP.

(See Plate 63.)

The dorsal cup in its simplest form is composed of two or three circlets of five plates, those in one circlet alternating with the five in the adjacent circlet. Of these the most important are those that support the brachia, and to them the term *radials* is restricted (colored blue). The interradial plates below these are the *basals* (colored red), so called because in many crinoids they form the base of the cup and rest on the stem. Such crinoids are called *monocyclic*. In other crinoids a circlet of *infrabasals* occurs beneath the basals (colored yellow), and these, therefore, are known as *dicyclic*.

Primarily there are five plates in each circlet; but owing to the fusion of two or more of the proximal plates the number of basals in monocyclic forms may be reduced to four, three, or even two, and the infrabasals in dicyclic crinoids to three.

The cup often has, in addition to the plates above described, supplementary plates known as "*anals*" and "*interbrachials*," which assist in enlarging the cup.

776. Batocrinus longirostris. Lower Carbonic. The cup plates not colored are the *interbrachials*.
7519. Platycrinus planus. Lower Carbonic.
24191. Cyathocrinus multibrachiatus. Lower Carbonic.

THE TEGMEN.

(See Plate 64.)

The tegmen in its simplest form is composed of five plates called *deltoids* or *orals* (colored red). There are nearly always present also *ambulacrals* (colored blue) covering the food grooves or ambulacra that lead from the brachia to the mouth. In many Paleozoic genera the ambulacral plates are covered by the *interradial dome plates* (colored yellow). When the dorsal cup is enlarged by other plates than those of a simple crinoid, the tegmen also introduces supplementary plates known as *interambulacrals* (black). Finally the tegmen may be in the form of a coriaceous skin, in which large numbers of thin calcareous ossicles are embedded.

The mouth is nearly always covered by the deltoids or the dome plates, while the *anus*, which is closed by a *valvular pyramid*, is often surrounded by or raised on small plates (colored brown).

24,185. Platycrinus hemisphericus. Lower Carbonic.
768. Dorycrinus unicornis. Lower Carbonic. The anal pyramid is not preserved.
775. Batocrinus elegans. Lower Carbonic. The anal tube is broken away.
24,413. Strotocrinus regalis. Lower Carbonic. A natural cast of the interior surface of the tegmen showing the ambulacral grooves.

THE BRACHIA AND PINNULES.

(See Plate 65.)

The brachia or arms in their simplest form consist of a series of ossicles called *brachials* (colored blue), which continue straight up from the *radials* (colored red). The brachials may be in single or alternating double rows, and hence are spoken of as *uniserial* or *biserial*. The inner surface of the brachia are grooved for the transmission of food-laden water to the mouth and for the soft parts; and these are protected by covering plates called *ambulacrals* (yellow), which can open or close as occasion demands.

The brachia are rarely single, usually bifurcating in a regular or irregular manner at definite points. The *pinnule* (colored black) is a brachium in miniature; it differs in nothing but position from the small end branches of a simple dichotomous arm. However, when the pinnules are regularly placed on alternate sides of successive brachials of the main branch the arm is said to be *pinnulate*. To these pinnules are restricted the fertile portions of the genital rachis.

24,193. Scytalocrinus robustus. Lower Carbonic. Brachia pinnulate with regular bifurcations. Brachials in single columns.

34,087. Platycrinus agassizi. Lower Carbonic. Brachia pinnulate with regular bifurcations. Brachials in double, alternating columns.

24,191. Cyathocrinus multibrachiatus. Lower Carbonic. Brachia dichotomous, without pinnules.

24,155. Baryerinus hercules. Lower Carbonic. Pinnulate brachia showing the ambulacral groove and ambulacral plates.

THE ANAL AREA.

(See Plate 66.)

In most crinoids there is inserted in an interradius one or more extra pieces called *anal plates* (colored red). The *anal tube* when present (colored blue) is supported by the anal plates. The *anal opening* (colored brown) may be in the side or at the apex of the tube.

26,771. Cactocrinus ornatissimus. Lower Carbonic. Showing the anal tube between the brachia.

24,192. Scaphiocrinus unicus. Lower Carbonic. Showing the anal tube with the anal opening in the side.

24,193. Scytalocrinus robustus. Lower Carbonic.

27,868. Æsiocrinus magnificus. Upper Carbonic. The brachia have been removed.

ENLARGEMENT OF THE SIMPLE DORSAL CUP.

(See Plate 63.)

The dorsal cup may be enlarged by the addition of *proximal brachials* (here colored blue) or by the insertion of a variable number of extra plates between the brachials. The latter are called *interbrachials* (colored red).

24,156. Taxocrinus multibrachiatus. Lower Carbonic.

24,163. Batocrinus wachsmuthi. Lower Carbonic.

THE STEM.

(See Plate 67.)

The flexible *stem* is composed of *stem ossicles*, which vary not only greatly in number in different crinoids, but often also in form in different parts of the same stem. It has a more or less large axial canal which serves to transmit vascular and nervous prolongations, and in the earlier forms may have served other purposes. The larger segments are called *nodal ossicles* (blue), and may bear *cirri* (red) at regular or irregular intervals throughout the whole length of the stem.

In some forms the stem is almost absent, the cup then cementing to solid objects. In Pentacrinus the stem attains a length of 18 feet. In rare cases the stem has no roots, but attaches by the cirri or by winding the stem around the object of attachment. In others it ends in a four-fluked grapnel or in a bulb; finally, there are

forms without stems or anchoring structures. The latter are adapted to free locomotion either by swimming or by crawling about by the brachia.

24,887. Ordovician stems and stem ossicles. St. Paul, Minn.

15,518. Stem of Glyptocrinus. Winding around foreign object. Upper Ordovician.

34,091. Upper Silurian stem and stem ossicles. Dayton, Ohio.

26,468. Myrtillocrinus bulbosus. Middle Devonian. Stem ending in a four-fluked grapnel.

34,086. Stem and ossicles of Platycrinus. Lower Carbonic. The spiral twist of the flattened stem enables the animal to turn in any direction.

34,092. Stem with cirri. Lower Carbonic.

ROOTS.

(See Plate 68.)

The roots are distal branches of the stem, and, like it, are usually made up of perforated ossicles. In some forms the stem terminates in a disk-shaped or encrusting nonsegmented root.

34,089. Anomalocrinus incurvus. Growing upon a monticuliporoid bryozoan. Upper Ordovician.

34,093. Root of Ectenocrinus(?). Upper Ordovician.

10,425. Eucalyptocrinus crassus. Upper Silurian.

34,088. Poteriocrinus spartarius. Lower Carbonic.

INJURIES.

Crinoids are found which during life had lost a considerable portion of the brachia. Such lost parts may be subsequently regrown and pass through the same growth stages as the adult.

The stems when fractured repair the broken place by profuse calcareous deposit, as shown by the annexed specimens.

CRINOID PARASITES.

(See Plate 69.)

Gastropods of the genera Cyclonema and Platyceras are found situated over the anal region of many crinoids. In the Silurian and Devonian such occurrences are rare and there do not appear to have been permanent parasites. In the Lower Carboniferous, however, the form of the shell is considerably modified and perfectly molded to the crinoid, proving that the Platyceras spent its life where found. Its sustenance, therefore, must have been largely the effete matter of the crinoid.

15,513. Glyptocrinus decadactylus. The parasite is Cyclonema bilix. Upper Ordovician.

26,465. Arthracantha punctobrachiata. The parasite is Platyceras dumosum rarispinum? Middle Devonian.

24,185. Platycrinus hemisphericus. Lower Carbonic. The parasite is Platyceras uncum.

CRINOIDAL LIMESTONE.

Limestones are found, many feet in thickness, almost entirely made up of the disjointed skeletal parts of crinoids. Such limestones are usually of local occurrence, but in the region of Iowa and Missouri the Burlington crinoid limestone extends for more than 300 miles. This is the most extensive crinoid bed, having furnished between 300 and 400 species and many thousands of individuals.

15518. Upper Ordovician crinoidal limestone, from Madison, Ind.

34094. Lower Carbonic crinoidal limestone, from Burlington, Iowa.

Following the crinoids were shown the fossil cephalopods, with special reference to the ammonites. Here the testaceous anatomy is not so complicated as in the crinoids and requires fewer descriptive labels in the introductory series.

INTRODUCTORY LABEL.

CLASS CEPHALOPODA.

The pearly nautilus, squid, and cuttlefish are three types of living Cephalopods. These animals are restricted to marine waters, and are the most highly organized class of the Mollusca, a division of the animal kingdom, including, besides the Cephalopoda, the bivalve (clams, oysters), and univalve (drills, snails) shells.

The forms here shown are those having external chambered shells. They abounded in Paleozoic and Mesozoic seas. In the Tertiary seas the shelled Cephalopoda are restricted to a few forms very much like the living pearly nautilus of the Pacific Ocean. (See complete animal in jar, with alcohol.) The shell may be straight, curved, or coiled, and is divided at regular intervals by *septa*. The chambers thus formed are connected with the animal by a tube or *siphо*.

The shelled Cephalopods are divided into two orders, *Nautiloidea* and *Ammonoidea*. In the former the *sutures* (lines of junction of the *septa* with the outer shell) are usually straight or merely undulated, while in the latter they are more or less abundantly lobed and inflected, the greatest complexity having been attained during Mesozoic time. Of Nautiloids about 2,500 species are known, and of Ammonoids not less than 5,000. The latter died out during Mesozoic time. Some straight Nautiloidea grew to a length of more than 15 feet, while certain coiled Ammonoids have attained a diameter of 5 feet.

The classification here adopted is that of Hyatt, as published in Text Book of Paleontology, by Zittel and Eastman.

SPECIAL EXPLANATORY LABEL.

NAUTILUS POMPILIUS LINNÆUS.

(Shell with animal.)

South Seas, Pacific.

(*c*) *Hood*, serving to close the aperture of the shell when the animal is withdrawn into the living chamber.

(*d*) *Hyponome*, serving to conduct water by suction into the gill cavity of the mantel, from which it is then violently expelled, the reaction driving the creature backward.

(*t*) *Tentacles*, of which there are about ninety.

SEPTA AND SIPHO.

NAUTILUS MACROMPHALUS Sowerby.

New Caledonian sea.

The animal is removed and the shell sectioned to show the various parts, with the technical names applied directly to each part.

JAWS OF A NAUTILOID.

TEMNOCHEILUS BIDORSATUS Schlotheim.

(Conchorhynchus avirostris.)

TRIASSIC (MUSCHELKALK).

Wurzburg, Bavaria, Germany. 29104.

SUTURE.

CERATITES NODOSUS de Haan.

TRIASSIC.

Goettingen, Germany. 4463.

A simple Ammonoid with the shell removed to show the suture line (colored red).

DEVELOPMENT OF THE NAUTILOIDEA.

(After Branco.)

Primordial chamber of Orthoceras from the Triassic of St. Cassian. Enlarged 18 diameters.

DEVELOPMENT OF THE NAUTILOIDEA.

(After Branco.)

1. Primordial, second, and third chambers of *Nautilus pompilius*. Enlarged 18 diameters.

2. Section of same to show the beginning of the *sipho*. Enlarged 25 diameters.

DEVELOPMENT OF THE AMMONOIDEA.

(After Branco.)

1. Primordial chamber of a goniatite (*Mimoceras compressus*), enlarged 60 diameters.

2. Primordial chamber and first volution of same, enlarged 60 diameters.

DEVELOPMENT OF THE AMMONOIDEA.

(After Branco.)

1. Primordial chamber of a latisellate Ammonoid (*Arcestes cymbiformis*), greatly enlarged. The term *latisellate* has reference to the suture (colored red) forming a decided broad *saddle* on the venter.

2. First volution of a latisellate Ammonoid.

DEVELOPMENT OF THE AMMONOIDEA.

(After Branco.)

1. Primordial chamber of an angustisellate Ammonoid (of the type of *Phylloceras heterophyllum*) enlarged 60 diameters.

2. Section through the primordial, second, and third chambers, to show the beginning of the *sipho* of an angustisellate Ammonoid. Enlarged 100 diameters.

DEVELOPMENT OF THE AMMONOIDEA.

(After Branco.)

1. Primordial chamber of an angustisellate Ammonoid (of the type of *Ceratites crassus*), enlarged 60 diameters. The term *angustisellate* has reference to the sutures (colored red) having prominent *ventral saddles*, with corresponding deep *lateral lobes*, and definite saddles at the umbilical depression.

2, 3. First and second volution of an angustisellate Ammonoid.

4. First three volutions, showing the introduction of sutural inflections and shell sculpture.

DEVELOPMENT OF THE AMMONOIDEA.

(After Branco.)

Section through the first and second volution of a latisellate Ammonoid (*Tropites*). It shows the beginning of the *sipho* in the cæcal condition in the primordial cham-

ber and its transition from the dorsal to the ventral side; also the transition from the *monochoanitic* (having only a funnel) to the later *choiochoanitic* (funnels lost, collars alone remaining) condition. Enlarged 60 diameters.

B. Section of Vertebrate Fossils.

The exhibit of the section of vertebrate fossils comprised a series of specimens representing the Mastodon, Mammoth, and Titanotherium, reproductions of the skeletons of Zeuglodon and Triceratops, and a very complete mounted skeleton of the Cretaceous diving bird *Hesperornis regalis*. This last is of special importance, not only as being the first skeleton of this representative of the toothed birds to be mounted and exhibited, but because it threw new light on the structure and attitude of the bird. In ordinary swimming birds the legs are directed downward, beneath the body, but the character of the articulations show that in Hesperornis the tarsi were directed outward at right angles to the body. A photograph of the skeleton as exhibited is shown in Plate 70.

The skeleton of Zeuglodon was modeled from material obtained by Mr. Charles Schuchert in Alabama. It comprised practically a complete vertebral column, many of the ribs, a good skull containing the complete dentition, and the major portions of the fore and hind limbs. This is a greater amount of material than is present in any other museum, and made it possible for the first time to obtain an accurate idea of the skeleton of this animal. It is shown suspended from the ceiling in the background of Plate 59.

The skeleton of Triceratops was a full-sized reproduction based on the material in the United States National Museum, which contains portions of fifteen specimens. These include the skull, limbs, lacking phalanges, pelvis, nearly complete vertebral column in advance of the sacrum, and several ribs. The greater part of the skeleton was thus present and restoration was limited to some of the ribs and the greater portion of the caudal vertebræ. The reproduction of the skeleton provided the first accurate representation of one of these huge dinosaurs ever placed on exhibition. It is regretted that no more satisfactory view of this interesting restoration could have been obtained than that furnished in Plates 58 and 59. This exhibit was accompanied by a small model, some 18 inches in length, and a painting by Mr. Charles Knight, showing the animal as it was supposed to appear in life. See Plates 71 and 72.

The exhibit for the Division of Geology, it should be stated, was prepared under the direct supervision of the head curator; that of the Division of Mineralogy by Mr. Wirt Tassin, assistant curator; that of the Section of Invertebrate Fossils by Mr. Charles Schuchert, assistant curator, and that of the Section of Vertebrate Paleontology by Mr. F. A. Lucas, curator of comparative anatomy in charge collection of vertebrate fossils.

