Chicago Natural History Museum
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THE BULLETIN

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Members are requested to inform the Museum promptly of changes of address.

THIS MONTH'S COVER

The head of a carved wooden figure from Africa is shown on our cover. The figure is one of the objects selected for a special exhibit "What Is Primitive Art?" that will be on view in Stanley Field Hall from July 1 to September 30 (see page 3). This figure, which is 43 inches tall, was made and used about 50 years ago by members of one of the Cameroons tribes. Probably it represented a female ancestor of the person for whom the carving was made and was used as part of an ancestral shrine.

IN PURSUIT OF DARKNESS

BY EUGENE S. RICHARDSON, JR.
CURATOR OF FOSSIL INVERTEBRATES

PERHAPS you think that the scientists who work behind the scenes at the Museum are always seeking to cast light on their special fields of natural history. Well, so we are, but recently Dr. Rainer Zangerl, Curator of Fossil Reptiles, and I have been assiduously pursuing some darkness.

This came about because we are not chemists, and we have not been able to persuade a chemist to work on our particular problem. The problem sounds simple: How black is our black shale and how much variation is there in its blackness?

The black shale in question is a thin bed lying above Coal IIIA in Parke and Vermillion counties, Indiana, and in the last several years we have been endeavoring to learn about the conditions under which it was deposited. Since it contains an unprecedented number of exceedingly rare fossil sharks and armored fishes, beautifully preserved, we have been seeking to unravel the clues in the shale that might tell us how these extraordinary fishes came to live and to die where we now find their remains.

One of the most obvious clues to the vanished environment lies in the composition of the shale itself. It is black. The black is due to heavy carbon compounds, bitumens, derived from the partial decay of vegetation. We have long noticed that in the blackest layers are the most fossils, and we want to be able to chart this in detail so that we can say (if indeed this is so) that the quantity of fossils and fossil debris in a given level is in a definite proportion to the bitumen content of that level. If the proportion is definite, one conclusion may result regarding the environment; if it is variable, another conclusion may be forced on us.

Although this determination is of considerable interest and value in our work, it is not one of the major points, and we felt that we would not be justified in employing a high-priced chemical laboratory to analyze the bitumen content of the shale. Analysis of a single sample would cost in excess of $200 and we have more than a hundred specimens to be determined. So we have attempted to find our own answer.

The process has been long and perhaps roundabout, and a play-by-play description of it may serve to illustrate some of the problems that sometimes are behind an apparently simple scientific statement.

FIRST STEP: WEIGHT LOSS

First we attempted to measure the loss of weight when a sample of shale was ground to a fine dust and then heated to a temperature that would destroy the bitumens. The difference in weight before and after heating should have told us how much organic matter had been present. But the results were not encouraging, for the simple reason that some of the clay minerals in the shale also lost weight at the temperature we had to use. We then tried dissolving the bitumens from the finely ground shale, but found that none of the available solvents would remove them. So we abandoned the direct attack on the bitumens.

It then occurred to us that we could measure the opaqueness of the shale to X-rays. We knew from studying our X-ray pictures of the fossils that the bitumen in the shale was transparent to X-rays and the clay minerals were not. But on second thought we had to abandon this method too. For we remembered some chemical analyses that had been made for us at the University of Chicago that showed a notable amount of heavy elements present in the shale. Now the heavier an element is, the more opaque to X-rays it is, and we had in the shale variable amounts of such heavy atoms as ytterbium, tin, silver, and uranium. If the amount were the same in all levels of the shale, we could accept it as a constant with respect to the bitumens, but it was not.

Farewell, then, to the X-rays. Could we measure some other character of the shale that might give us a value for the bitumen content? We settled next on color and decided that if we could measure the darkness of the shale we would know its relative bitumen content in the 35 levels that we were investigating.

Thus began our search for darkness. We attempted first to photograph a set of small samples and to measure the relative density of the resulting photographic negative in the parts corresponding to each sample. But we could not be sure that the lighting was uniform, and in any case it was difficult to distinguish enough shades of gray to make a worthwhile chart.