APPENDIX.

[PUBLIC—No. 184.]

AN ACT to encourage the holding of a Pan-American Exposition on the Niagara frontier, within the county of Erie or Niagara, in the State of New York, in the year nineteen hundred and one.

Whereas it is desirable to encourage the holding of a Pan-American Exposition on the Niagara frontier, within the county of Erie or Niagara, in the State of New York, in the year nineteen hundred and one, to fittingly illustrate the marvelous development of the Western Hemisphere during the nineteenth century, by a display of the arts, industries, manufactures, and products of the soil, mines, and sea; and

Whereas the proposed Pan-American Exposition, being confined to the Western Hemisphere, and being held in the near vicinity of the great Niagara cataract, within a day's journey of which reside forty million people, would unquestionably be of vast benefit to the commercial interests, not only of this country, but of the entire hemisphere, and should therefore have the sanction of the Congress of the United States; and

Whereas satisfactory assurances have already been given by the diplomatic representatives of Canada, Mexico, the Central and South American Republics, and most of the States of the United States that these countries and States will make unique, interesting, and instructive exhibits peculiarly illustrative of their material progress during the century about to close; and

Whereas no exposition of a similar character as that proposed has ever been held in the great State of New York; and

Whereas the Pan-American Exposition Company has undertaken to hold such exposition, beginning on the first day of May, nineteen hundred and one, and closing on the first day of November, nineteen hundred and one: Therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That all articles that shall be imported from foreign countries for the sole purpose of exhibition at said exposition upon which there shall be a tariff or customs duty shall be admitted free of payment of duty, customs fees, or charges, under such regulation as the Secretary of the Treasury shall prescribe; but it shall be lawful at any time during the exposition to sell for delivery at the close thereof any goods or property imported for or actually on exhibition in the exposition buildings, or on the grounds, subject to such regulation for the security of the revenue and for the collection of import duties as the Secretary of the Treasury shall prescribe: *Provided*, That all such articles when sold or withdrawn for consumption in the United States shall be subject to the duty, if any, imposed upon such articles by the revenue laws in force at the date of importation, and all penalties prescribed by law shall be applied and enforced against the persons who may be guilty of any illegal sale or withdrawal: *And provided further*, That all necessary expenses incurred in carrying out the provisions of this section including salaries of customs officials in charge of imported articles, shall be paid to the Treasury of the United States by the Pan-American Exposition Company, under regulations to be prescribed by the Secretary of the Treasury.

SEC. 2. That there shall be exhibited at said exposition by the Government of the United States, from its Executive Departments, the Smithsonian Institution and

National Museum, the United States Commission of Fish and Fisheries, the Department of Labor, and the Bureau of the American Republics, such articles and material as illustrate the function and administrative faculty of the Government in time of peace, and its resources as a war power, and its relations to other American Republics, tending to demonstrate the nature of our institutions and their adaption to the wants of the people. And to secure a complete and harmonious arrangement of such Government exhibit, a board of management shall be created, to be charged with the selection, purchase, preparation, transportation, arrangement, safe-keeping, exhibition, and return of such articles and materials as the heads of the several Departments and the Secretary of the Smithsonian Institution, the Commissioner of Fish and Fisheries, the Commissioner of Labor, and the Director of the Bureau of the American Republics may respectively decide shall be embraced in said Government exhibit. The President may also designate additional articles for exhibition. Such board shall be composed of one person to be named by the head of each Executive Department, one by the head of the Smithsonian Institution and National Museum, one by the head of the United States Commission of Fish and Fisheries, one by the Commissioner of Labor, and one by the Director of the Bureau of the American Republics. The President shall name one of said persons so detailed as chairman, and the board itself shall appoint its secretary, disbursing officer, and such other officers as it may deem necessary. The members of said board of management, with other officers and employees of the Government who may be detailed to assist them, including officers of the Army and Navy, shall receive no compensation in addition to their regular salaries, but they shall be allowed their actual and necessary traveling expenses, together with a per diem in lieu of subsistence, to be fixed by the Secretary of the Treasury, while necessarily absent from their homes engaged upon the business of the board. Officers of the Army and Navy shall receive this allowance in lieu of the transportation and mileage now allowed by law. Any provision of law which may prohibit the detail of persons in the employ of the United States to other service than that which they customarily perform shall not apply to persons detailed for duty in connection with the Pan-American Exposition. Employees of the board not otherwise employed by the Government shall be entitled to such compensation as the board may determine. The disbursing officer shall give bond in the sum of twenty thousand dollars for the faithful performance of his duties, said bond to be approved by the Secretary of the Treasury. The Secretary of the Treasury shall advance to said officer, from time to time, under such regulations as the Secretary of the Treasury may prescribe, a sum of money from the appropriation for the Government exhibit, not exceeding at any one time three-fourths of the penalty of his bond, to enable him to pay the expenses of said exhibit as authorized by the board of management herein created.

SEC. 3. That the Secretary of the Treasury shall cause a suitable building or buildings to be erected on the site selected for the Pan-American Exposition for the Government exhibits from plans to be approved by the board, and he is hereby authorized and directed to contract therefor in the same manner and under the same regulations as for other public buildings of the United States; but the contract for said building or buildings shall not exceed the sum of two hundred thousand dollars, said sum being hereby appropriated for said purpose, out of any money in the Treasury not otherwise appropriated. The Secretary of the Treasury is authorized and required to dispose of such building or buildings, or the material composing the same, at the close of the exposition, giving preference to the city of Buffalo or to the said Pan-American Exposition Company to purchase the same at an appraised value, to be ascertained in such manner as may be determined by the Secretary of the Treasury.

SEC. 4. That the United States shall not be liable on account of said exposition for any expense incident to or growing out of same, except for the construction of the building or buildings hereinbefore provided for, and for the purpose of paying the

expense of selection, preparation, purchase, installation, transportation, care, custody, and safe return of exhibits by the Government, for the employment of proper persons as officers and assistants by the board of management created by this Act and for their expenses, and for the maintenance of the said building or buildings and other contingent expenses, to be approved by the chairman of the board of management, or, in the event of his absence or disability, by such other officer as the board may designate and the Secretary of the Treasury upon itemized accounts and vouchers; and the total cost of said building or buildings shall not exceed the sum of two hundred thousand dollars; nor shall the expenses of said Government exhibit for each and every purpose connected therewith, including transportation, exceed the sum of three hundred thousand dollars, amounting in all to not exceeding the sum of five hundred thousand dollars, which sum is hereby appropriated, out of any money in the Treasury not otherwise appropriated, the sum of five hundred thousand dollars, or so much thereof as may be necessary, to be disbursed by the board of management hereinbefore created, of which not exceeding the sum of ten thousand dollars shall be expended for clerical service: *Provided*, That no liability against the Government shall be incurred, and no expenditure of money under this Act shall be made, until the officers of said exposition shall have furnished the Secretary of the Treasury proofs to his satisfaction that there has been obtained by said exposition corporation subscriptions of stock in good faith, contributions, donations, or appropriations from all sources for the purposes of said exposition a sum aggregating not less than five hundred thousand dollars.

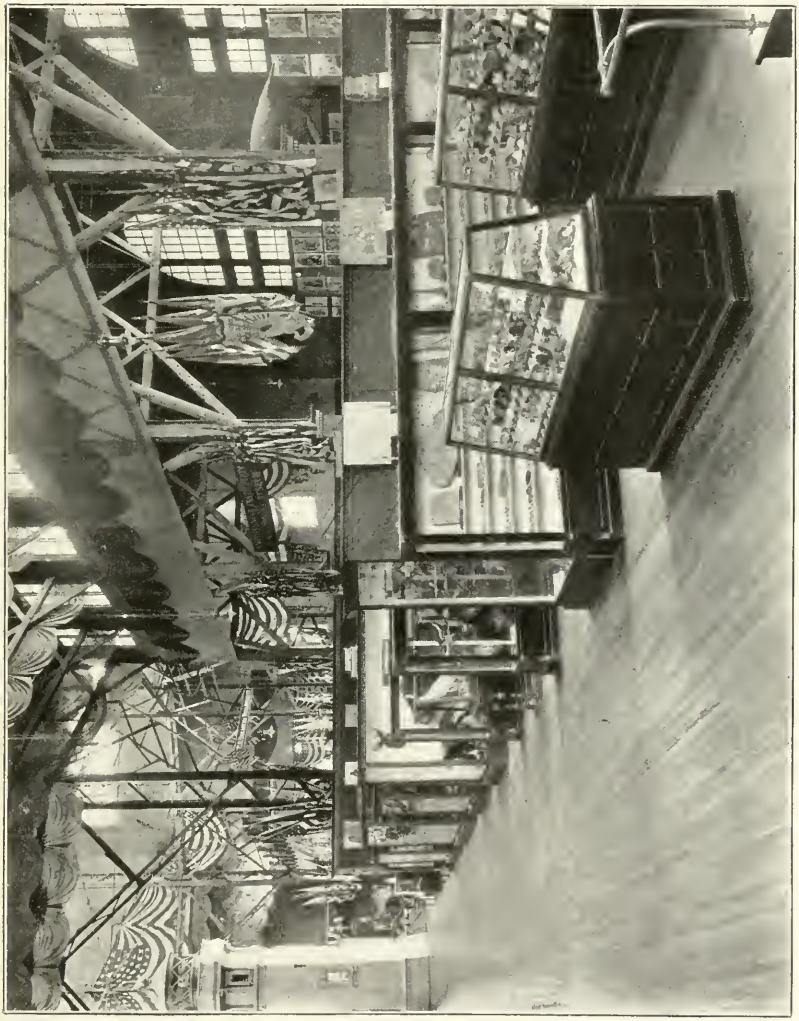
SEC. 5. That medals, with appropriate devices, emblems, and inscriptions commemorative of said Pan-American Exposition, and of the awards to be made to the exhibitors thereat, shall be prepared at some mint of the United States for the board of [illegible]gers thereof, subject to the provisions of the fifty-second section of the coinage [illegible] of eighteen hundred and ninety-three, upon the payment of a sum not less than the cost thereof; and all the provisions, whether penal or otherwise, of said coinage Act against the counterfeiting or imitating of coins of the United States shall apply to the medals struck and issued under this Act.

SEC. 6. That the United States shall not in any manner nor under any circumstances be liable for any of the acts, doings, proceedings, or representations of said Pan-American Exposition Association, its officers, agents, servants, or employees, or any of them, or for service, salaries, labor, or wages of said officers, agents, servants, or employees, or any of them, or for any subscriptions to the capital stock, or for any certificates of stock, bonds, mortgages, or obligations of any kind issued by said corporation, or for any debts, liabilities, or expenses of any kind whatever attending such corporation, or accruing by reason of the same.

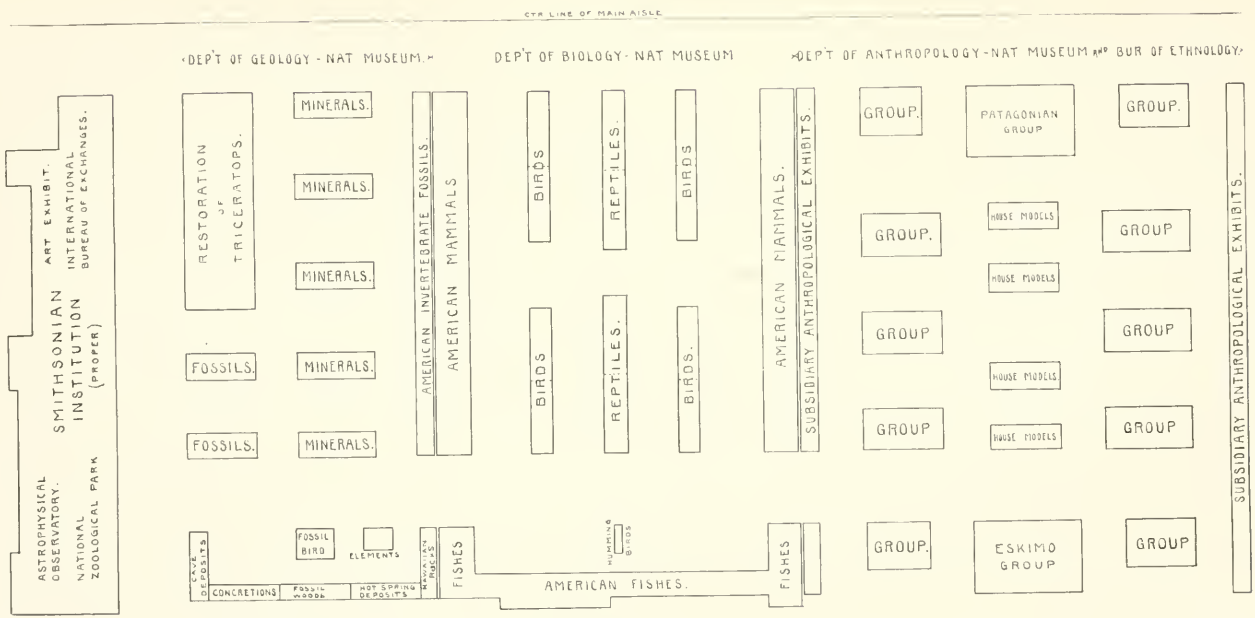
SEC. 7. That nothing in this Act shall be so construed as to create any liability of the United States, direct or indirect, for any debt or obligation incurred, nor for any claim for aid or pecuniary assistance from Congress or the Treasury of the United States in support or liquidation of any debts or obligations created by said commission in excess of appropriations made by Congress therefor.

SEC. 8. That the appropriation herein made of five hundred thousand dollars in all shall take effect and become available immediately upon the passage of this Act.

Approved, March 3, 1899.