At this point we discovered that the Museum's Division of Photography was using a very sensitive photoelectric cell for measuring the amount of light on the ground glass of a camera—a device known as a Densichron, which was lent to the Museum by John Maurer of Chicago. We borrowed the Densichron. Then it was necessary to obtain a uniformly bright vertical source of light. Again this was found in the Museum, an Ultrapak illuminator used by the Division of Insects for photographing microscopic beetles. And again an important piece of equipment was borne into the geology darkroom.

Meanwhile it was necessary to prepare the shale samples for examination. We could not trust the random reflections that might rise from a naturally broken surface of the shale, so we ground our samples with a fine carborundum powder on a plate-glass surface, producing a set of about a hundred small pieces of black shale with a uniform matte surface. Next, it was necessary to mount these samples so that they would lie horizontally under the Ultrapak illuminator. After several hours of manipulating, we finally had them all fastened temporarily on glass microscope slides, with the upper surface of the shale measured exactly parallel to the bottom of the slide.

REFLECTIONS MEASURED

Having mounted the photoelectric cell above the Ultrapak, shielding it from extraneous light with a camera bellows, we

(Continued on page 8, column 1)

"WHAT IS PRIMITIVE ART?"—ANSWER TOLD IN EXHIBIT

By PHILLIP H. LEWIS
ASSISTANT CURATOR OF PRIMITIVE ART

A SPECIAL exhibit entitled "What is Primitive Art?" will be shown in Stanley Field Hall from July 1 until the end of September. This exhibit will serve as an introduction to the increasingly popular field of primitive art by attempting to answer the title question.

In addition the exhibit shows the scope and quality of the huge art holdings of the Museum. Civilized societies, such as China, Egypt, and Rome, as well as the many primitive societies of the world are represented at the Museum. The great collections from North and South America, the enormous and excellent Melanesian collections, the Malaysian collections, including that from Madagascar, and the Cameroons and Benin collections from Africa form an aggregation of primitive art unequaled in most museums of the world.

NEW GUINEA ART
Wooden bench carved by artists of tribe living on the banks of Sepik River.

The exhibit defines art by comparing it with non-art. It also shows the distribution of the Museum's collections containing art, compares primitive art with the art of civilized societies, and deals with the dating of primitive art objects.

Primitive art is the art that is made and used by members of primitive societies. To understand this answer to the question "What is primitive art?" we must first define art (visual art, not music, literature, or the dance) and then explain what is meant by a primitive society.

ART ALWAYS HAS PURPOSE

An art object is first of all an artifact, which means that it is a product of conscious human design. Art is produced only by human beings—"chimpanzee art" notwithstanding. As products of conscious and deliberate design, art objects are therefore purposefully made. Only in civilized societies can anyone pretend that art objects have neither purpose nor function. Whenever it is possible to discover the meaning of primitive art objects, it is clear that they are useful. Therefore uselessness as a criterion for art is completely wrong—it would eliminate from consideration most of the art of the world.

It is the peculiar way in which art objects are made and used that points to an essential quality of art. An ax must have certain physical characteristics so that the implement can be grasped, held, and manipulated by human hands. A pottery vessel, to be used, must hold liquids and resist heat. The design of an art object—the imposition of physical form upon the material—is determined by one factor. Art functions by being *seen*.

Art, therefore, is, in part, a matter of shapes and surfaces that present visually apparent forms to human eyes. When such art forms are seen, they can communicate ideas, as in depicting real or supernatural beings, in recording historical events, and in commenting on real or imaginary happenings of life. Decorative art embellishes objects of everyday use, perhaps to bring magic protection or power to such objects by making visible to other men the fact that the object has magic qualities.

ART DEFINED

Art is the conscious design or elaboration of material objects that enables them to be used primarily by visual perception. Visual art has to be seen, and that necessity determines its form. Art objects must contrast with their physical surroundings. Their component lines, flat planes, solid volumes, colors, and textures must be arranged into rhythmic and harmonic compositions. These are elements of which systems of visual art have been made by *all* men in *all* known times.

There can be varying degrees to which the design of art objects succeeds. Craftsmanship and artistry vary among members of all human societies, among primitive as well as civilized ones. Thus there is good and bad art, just as there are well-made and poorly made tools. To make aesthetic judgments of primitive art objects we are faced with the considerable task of determining how well the visual design has succeeded in meeting the artist's intent, of knowing how well the design conforms to the traditional style, and, most important, of knowing how well the object functions in its social context.

Let us now consider the word "primitive" as applied to art. It has come to mean various things: an early period of art of a civilized society, or the work of supposedly naive artists who live in civilized societies, or the art of non-European civilized peoples.

PRIMITIVE SOCIETY

In anthropological use the word "primitive" refers to societies with a certain kind of social organization and way of life. When anthropologists speak of primitive societies we mean that these societies are small, intimate, isolated, self-contained, self-sufficient, and homogeneous. They have no writing and few or no political institutions. Primitive societies are held together by bonds of kinship and by the sharing of common traditions of thought and action. Specialization is rare in primitive societies. Except for the fact that there is work for women and for men and work for young and for old, everyone does much what everyone else does.

Artists in primitive societies stay at home, often just a few feet from where they were born. They work at their art when not engaged in subsistence tasks. They often work while being watched by other people, who do not hesitate to direct the progress of the work or to comment on what has been done. The sharing of traditional thought affects the primitive artist's treatment of his subject matter. The natural and supernatural environment that the artist pictures in his world is known to all. The problem of being original or different does not exist for primitive artists, except as one to be avoided. Everyone, including the artist, knows what the art ought to look like, and expects that it will indeed turn out that way.

ARTIST CONFORMS

The public for whom the primitive artist works is often comprised of his own relatives. He must meet their demands—they are his own kinsmen and must be treated as such. Revolt against a patron of art in a primitive society would be the same as disobedience of one's own father or uncle, who at the same time might be a chief or clan leader.

The isolation of primitive societies is such that outside influences rarely reach the artist. The organization of primitive societies is such that, if such influences do reach him, he probably would reject them. Changes in art styles in primitive societies thus proceed very slowly and by processes that are not apparent to the people. When strong foreign influences do intrude, they disrupt much of the society's activities, including the art. Under such circumstances, change can occur rapidly.

A very important difference between the art of primitive and of civilized societies is in the attitude of the people towards the idea of art. Only in civilized societies do there arise elaborations of art schools, art critics, art historians, art collectors, art museums, and the like—all, of course, are in addition to those almost forgotten creatures, the artists themselves.

In primitive societies there are but two divisions of artistic endeavor—the makers and the users of art. It frequently happens that one individual acts in both roles.

We can thus see that the differences between primitive art and the art of civilized societies lie in the social and cultural background of the art and in the places of geographic origin. Such differences are not readily apparent in the form of art objects. The art of the world must be classified into categories of the place of origin, kind of society, and function. Then it will be possible to deal more meaningfully with the familiar categories of technique and form. It is hoped that the exhibit "What is Primitive Art?" will serve as a start in that direction.

KARL P. SCHMIDT FUND COMMITTEE NAMED

The Karl P. Schmidt Fund (see March 1958 BULLETIN) has completed its permanent organization and the selection of its permanent committee, which includes Dr. Alfred E. Emerson of the University of Chicago, Harry G. Nelson of Roosevelt University, and Dr. Theodor Just, Dr. Rainer Zangerl, George I. Quimby, and D. Dwight Davis of the Museum staff. Dr. Robert F. Inger of the Museum staff has been selected as permanent chairman.

The permanent committee has the responsibility of awarding grants to aid naturalists who desire to visit Chicago Natural History Museum for study. The committee has turned over $4,900 to the Museum for investment, but grants will be made at the sole discretion of the committee.

To date approximately 300 persons and a few institutions have contributed to the fund in memory of the late Dr. Schmidt. Noteworthy among the latter is a contribution from the Institut des Parcs Nationaux du Congo Belge.

Contributions in honor of Dr. Schmidt may be addressed to The Karl P. Schmidt Fund in care of the Museum.