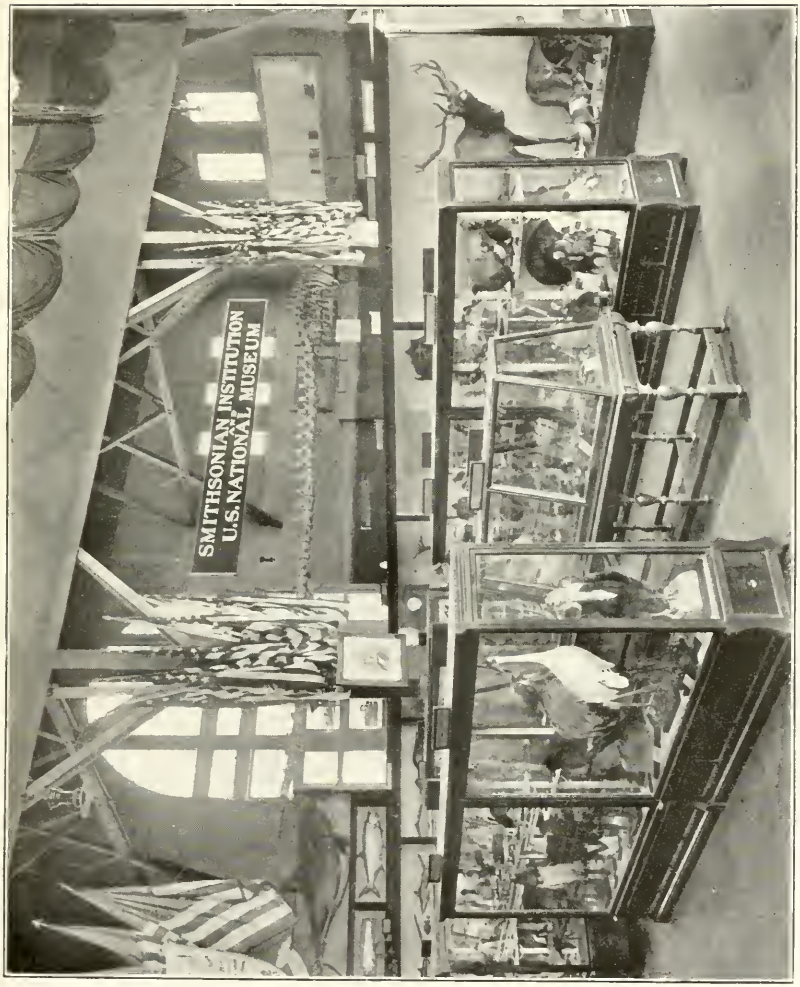


GENERAL VIEW OF U. S. NATIONAL MUSEUM EXHIBITS, PAN-AMERICAN EXPOSITION

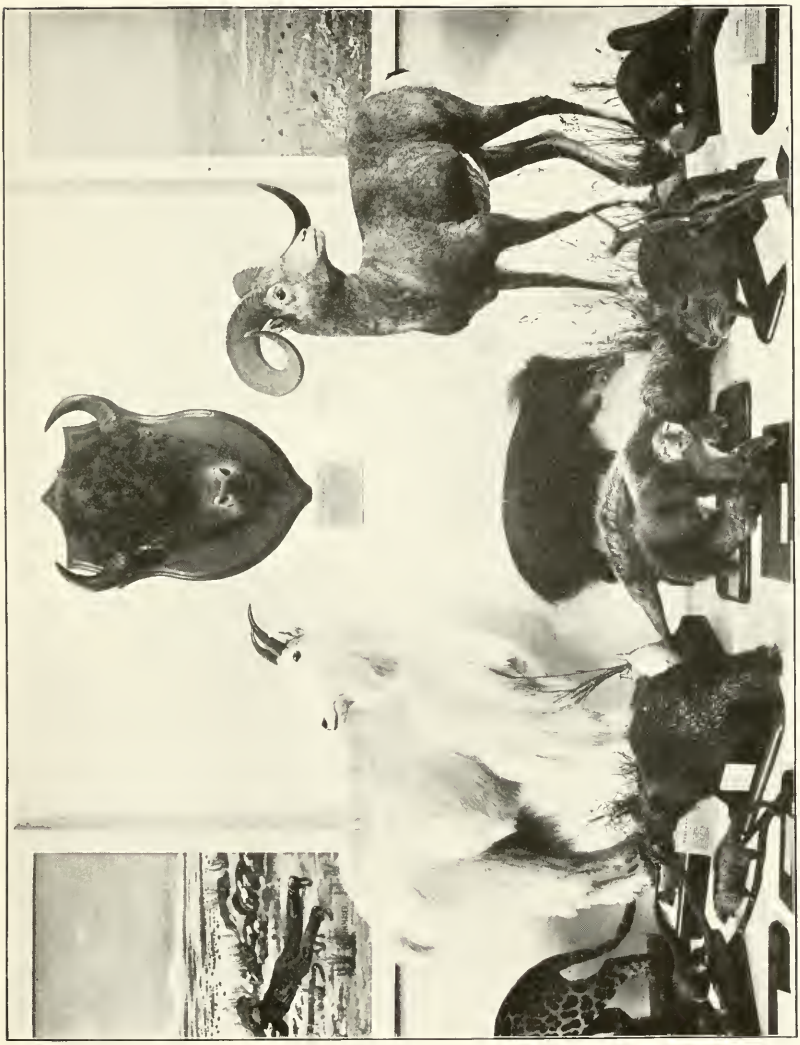


FLOOR SPACE SMITHSONIAN INSTITUTION AND NATIONAL MUSEUM

PAN-AMERICAN EXPOSITION



GENERAL VIEW OF EXHIBITS OF DEPARTMENT OF BIOLOGY.



PART OF LARGE MAMMAL CASE.

GENERAL VIEW OF EXHIBIT OF FISHES.

KADIAK BEAR.

STONE'S SHEEP.

GLACIER BEAR.

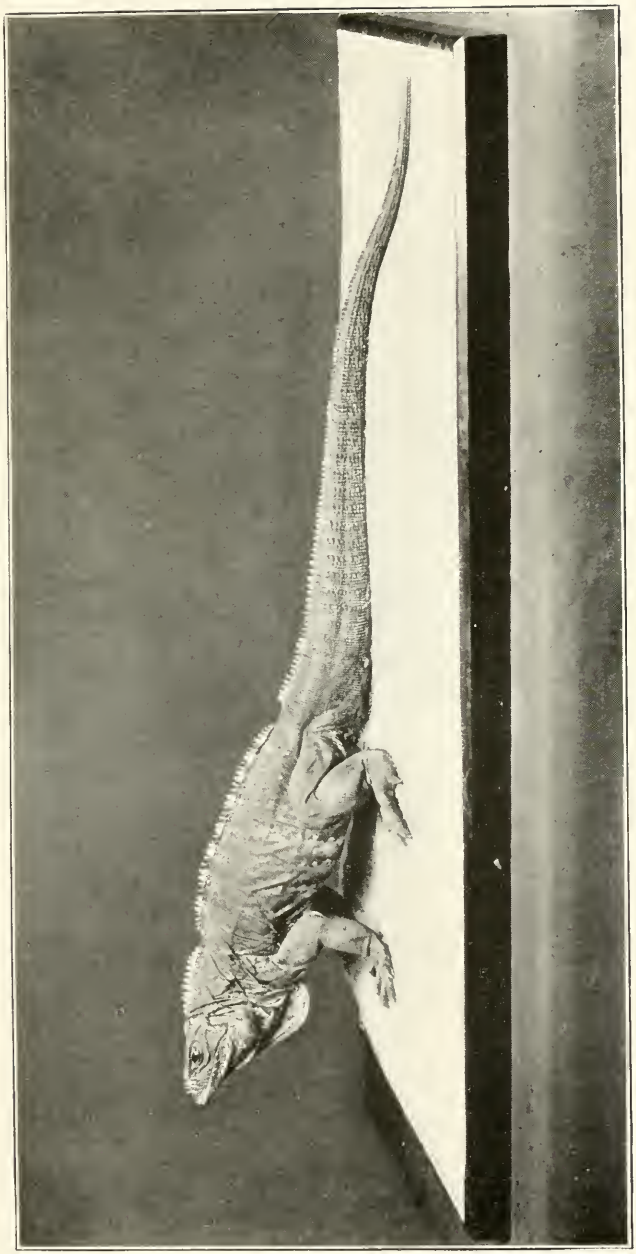
WHITE GOAT.

ALASKA WOLF.

PENGUIN.

CONDOR.

WHOOPING CRANE.

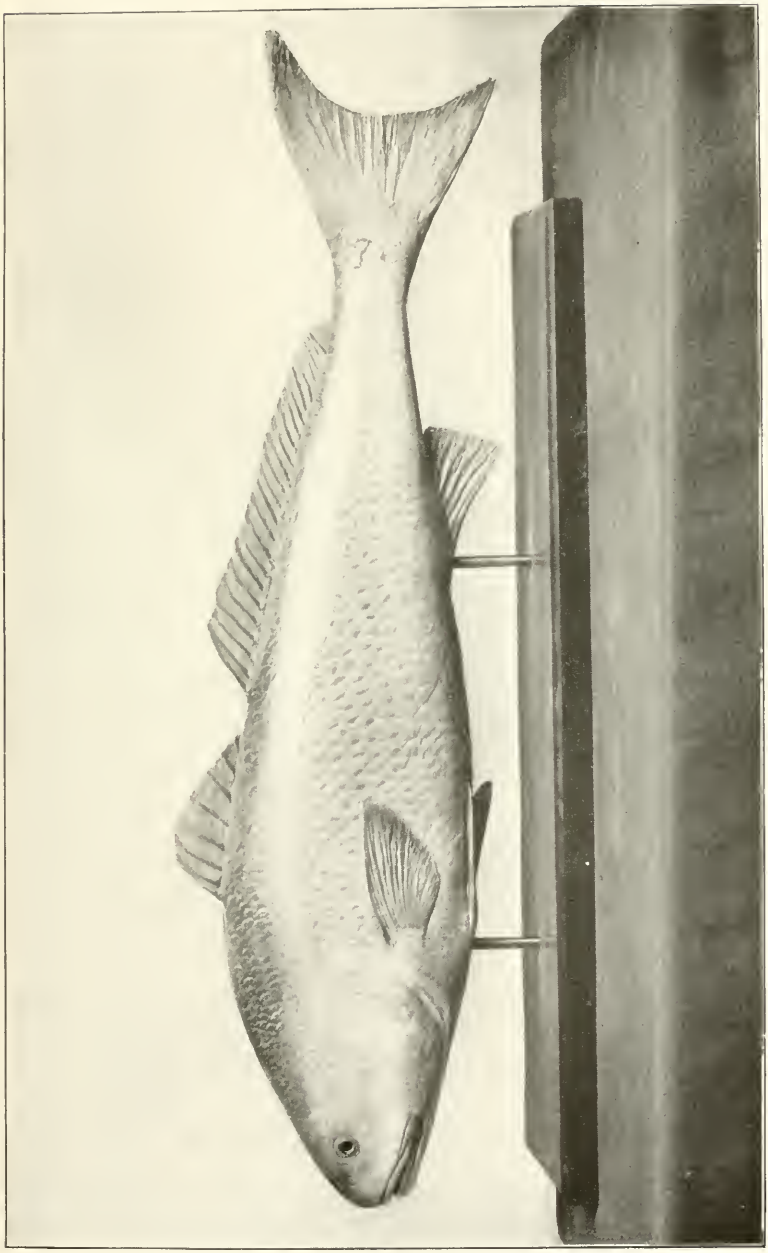


CUBAN IGUANA.

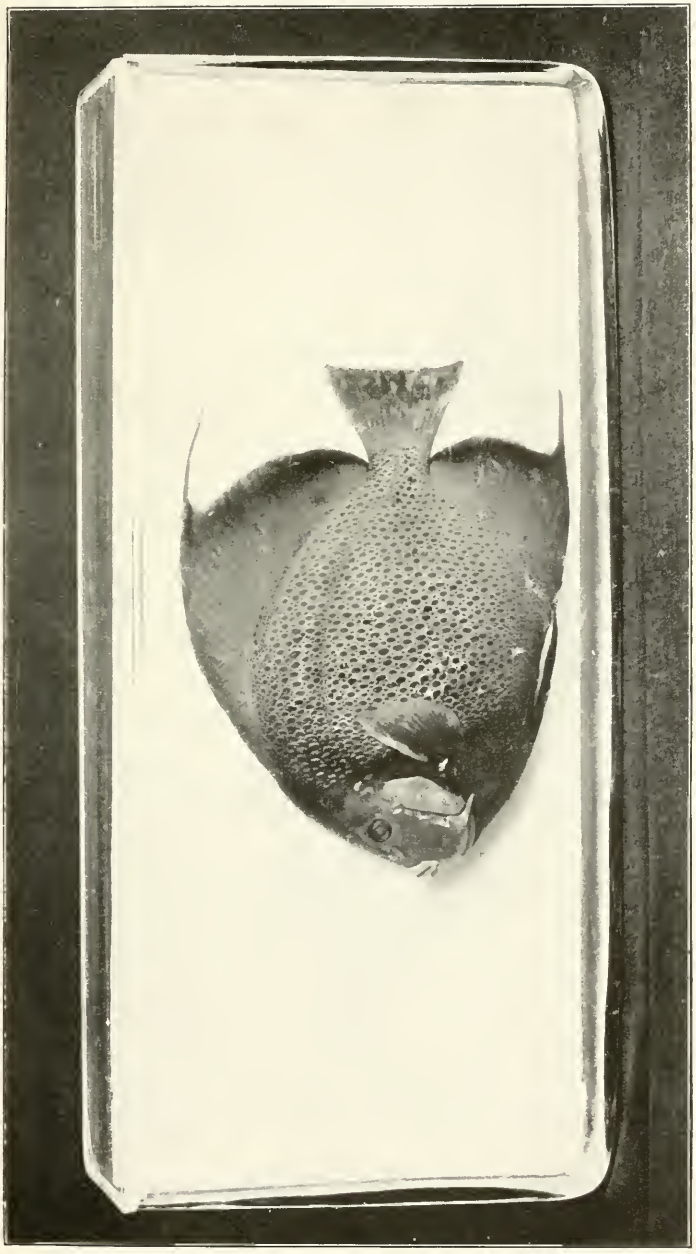
LARGE BOA CONSTICTOR.

HOG-NOSE SNAKE GROUP.

ALLIGATOR SNAPPER.

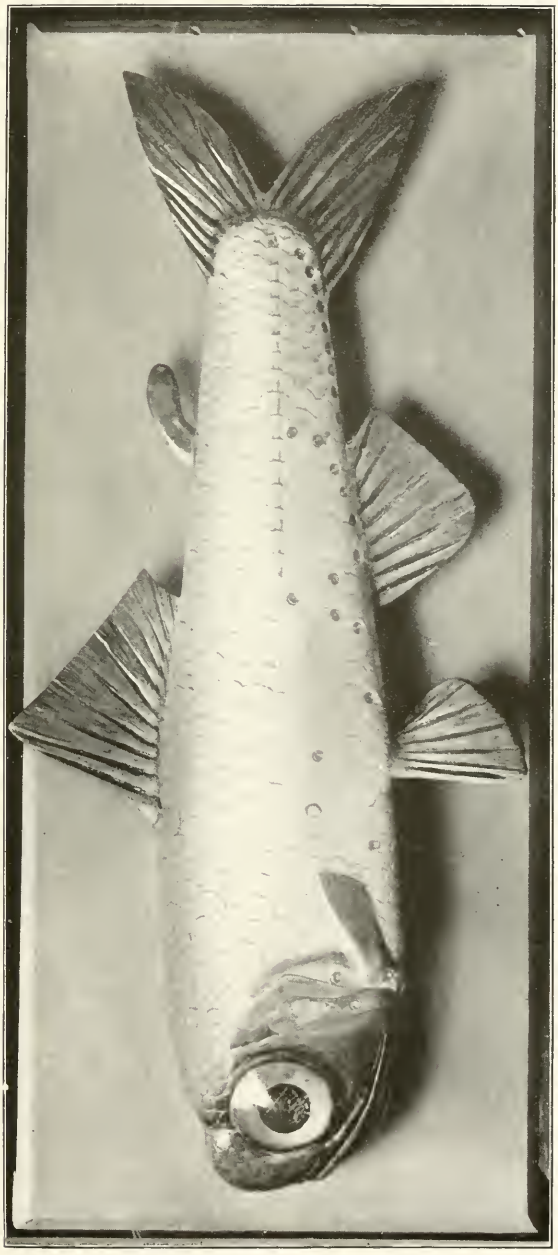


RED DRUM.



BLACK ANGEL-FISH IN FORMALIN.

HOG-FISH IN FORMALIN.



LUMINOUS DEEP-SEA FISH MODEL.

FAMILY GROUP OF THE SMITH SOUND ESKIMO.

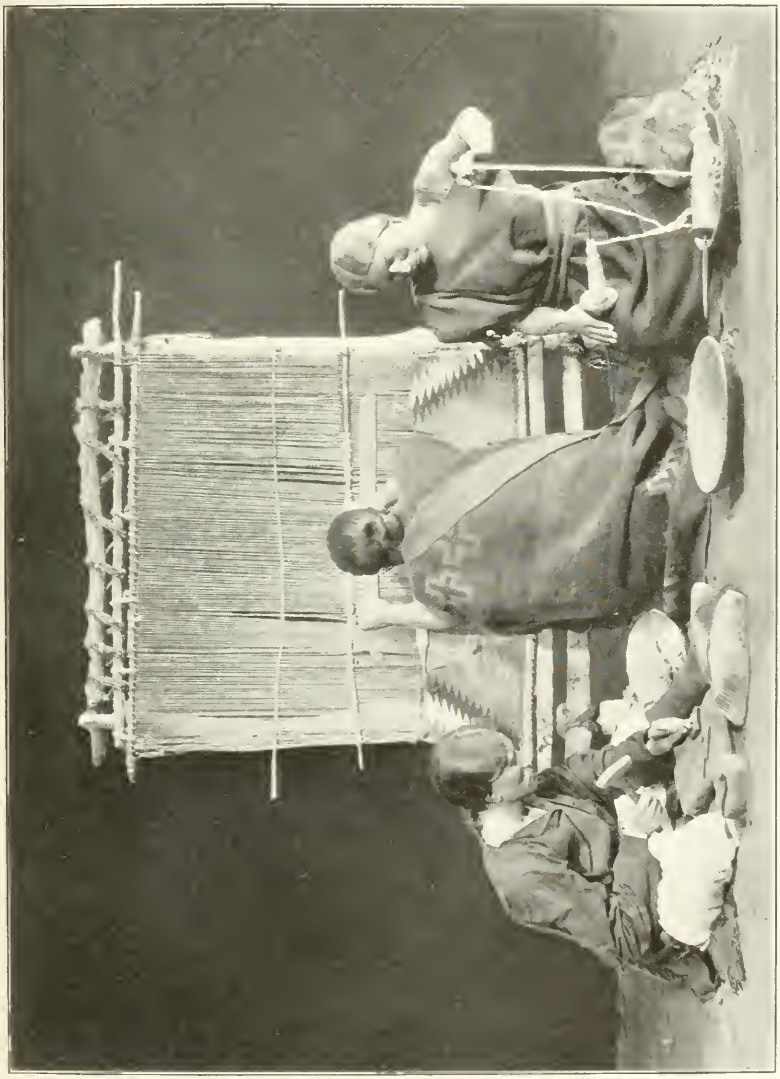
LAY FIGURE GROUP OF EASTERN ESKIMO.

LAY FIGURE GROUP OF WESTERN ESKIMO.

FAMILY GROUP OF CHILKAT INDIANS.

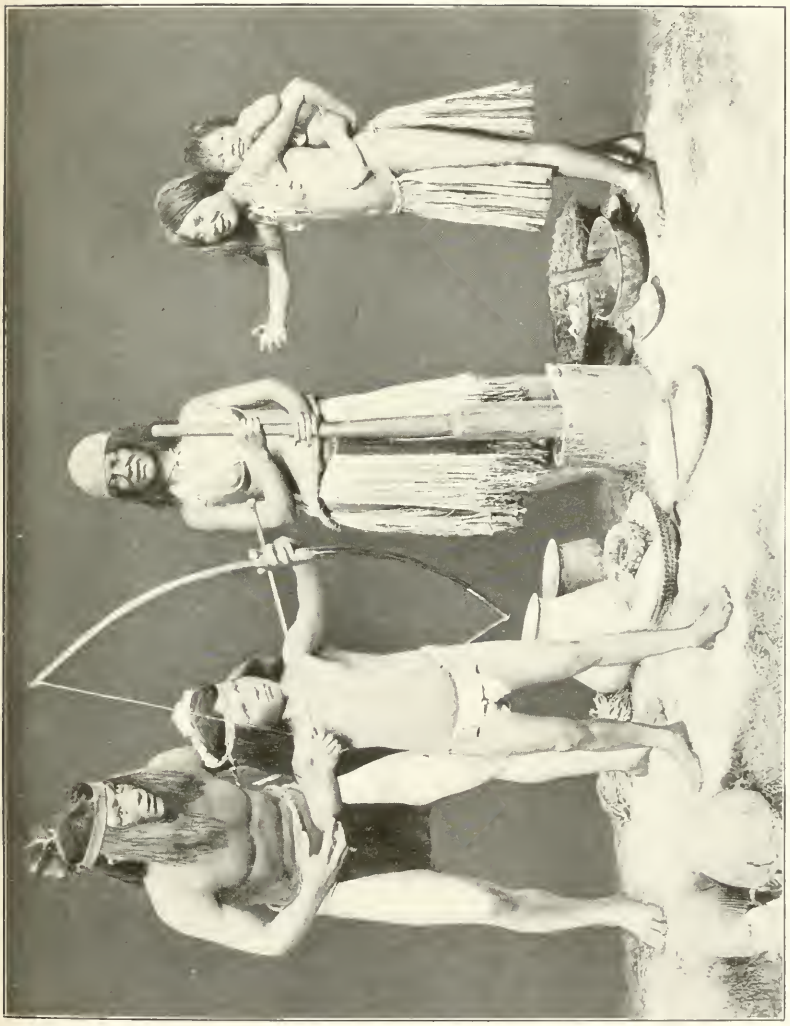
FAMILY GROUP OF HUPA INDIANS.

FAMILY GROUP OF SIOUX INDIANS.



FAMILY GROUP OF NAVAHO INDIANS.

FAMILY GROUP OF ZUÑI INDIANS.

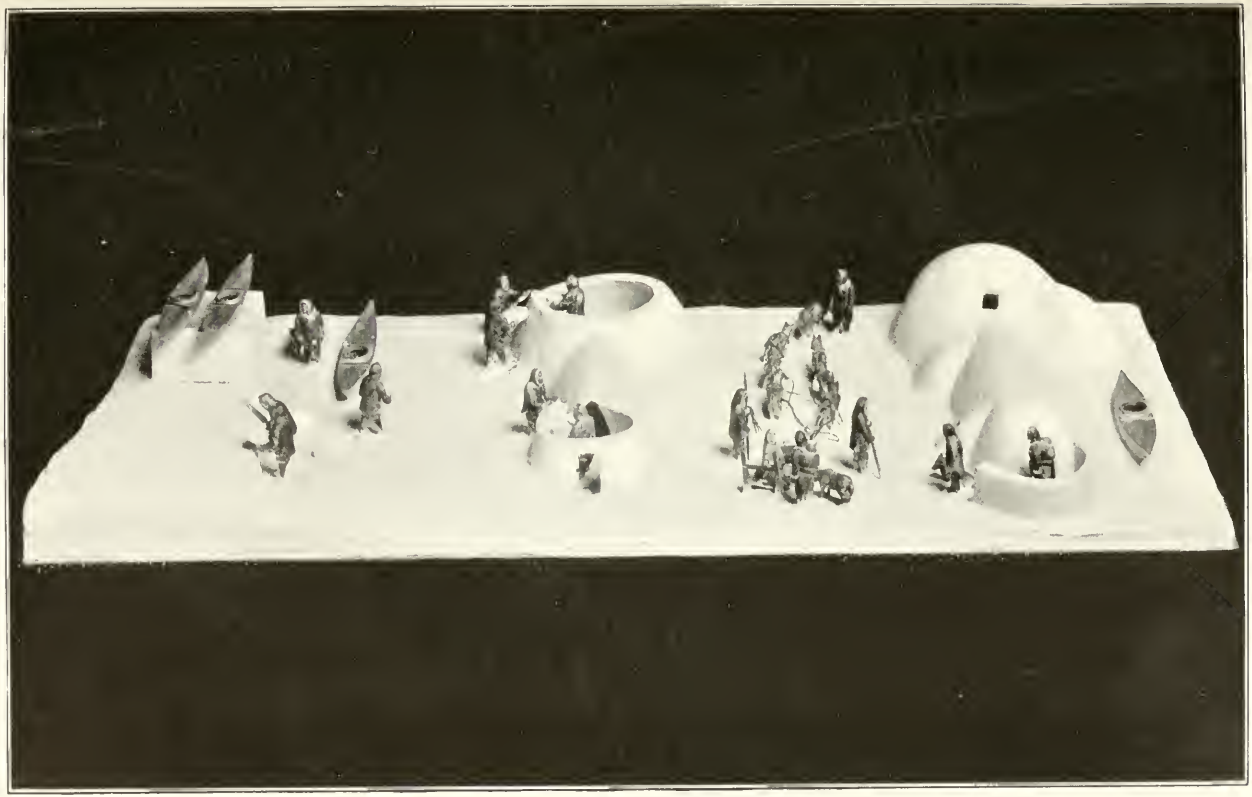


FAMILY GROUP OF COCOPA INDIANS.

FAMILY GROUP OF MAYA-QUICHE INDIANS.

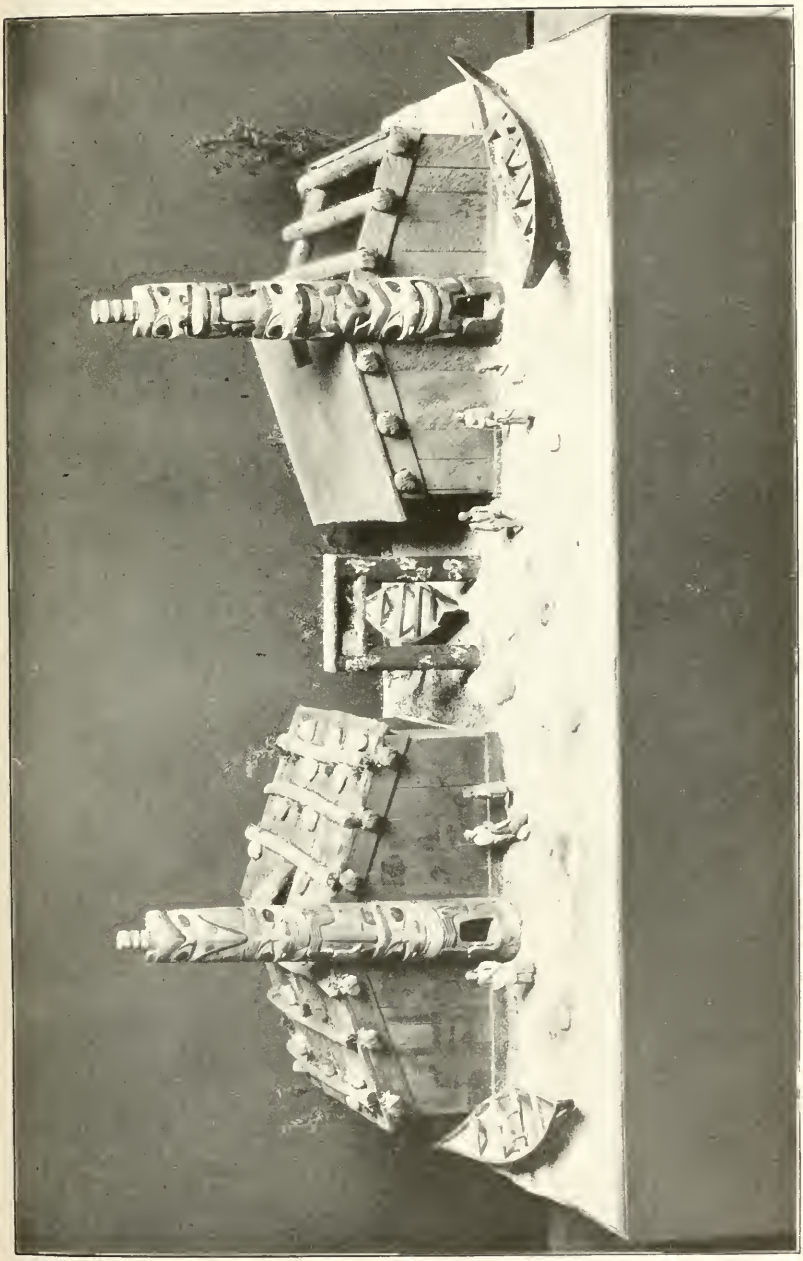
LAY FIGURE GROUP OF MEXICAN AND SOUTH AMERICAN INDIANS.

FAMILY GROUP OF TEHUELCHE INDIANS.

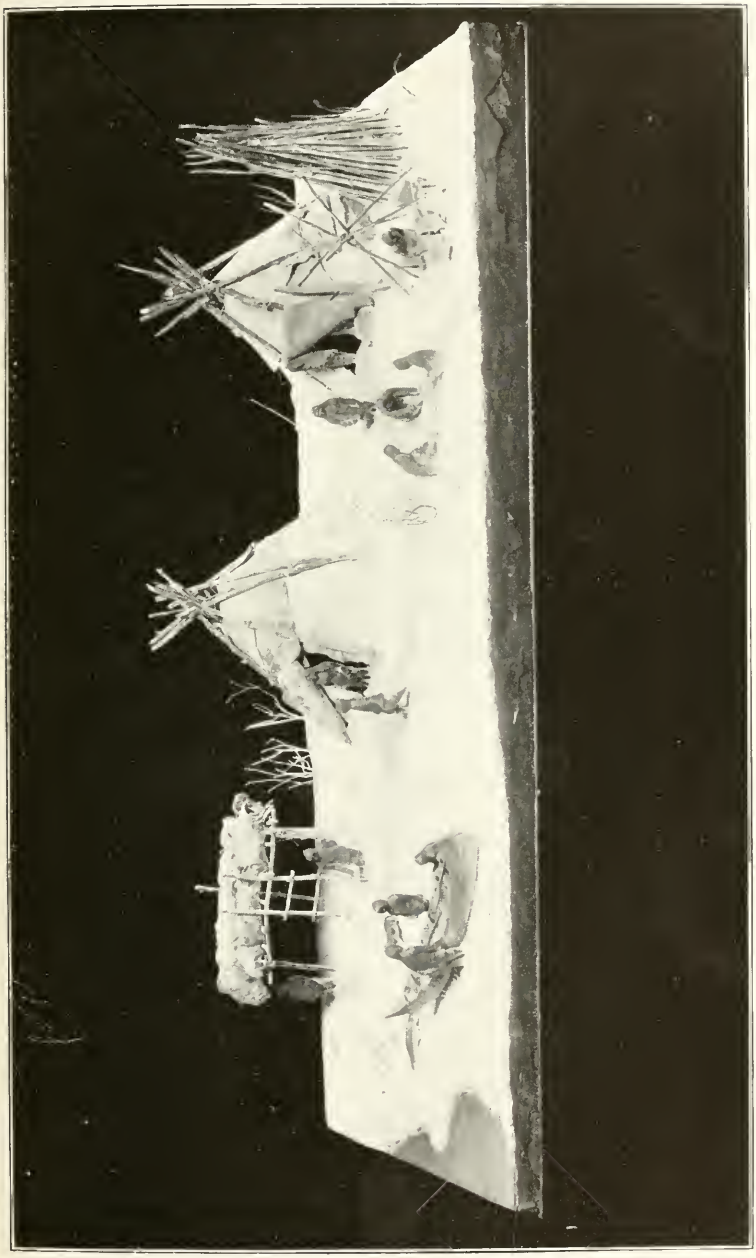


DWELLING GROUP OF CENTRAL ESKIMO.