ABUNDANCE OF ANIMALS DEFIES CALCULATION

BY AUSTIN L. RAND
CHIEF CURATOR OF ZOOLOGY

I DOUBT that anyone has been bold enough to guess how many individual animals there are in the world. And if they have, the total number would be so large as to be meaningless. Not only mammals (animals in the vernacular) but fishes, frogs, birds, worms, crabs, insects, sponges, jellyfish, starfish, and amoebas are animals, too. And there are a great many more of those of tiny or microscopic size than the few larger ones we see in a day in the country. For example, many millions of animals of various sizes, and perhaps three times as many plants have been estimated to live in the soil of an acre of meadowland in the eastern United States. In the sea, animal life is still richer. In a quart of sea water, there may be one million one-celled animals and plants, perhaps one-quarter of them animals.

Among the protozoans, or one-celled animals, most of which are microscopic, is Euglena, scarcely visible to the naked eye. Yet it may be abundant enough to color the water of a pond green. Other species can tinge glaciers pink, cause red snow, and help make sea water red. Other protozoans may cause the phosphorescence that lights the oceans's surface at night.

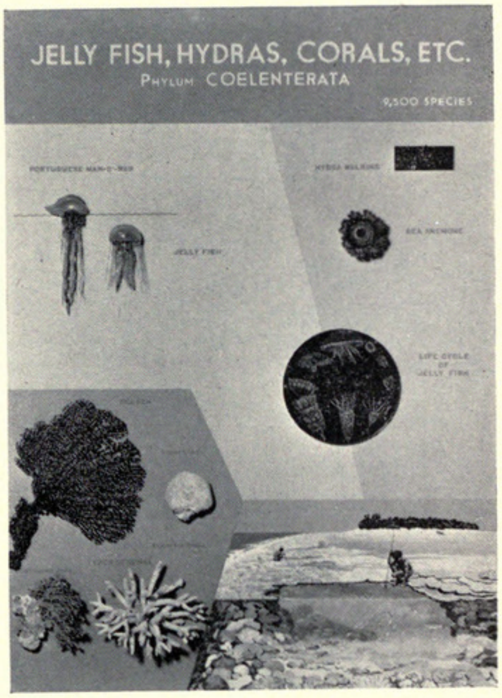
Tiny shelled-amoeba, such as foraminifera, are so abundant in the sea's surface water that the shells of the dead animals falling to the bottom have covered a large part of the ocean depths with ooze. The bulk of these shells that has accumulated over the years is nowhere more apparent than in the white cliffs of Dover and the 1,000-foot thick chalk deposits of Mississippi and Georgia, which are composed entirely of the remains of these creatures.

PARASITES BY THE BILLION

The abundance of microscopic one-celled parasites is illustrated by the one that causes malaria. It is introduced into the human blood stream by a mosquito whose salivary glands may contain 200,000 parasites. In a man's blood they feed on the red blood corpuscles and multiply until there are 40,000 of them in a cubic millimeter (there are about 25 millimeters to an inch) of the victim's blood (and a man has about five quarts of blood). There is another protozoan of the order *Spirotricha* that lives in the digestive system of cows, and it is estimated there may be as many as 50 billion of them in a single animal.

Sponges do not seem so impressive in density of population. But an interesting numerical note is sounded by the numbers of other animals that lived in the crevices and canals of one sponge, about a yard across, that came from Florida waters. It harbored some 17,120 other animals, including a number of fishes.

Perhaps none of the living animals are quite as impressive in their massed abundance (aggregate bulk) as the coral (Coelenterates, relatives of jellyfish and sea anemones). This is seen in the reefs they build—coral reefs that are composed of the living skeletons of certain small kinds of polyps, as this type of coelenterates is called. The most famous reef of this sort is the Great Barrier Reef of Australia that stretches for more than 1,000 miles along the east coast of Australia and extends scores of miles off shore in places. On the west coast of Madagascar is another, where I've sailed for days



CORALS AND THEIR RELATIVES
One of the panels in "Synopsis of the Animal Kingdom." Tiny coral animals may be so abundant that their skeletons form reefs extending a thousand miles, as in the Great Barrier Reef of Australia, a section of which is shown in the exhibit.

inside the reef. The reef-building corals are all inhabitants of warm, shallow seas, and it is off our Carolina coast, in Bermuda, that the farthest north of these reefs exist.