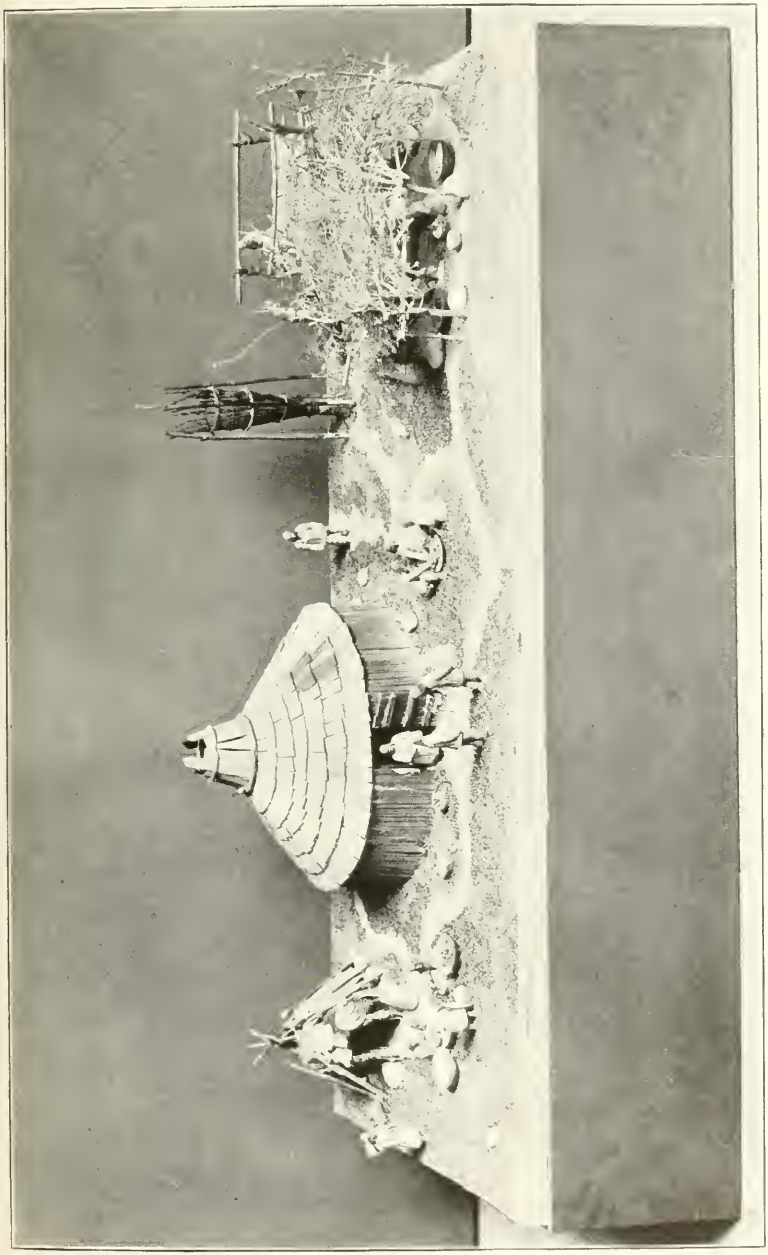
DWELLING GROUP OF THE WESTERN ESKIMO.



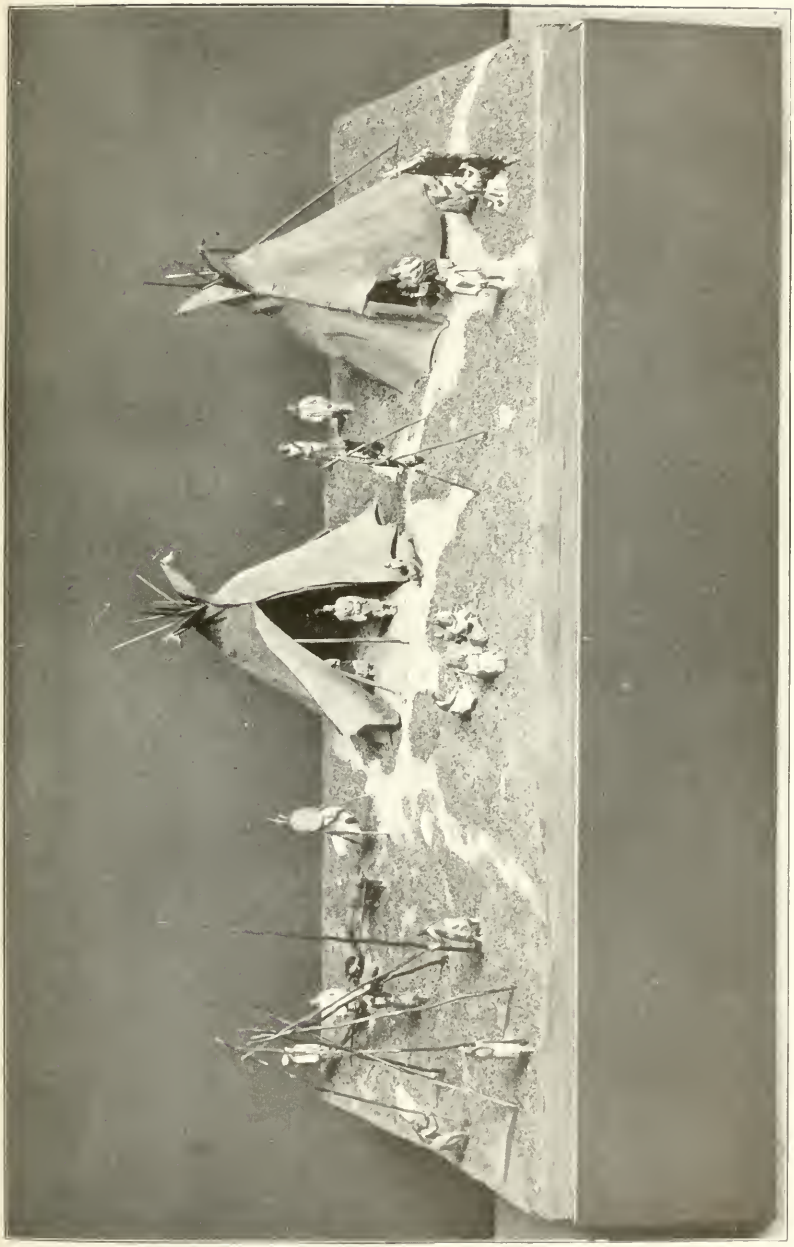
DWELLING GROUP OF THE HAIDA INDIANS.



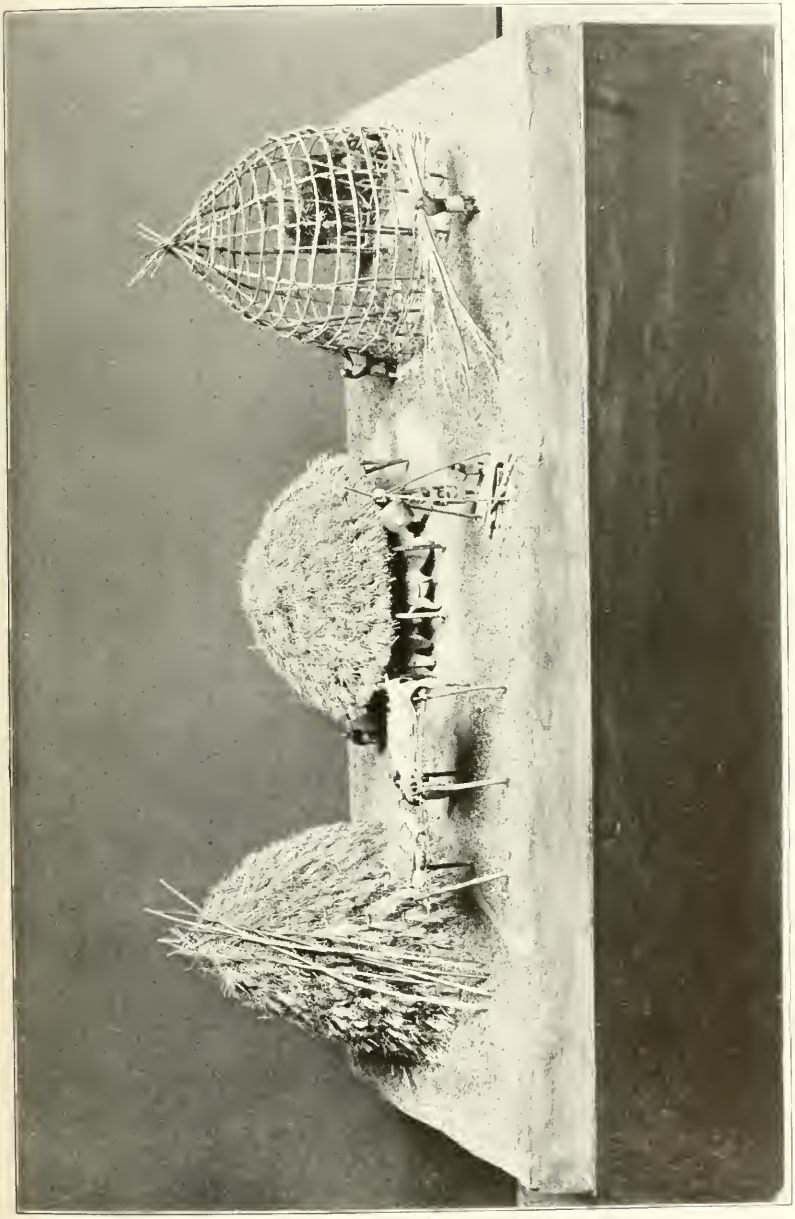
DWELLING GROUP OF THE MONTAGNAIS INDIANS.



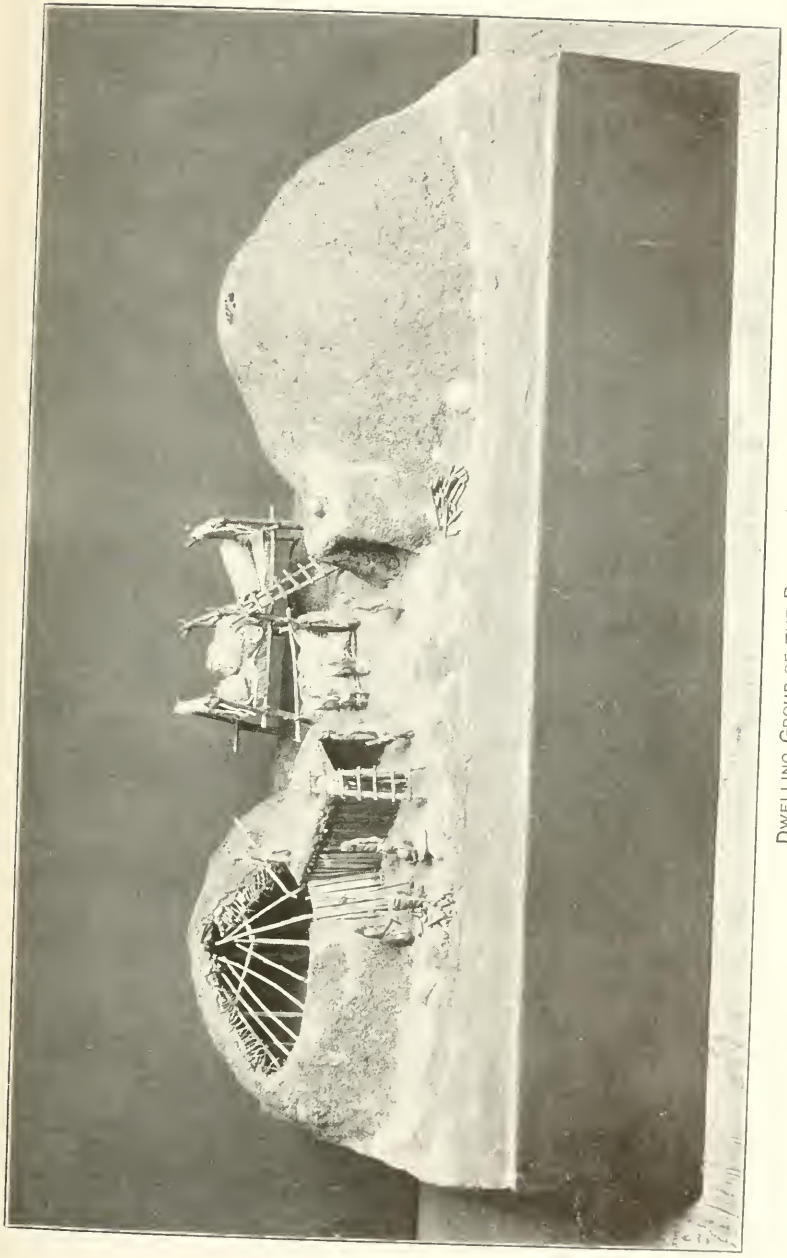
DWELLING GROUP OF CALIFORNIA INDIANS.



DWELLING GROUP OF THE SIOUX INDIANS.

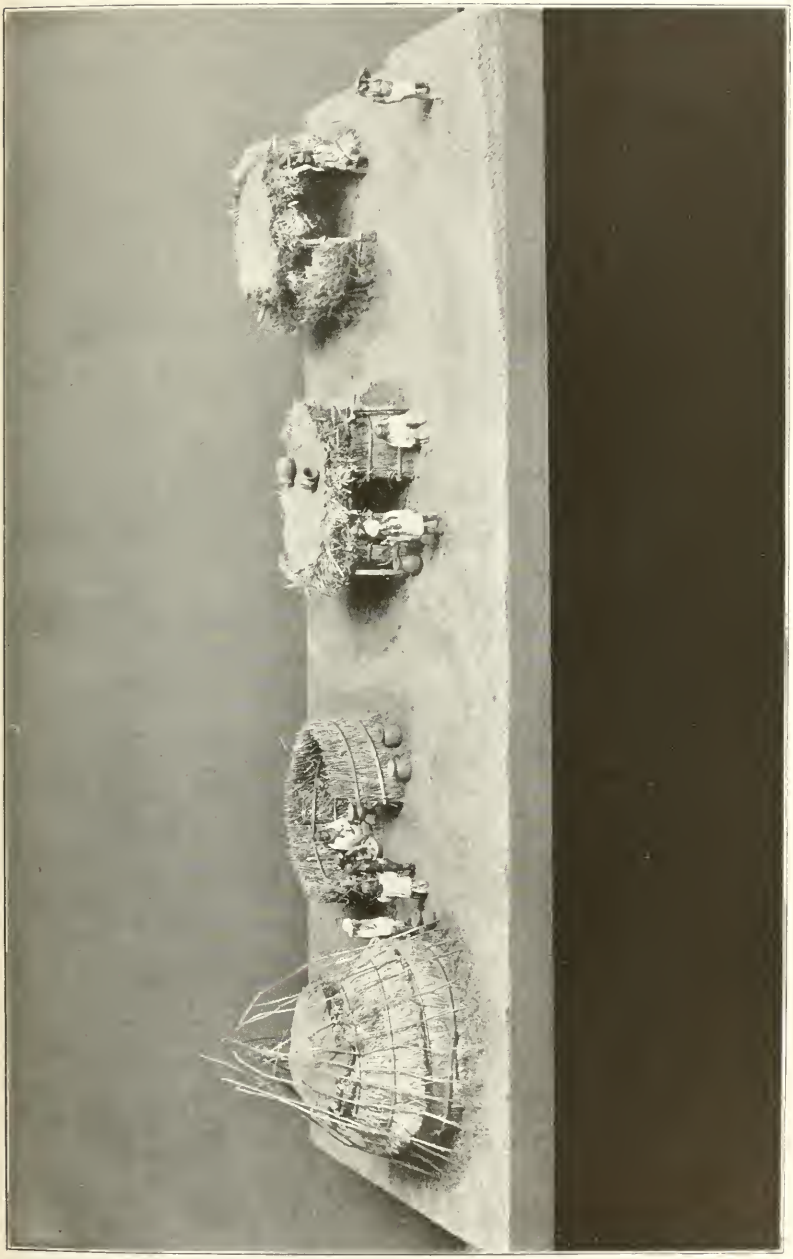


DWELLING GROUP OF THE WICHITA INDIANS.

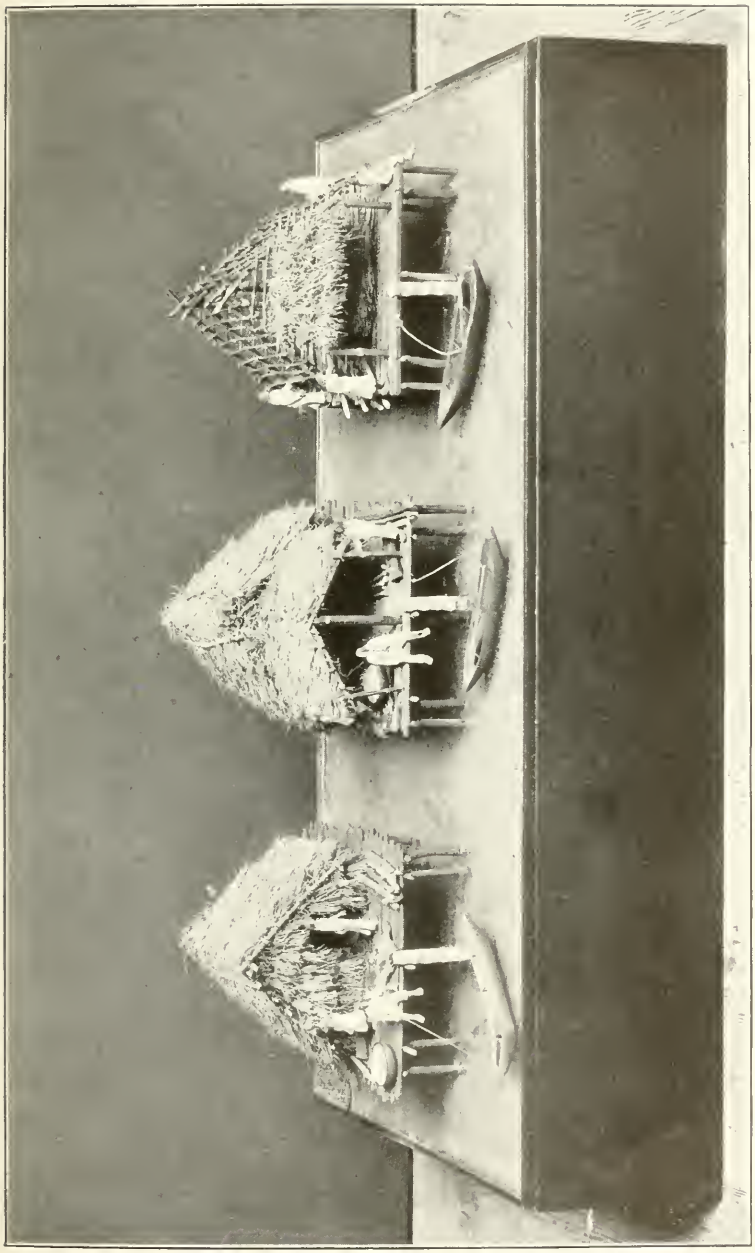


DWELLING GROUP OF THE PAWNEE INDIANS.

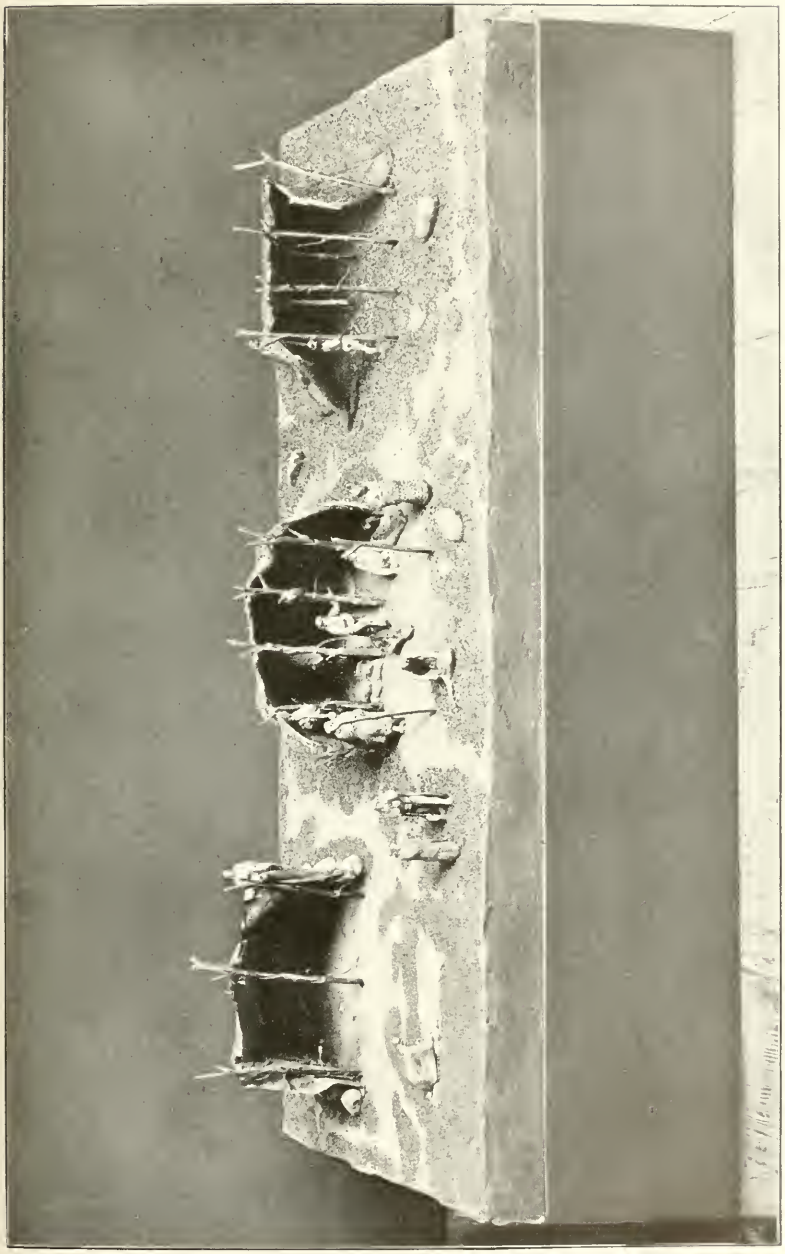
DWELLING GROUP OF THE CLIFF DWELLERS.



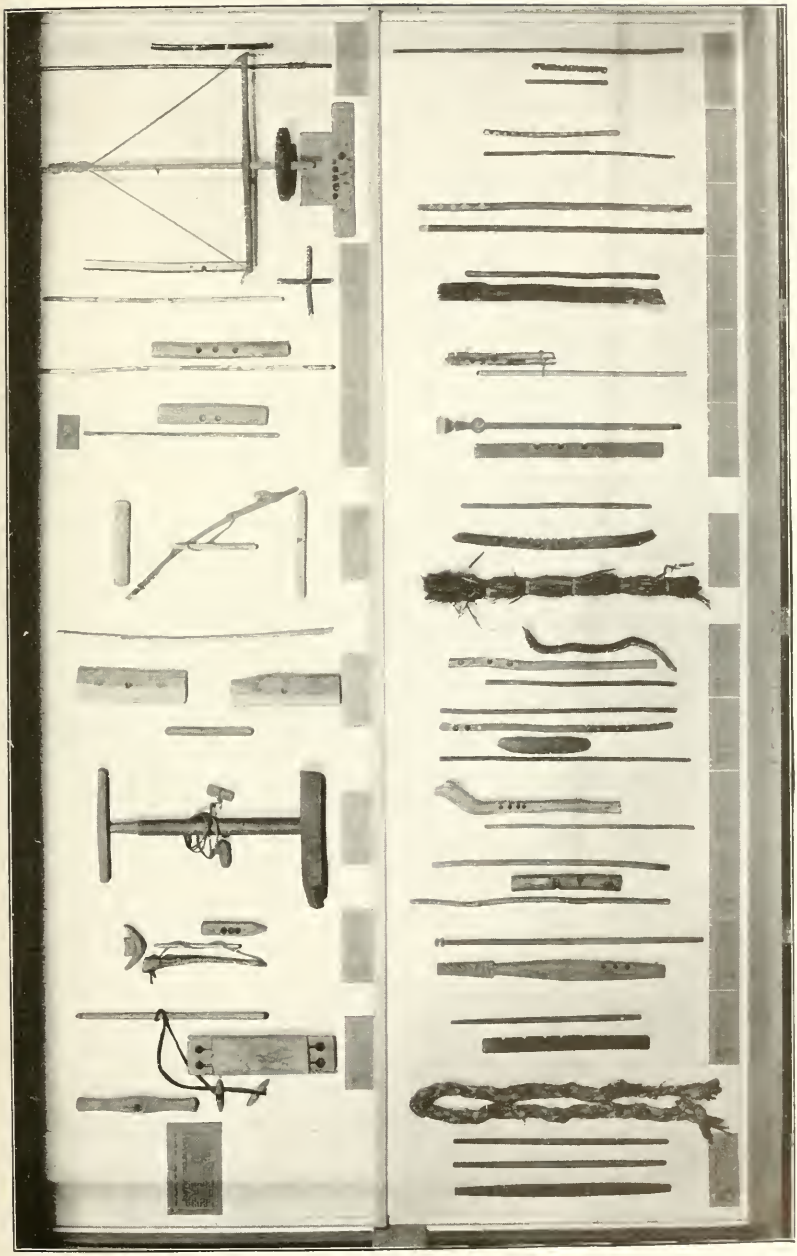
DWELLING GROUP OF THE PAPAGO INDIANS.



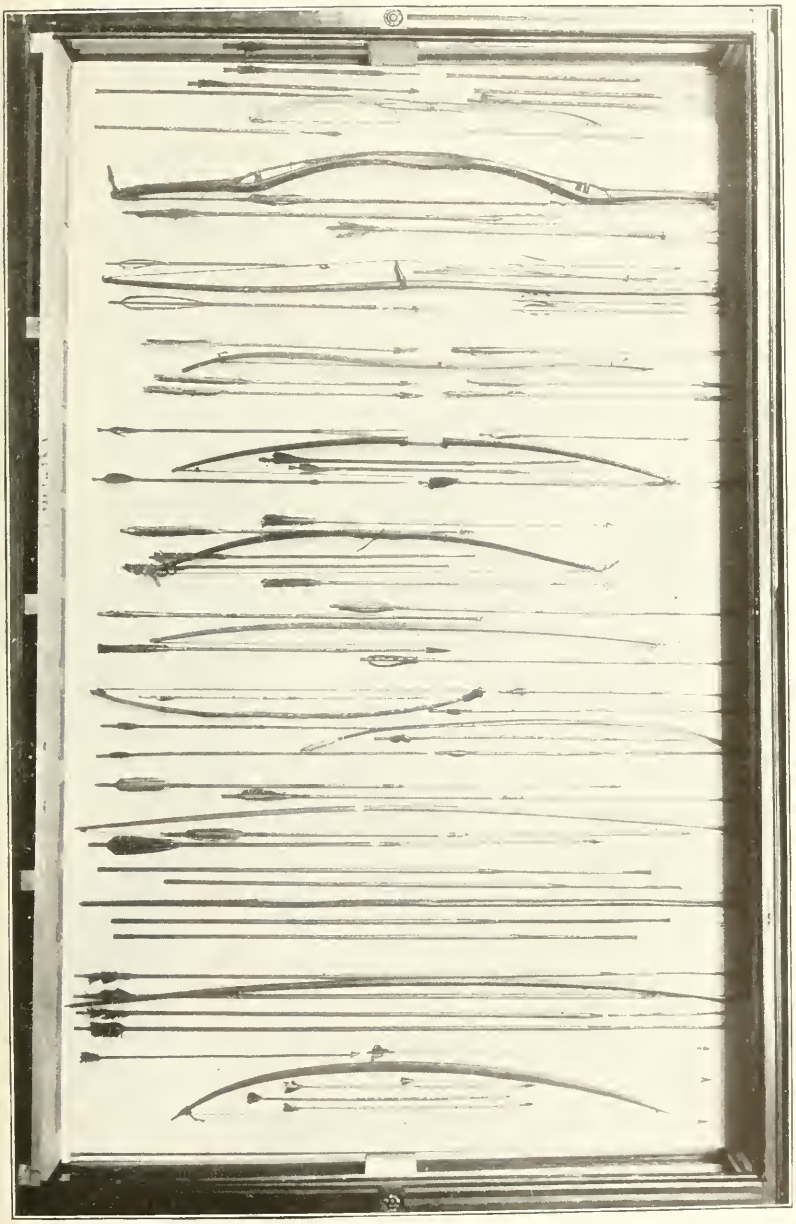
DWELLING GROUP OF VENEZUELA INDIANS.