Some worm-like animals of diverse sorts are parasitic and have a tremendous reproductive potential: a liver fluke may produce a half-million eggs; a large female roundworm that parasites humans may contain 27 million eggs. The complicated life histories of some of these parasites, with transfers from host to host and development in more than one kind of animal, undoubtedly result in the loss of most of them. But that they can still be very numerous is indicated by a species of roundworm which exists at one stage in swine; an ounce of heavily infected sausage may contain 100,000 of their encysted larvae. The minute free-living roundworms of the soil may reach 3 billion in the upper part of an acre of ground.

The most familiar of the worm-like animals is probably the earthworm, which may exist in tens of thousands to the acre, and whose activities in loosening and fertilizing the soil may improve its crop potentialities greatly. Among the arthropods, the insects on the land and various crustaceans in the sea are obviously abundant. You only have to think of the swarms of mosquitoes that rise as you walk through a swamp, the fireflies that rise from a field of ripening wheat on a summer evening, the lacewings feebly fluttering above an alfalfa field like a shimmering mist at sunset, the swarms of flying ants, or of the grasshoppers (or locusts) that devastate crops in eastern Asia or in our American west.

In California in winter, two people can collect 50 to 100 pounds of massed hibernating ladybird beetles in a day—a collection that would probably contain 1 to 2½ million ladybirds. A hive of bees in summer may contain 60,000 bees. It may be necessary to unwind 25,000 cocoons to get one pound of silk thread.

NUMBERLESS CRUSTACEANS

On some tropical mud beaches, and in mangrove swamps the crabs may be the conspicuous and common animals in sight. But the crustaceans of the plankton in the open ocean are in more enormous numbers. The copeopods, that feed on microscopic floating plants and are themselves only a small fraction of an inch long, are so abundant that the whalebone whale (which may reach a length of 100 feet) feeds on them, straining them out of the water with its baleen-fringed mouth. It is said that two tons of tiny copeopods were found in the stomach of a large blue whale.

Mollusks may lie side by side on a shallow sea bottom or buried in the bottom. On some Florida west coast beaches, if you make a scratch in the sand where the waves are breaking, the little coquina clams will simply pour out into the retreating wave. On the bottom of the North Sea there are miles of banks where 1,000 to 8,000 bivalve mollusks per square yard are estimated. On oyster beds as many as 400 to 500 million oysters have been harvested annually from a bay with an area of about 60 square miles. In the stomach of a fish about 35,000 small snails have been found.

The echinoderms are of moderate size, so one wouldn't expect the great numbers you find in smaller animals. But crinoids (sea-lilies) are common enough that a dredge has brought up, in one haul, 10,000 of them, and the brittle stars are sometimes as abundant as 18 to the square foot in some places on the ocean bottoms.

The fishes are probably the most numerous vertebrates. Standing on a Lake Michigan pier I've seen the emerald shiner pass in what seemed endless schools. Perhaps no fishes in the sea are caught in such numbers as the herring. One fishing boat may catch a million in a day. In northern and western Europe an estimated 7½ billion herring have been taken in a year.

Mammals are sometimes extremely conspicuous parts of the scenery as were the big game animals of the east African savannas. In America the herds of bison were once impressive. Now, especially in our western parks, herds of elk and in a few places bison can still be seen. But it is the smaller mammals that are actually more common. Red-backed mice of the spruce and pine forests have been estimated at 16,000 per square mile; and meadow mice at 70,000 per square mile.

SEVEN BILLION BIRDS IN U.S.

There are places in North America where water fowl congregate, and it is possible to see a million birds at once on the California wintering grounds, or the great Bear Lake marshes. But over much of our country the breeding bird population is only about two pair of birds per acre or perhaps 7 billion birds in the United States. By contrast there are only between two and three dozen whooping cranes left alive, and probably between 1,000 and 2,000 trumpeter swans.

I've tried to refrain from hyperbole, from adjectives which would lose their force by repetition in writing of animal numbers. When we discuss the actual numbers of microscopic and very small animals they are so great that their numbers actually surpass those of the leaves of the trees, of the blades of grass, and perhaps of the grains of sand.