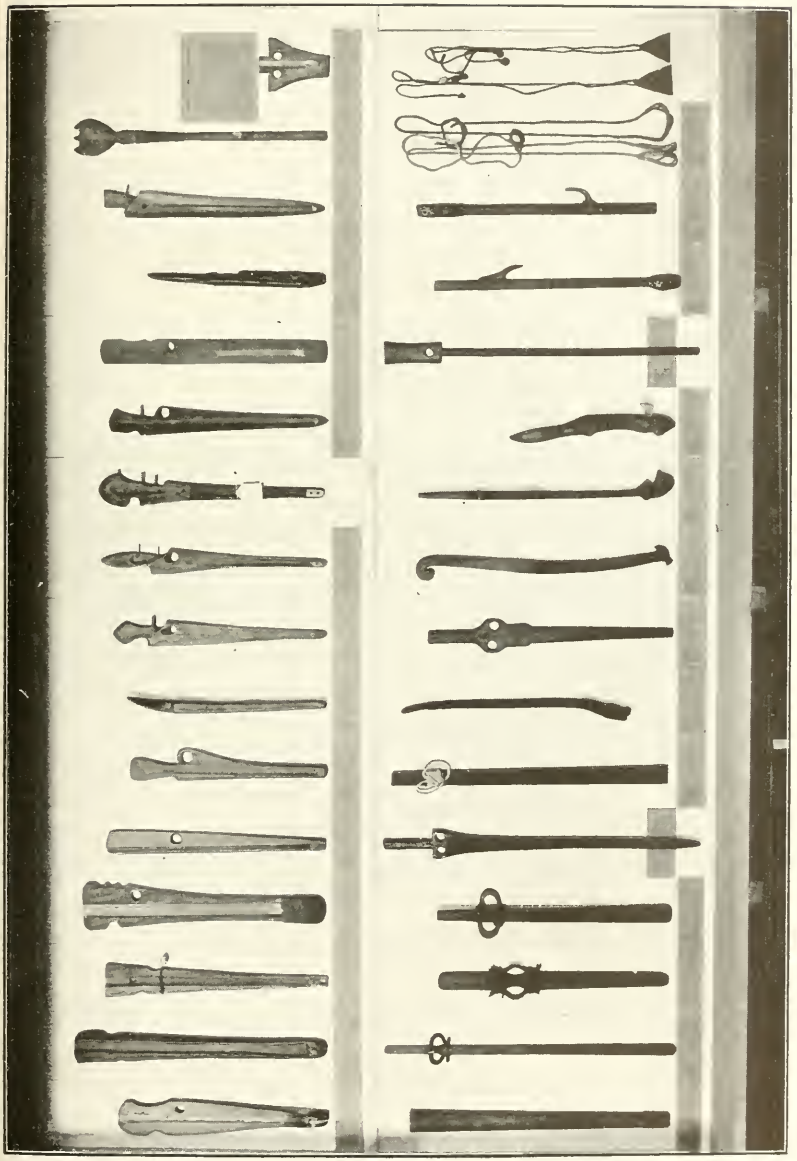
DWELLING GROUP OF THE TEHUELCHE INDIANS.



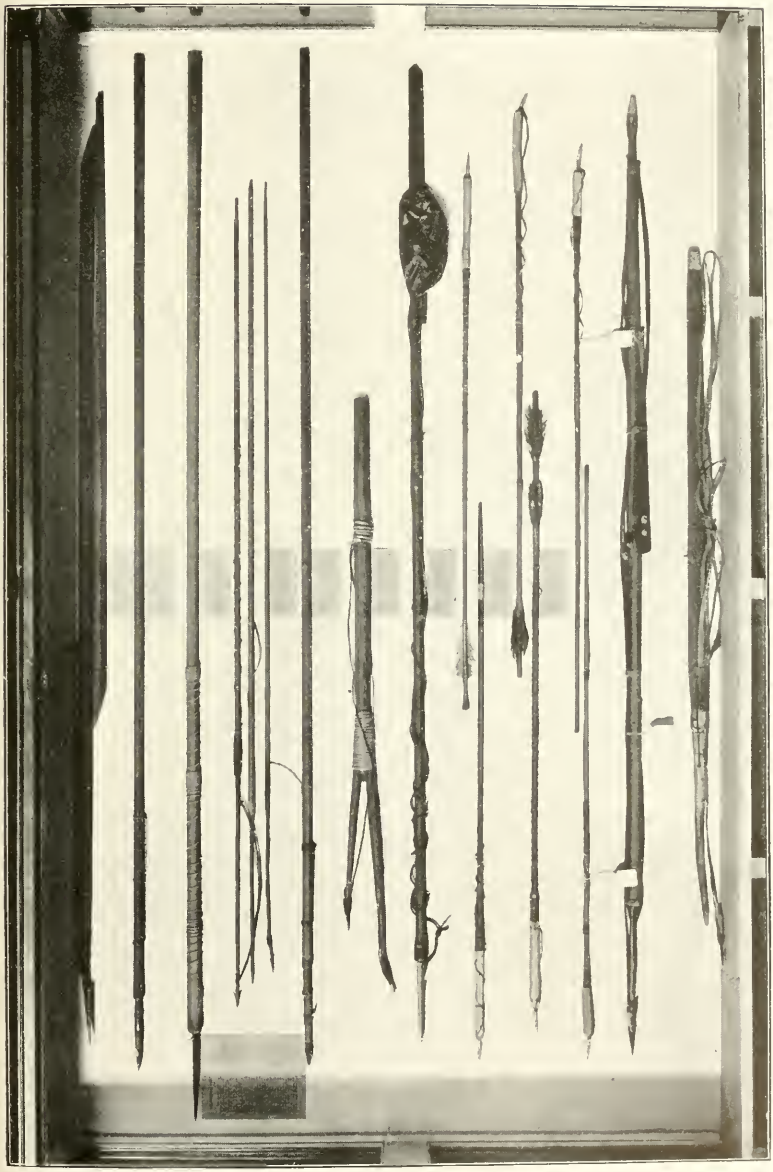
FIRE-MAKING APPARATUS OF THE AMERICAN INDIANS.



BOWS AND ARROWS OF THE AMERICAN INDIANS.



THROWING STICKS OF THE AMERICAN INDIANS.



HARPOONS OF THE AMERICAN INDIANS.

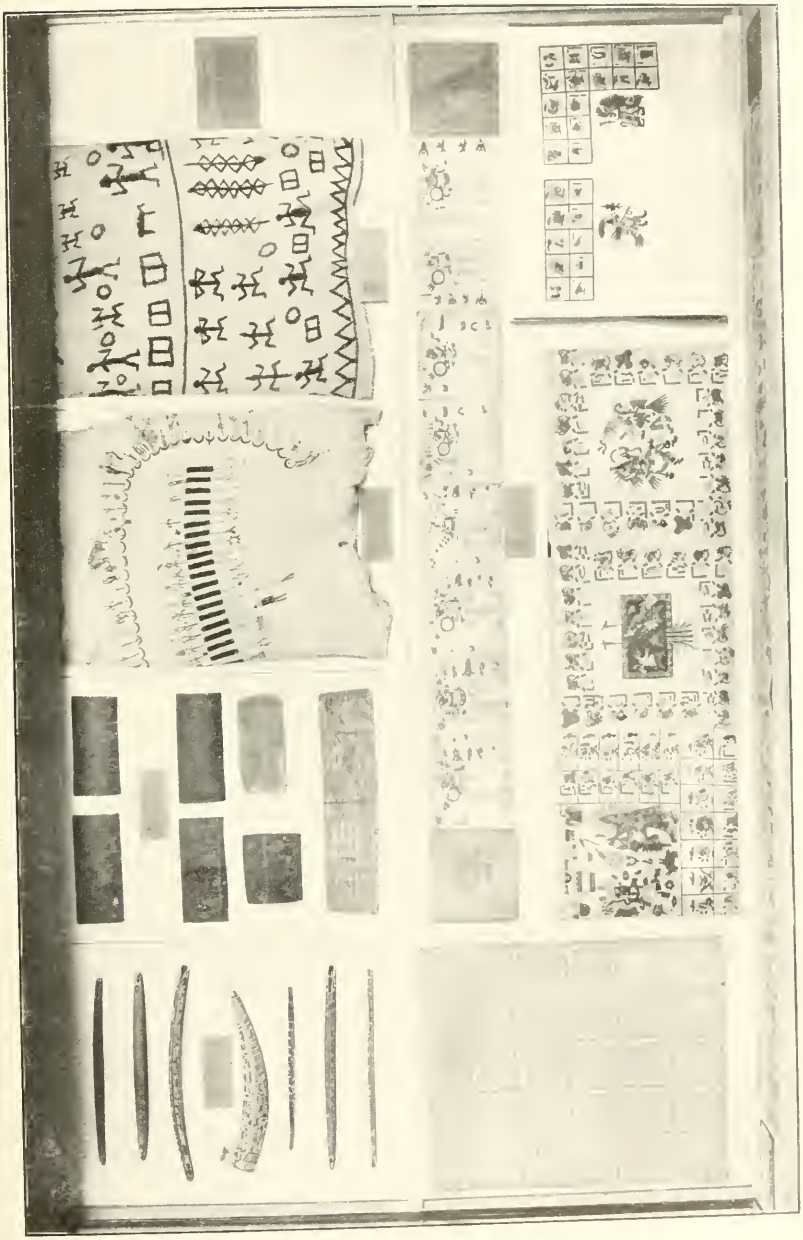
WATER CRAFT OF THE AMERICAN INDIANS.

TEXTILES OF THE AMERICAN INDIANS.

SCULPTURE OF THE AMERICAN INDIANS.

PERSONAL ADORNMENTS OF THE AMERICAN INDIANS.

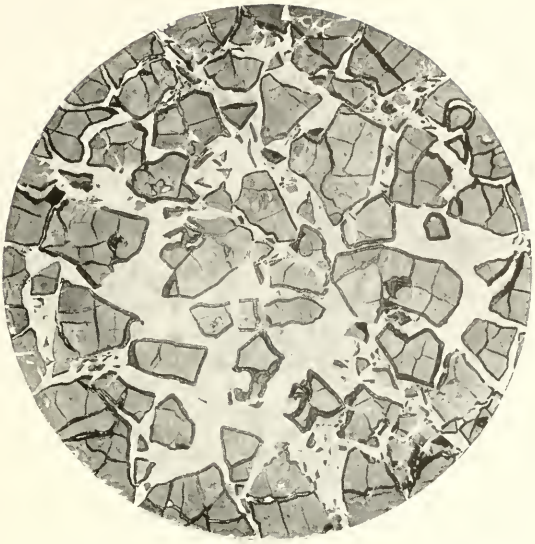
TOBACCO PIPES OF THE AMERICAN INDIANS.

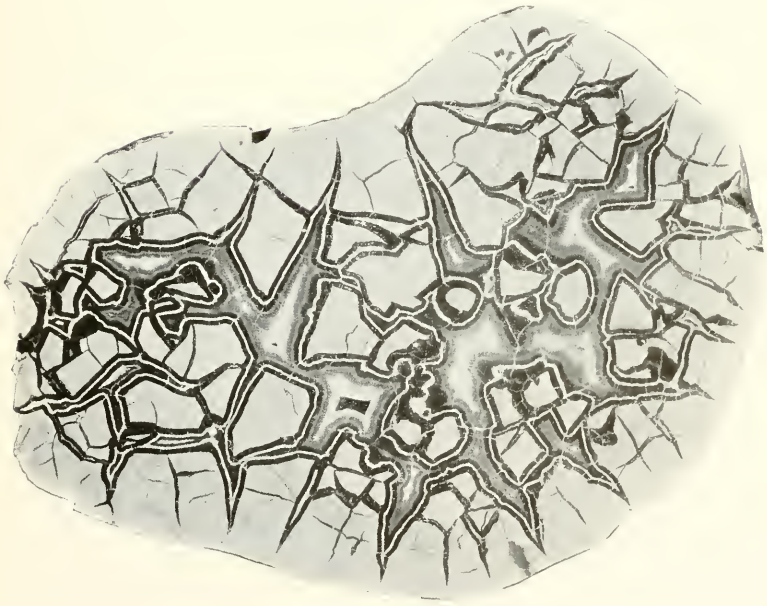


PICTOGRAPHY AND WRITING OF THE AMERICAN INDIANS.

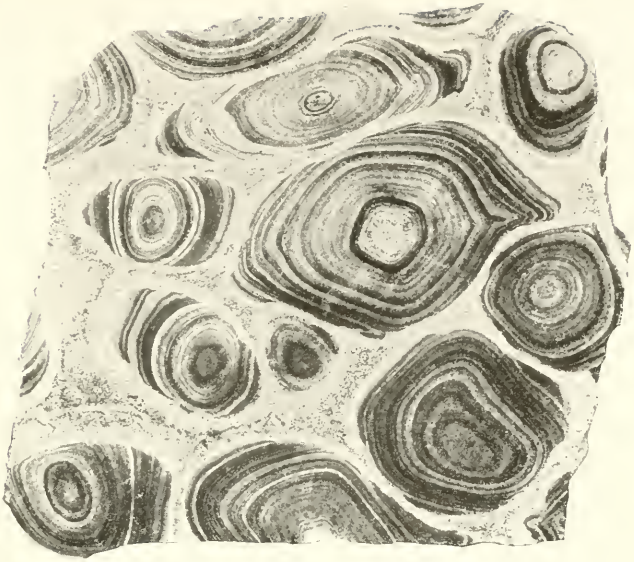
GENERAL VIEW OF EXHIBITS, DEPARTMENT OF GEOLOGY.

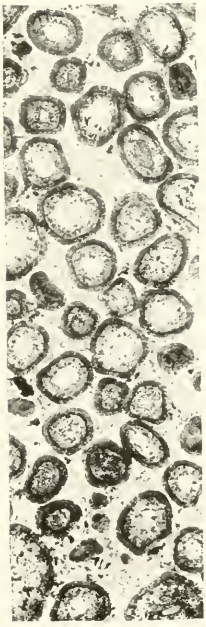
GENERAL VIEW OF EXHIBITS, DEPARTMENT OF GEOLOGY.





CONCRETIONARY STRUCTURES.





CONCRETIONARY STRUCTURES.

THE CROWN.

The crown consists of the *dorsal cup* or shortly *cup* (colored blue), the *tegmen*, sometimes called disc or vault (red), and the *brachia* or arms (yellow), which are generally provided with *pinnules* (black), and often there is an *anal tube* (brown).