As a general rule we can say that small animals tend to be more abundant than large ones. Space and food that can support one cow will support six sheep, many more rabbits, still more meadow mice, and still more grasshoppers along with still smaller things such as angleworms, roundworms, and protozoans in the soil. Predators must be less common than their prey species and are usually larger, as robins are larger than angleworms, or foxes than mice. Internal parasites are obviously smaller than their hosts, and often very much smaller as well as very much more numerous.

When we go into the countryside near Chicago, the plants, the grasses, and the trees are the obviously abundant living things, no matter how common swarming black birds, grasshoppers or mosquitoes may be. How different it is on a coral reef. In these beautiful sea gardens the corals form the substratum, with sponges, crustaceans, and fishes everywhere. Nowhere on the globe is animal life more obviously abundant.

In closing, let us remember that an acre of meadow may have a total population of animals, of various kinds and mostly very small, much more numerous than the human population of Chicago.

If your Museum visit coincides with lunchtime, don't forget there is a cafeteria, open from 11 A.M. to 2 P.M.

RADAR MAY BECOME BIRD-STUDY TOOL

The "spurious echoes" now called "angels" that began to plague the operators of radar sets as they became more powerful are now regarded as caused by birds. This was first demonstrated in 1941 in Britain, but most physicists continued to believe that "clouds of ions" were responsible. Security considerations restricted the exchange of information for some years. The facts have been rediscovered independently several times during the past few years, in Britain and Switzerland, and the evidence seems incontrovertible.

The use of radar equipment as a new tool for studying bird migration opens wonderful new vistas. Where knowledge of actual volume, height, direction, and speed of night migration has been limited to observations through telescopes trained on the moon or to deductions from deaths at radio towers, we may now get data from ornithologists watching migration on radar tubes.

Ibis, 1958

STAFF NOTES

An honorary degree of doctor of laws was conferred on **Dr. Clifford C. Gregg,** Director, on June 6 by the University of Cincinnati (of which he is a graduate). . . . **Dr. Sharat K. Roy,** Chief Curator of Geology, who since last September has been conducting a research project on meteorite collections in foreign museums, under the joint auspices of the National Science Foundation and the Museum, has completed his work in London, Paris, and Calcutta. He will next proceed to Vienna, Frankfort, and Helsinki, and possibly to Moscow and Leningrad. . . . **Henry S. Dybas,** Associate Curator of Insects, is engaged in field work in southern Illinois. . . . **Dr. Alan Solem,** Assistant Curator of Lower Invertebrates, has begun a survey of collections in mid-western museums. . . . **Dr. Robert H. Denison,** Curator of Fossil Fishes, recently lectured at a seminar on evolution at the University of Illinois and also at a seminar on paleoecology at the University of Chicago. . . . **William D. Turnbull,** Assistant Curator of Fossil Mammals, recently lectured at the University of Illinois. . . . **D. Dwight Davis,** Curator of Vertebrate Anatomy, **Philip Hershkovitz,** Curator of Mammals, and **Miss Sophie Andris,** Osteologist, attended the annual meeting of the American Society of Mammalogists in Tucson, Arizona. . . . **J. Francis Macbride,** Curator of Peruvian Botany, was made an Honorary Professor of the University of San Marcos during the recent South American Botanical Congress in Lima, Peru. . . . **D. S. Rabor,** Field Associate in Zoology, has been named Associate in the Division of Birds.