24,185. Platycrinus hemisphericus. Lower Carbonic.
24,191. Cyathocrinus multibrachiatus. Lower Carbonic.
24,163. Batocrinus wachsmuthi. Lower Carbonic. The brachia are removed to show the tegmen and anal tube.

ENLARGEMENT OF THE SIMPLE DORSAL CUP.

The dorsal cup may be enlarged by the addition of *proximal brachials* (here colored blue), or by the insertion of a variable number of extra plates between the brachials. The latter are called *interbrachials* (colored red).

24,156. Taxocrinus multibrachiatus. Lower Carbonic.
24,163. Batocrinus wachsmuthi. Lower Carbonic.

CRINOID SERIES—THE CROWN.

THE DORSAL CUP.

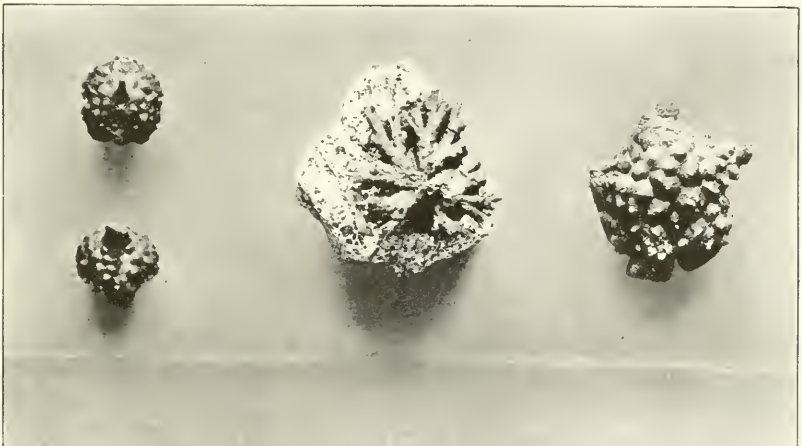
The Dorsal Cup in its simplest form is composed of 2 or 3 circlets of 5 plates, those in one circlet alternating with the 5 in the adjacent circlet. Of these the most important are those that support the brachia and to them the term *radials* is restricted (colored blue). The interradial plates below these are the *basals* (colored red), so called because in many crinoids they form the base of the cup and rest on the stem. Such crinoids are called *monocyclic*. In other crinoids a circlet of *infrabasals* occurs beneath the basals (colored yellow), and these, therefore, are known as *dicyclic*.

Primarily there are 5 plates in each circlet, but owing to the fusion of two or more of the proximal plates the number of basals in monocyclic forms may be reduced to 4, 3, or even 2, and the infrabasals in dicyclic crinoids to three.

The cup often has, in addition to the plates above described, supplementary plates known as *anals* and *interbrachials* which assist in enlarging the cup.

776. Batocrinus longirostris. Lower Carbonic. The cup plates not colored are the *interbrachials*.
7,519. Platycrinus planus. Lower Carbonic.
24,191. Cyathocrinus multibrachiatus. Lower Carbonic.

CRINOID SERIES—THE DORSAL CUP.



THE TEGMEN.

The Tegmen in its simplest form is composed of 5 plates called *deltoids* or *anals* (colored red). There are nearly always present also *ambulacrals* (colored blue), covering the food grooves or ambulacra that lead from the brachia to the mouth. In many Paleozoic genera the ambulacral plates are covered by the *interradial dome plates* (colored yellow). When the dorsal cup is enlarged by other plates than those of a simple crinoid the tegmen also introduces supplementary plates known as *interambulacrals* (black). Finally the tegmen may be in the form of a coriaceous skin, in which large numbers of thin calcareous ossicles are embedded.

The mouth is nearly always covered by the deltoids or the dome plates while the *anus*, which is closed by a *valvular pyramid*, is often surrounded by, or raised on, small plates (colored brown).

24,185. Platycrinus hemisphericus. Lower Carbonic.
768. Dorycrinus unicornis. Lower Carbonic. The anal pyramid is not preserved.
775. Batocrinus elegans. Lower Carbonic. The anal tube is broken away.
24,413. Strotocrinus regalis. Lower Carbonic. A natural cast of the interior surface of the tegmen showing the ambulacral grooves.

CRINOID SERIES—THE TEGMEN.

THE BRACHIA AND PINNULES.

The Brachia or arms in their simplest form consist of a series of ossicles called *brachials* (colored blue), which continue straight up from the *radials* (colored red). The brachials may be in single or alternating double rows, and hence are spoken of as *uniserial* or *biserial*. The inner surface of the brachia are grooved for the transmission of food laden water to the mouth and for the soft parts; and these are protected by covering plates called *ambulacrals* (yellow), which can open or close as occasion demands.

The brachia are rarely single, usually bifurcating in a regular or irregular manner at definite points. The *pinnul* (colored black) is a brachium in miniature; it differs in nothing but position from the small end-branches of a simple dichotomous arm. However, when the pinnules are regularly placed on alternate sides of successive brachials of the main branch, the arm is said to be *pinnulate*. To these pinnules are restricted the fertile portions of the genital rachis.

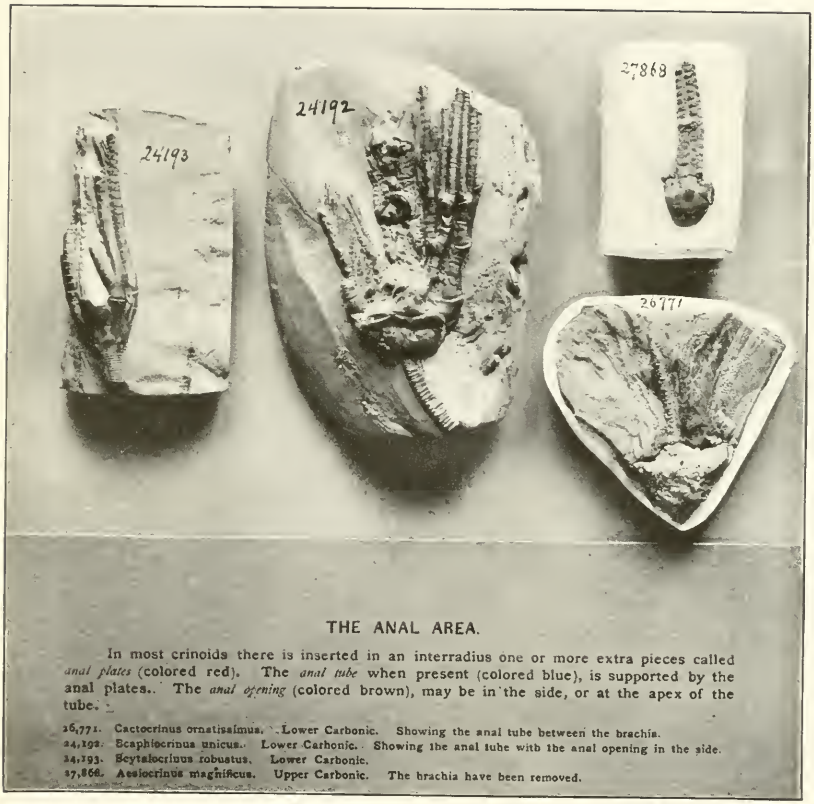
24,193. Scytalocrinus robustus. Lower Carbonic. Brachia pinnulate with regular bifurcations. Brachials in single columns.

34,087. Platycrinus agassizi. Lower Carbonic. Brachia pinnulate with regular bifurcations. Brachials in double, alternating columns.

24,191. Cyathocrinus multibrachiatus. Lower Carbonic. Brachia dichotomous, without pinnules.

24,155. Barycrinus hercules Lower Carbonic. Pinnulate brachia showing the ambulacral groove and ambulacral plates.

CRINOID SERIES—THE BRACHIA AND PINNULES.

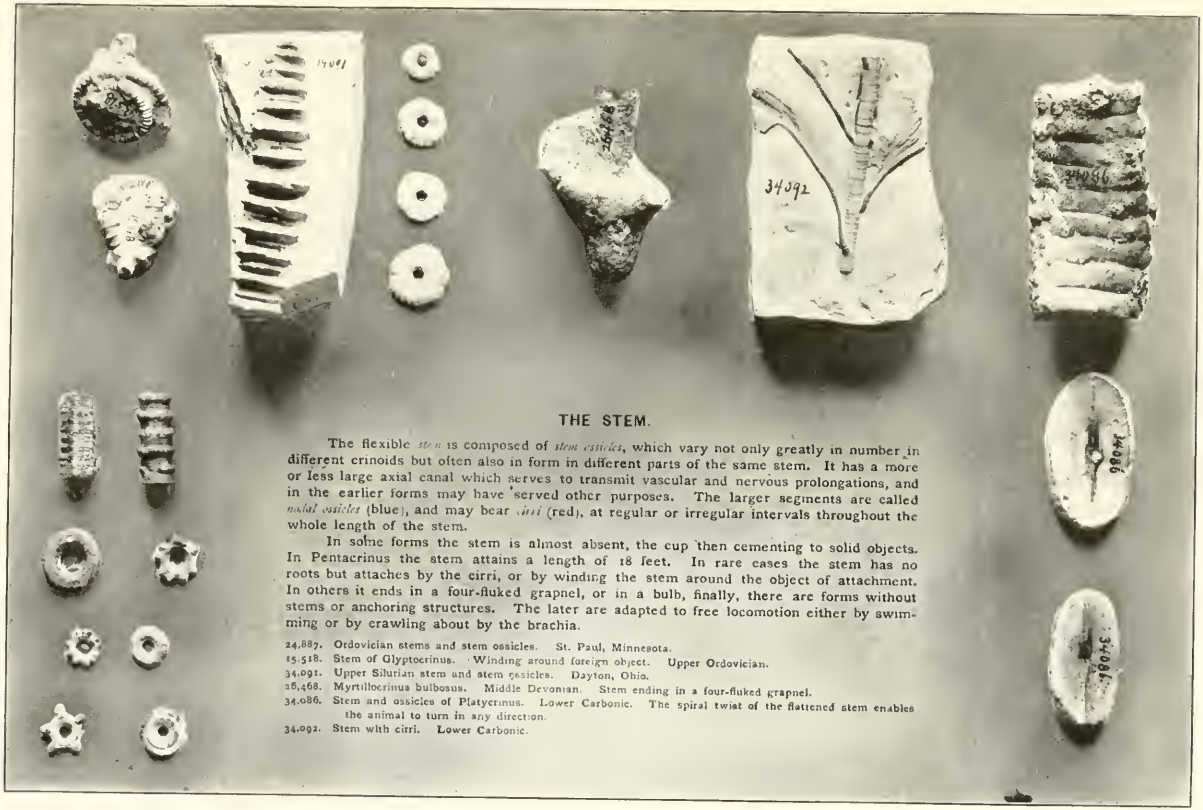


THE ANAL AREA.

In most crinoids there is inserted in an interradius one or more extra pieces called *anal plates* (colored red). The *anal tube* when present (colored blue), is supported by the anal plates. The *anal opening* (colored brown), may be in the side, or at the apex of the tube.

26,771. Cactocrinus ornatissimus. Lower Carbonic. Showing the anal tube between the brachia.
24,192. Scaphiocrinus unicus. Lower Carbonic. Showing the anal tube with the anal opening in the side.
24,193. Scytalocrinus robustus. Lower Carbonic.
27,868. Aesiocrinus magnificus. Upper Carbonic. The brachia have been removed.

CRINOID SERIES—THE ANAL AREA.



THE STEM.

The flexible *stem* is composed of *stem ossicles*, which vary not only greatly in number in different crinoids but often also in form in different parts of the same stem. It has a more or less large axial canal which serves to transmit vascular and nervous prolongations, and in the earlier forms may have served other purposes. The larger segments are called *nodal ossicles* (blue), and may bear *cirri* (red), at regular or irregular intervals throughout the whole length of the stem.

In some forms the stem is almost absent, the cup then cementing to solid objects. In Pentacrinus the stem attains a length of 18 feet. In rare cases the stem has no roots but attaches by the cirri, or by winding the stem around the object of attachment. In others it ends in a four-fluked grapnel, or in a bulb, finally, there are forms without stems or anchoring structures. The later are adapted to free locomotion either by swimming or by crawling about by the brachia.

24,887. Ordovician stems and stem ossicles. St. Paul, Minnesota.
15,518. Stem of Glyptocrinus. Winding around foreign object. Upper Ordovician.
34,091. Upper Silurian stem and stem ossicles. Dayton, Ohio.
28,468. Myrtillocrinus bulbosus. Middle Devonian. Stem ending in a four-fluked grapnel.
34,086. Stem and ossicles of Platycrinus. Lower Carbonic. The spiral twist of the flattened stem enables the animal to turn in any direction.
34,092. Stem with cirri. Lower Carbonic.

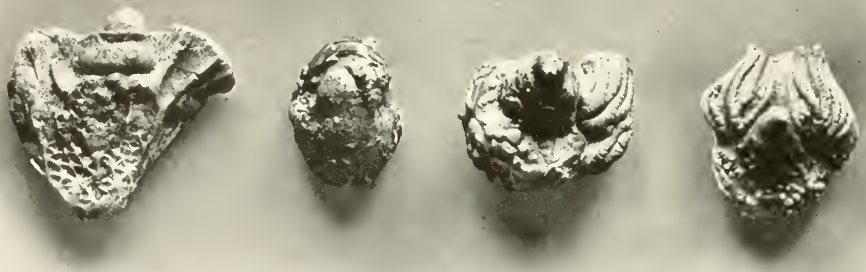
CRINOID SERIES—THE STEM.

ROOTS.

The Roots are distal branches of the stem and like it are usually made up of perforated ossicles. In some forms the stem terminates in a disk-shaped or encrusting non-segmented root.

34,089.	Anomalocrinus incurvus.	Growing upon a monticuliporoid bryozoan.	Upper Ordovician.
34,093.	Root of Ectenocrinus(?).	Upper Ordovician.	
10,425.	Eucalyptocrinus crassus	Upper Silurian.	
34,088.	Poteriocrinus spartarius.	Lower Carbonic.	

CRINOID SERIES—THE ROOTS.



CRINOID PARASITES.

Gastropods of the genera Cyclonema and Platyceras are found situated over the anal region of many crinoids. In the Silurian and Devonian such occurrences are rare and they do not appear to have been permanent parasites. In the Lower Carboniferous, however, the form of the shell is considerably modified and perfectly moulded to the crinoid, proving that the Platyceras spent its life where found. Its sustainance, therefore, must have been largely the effete matter of the crinoid.

15,513. Glyptocrinus decadactylus. The parasite is Cyclonema bilix. Upper Ordovician.
26,465. Arthracantha punctobrachiata. The parasite is Platyceras dumosum rarispinum? Middle Devonian.
24,185. Platyceras hemisphericus. Lower Carbonic. The parasite is Platyceras uncum.

CRINOID SERIES—CRINOID PARASITES.

HESPERORNIS REGALIS.

MODEL OF TRICERATOPS PRORSUS.

PAINTING OF TRICERATOPS PRORSUS.