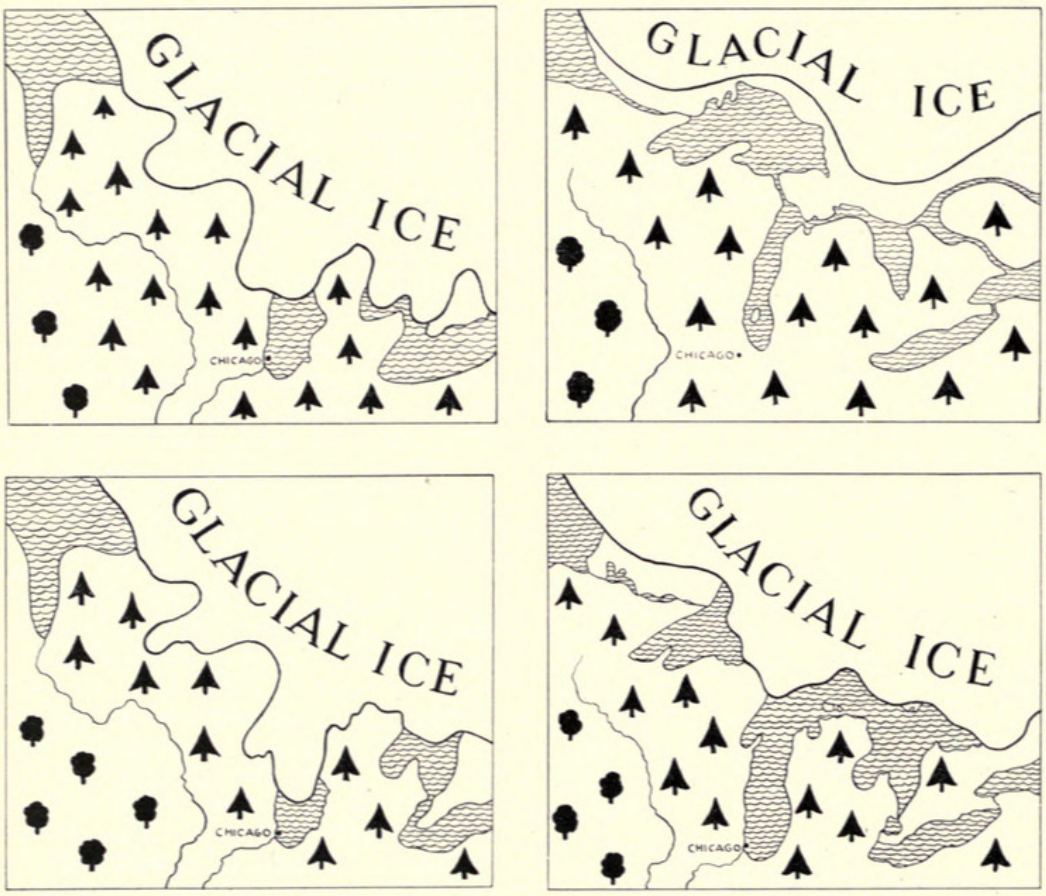
MASTODONS AND MEN IN THE UPPER GREAT LAKES AREA

By GEORGE I. QUIMBY
CURATOR OF NORTH AMERICAN ARCHAEOLOGY AND ETHNOLOGY

WHO were the first settlers of the Upper Great Lakes region? At the present time direct archaeological evidence is lacking. Nevertheless, as will be shown subsequently, a good circumstantial case can be constructed by using evidence from fields of natural history.

The first settlers in the Upper Great Lakes area probably were the Paleo-Indians who hunted mastodons and used spears pointed with fluted blades of chipped stone.

Fluted points are unique and easily recognized because they have longitudinal grooves or channels. There are several varieties of fluted points.



Maps by Gustaf Dalstrom

CHANGING ENVIRONMENT OF PALEO-INDIANS

Upper left: region at about 10,000 B.C. during retreat of glacier and at end of Glenwood stage of glacial Lake Chicago. Upper right: region at about 9500 B.C. during retreat of glacier and Bowmanville low-water stage. Lower left: region at about 9000 B.C. during advance of glacier and the Calumet stage of glacial Lake Chicago. Lower right: region from about 8000 B.C. to 7000 B.C. during glacial Lake Algonquin.

Clovis fluted points are the type most commonly found in the Upper Great Lakes region. They are lanceolate points with parallel or slightly convex sides and concave bases. They range in length from one and one-half to about six inches. The longitudinal flutes or grooves sometimes extend almost the full length of the point but usually no more than half-way from base to tip. The flutes are most often produced by the removal of multiple flakes. Most Clovis points are fluted on both faces, but some are fluted on only one face. Generally the basal parts of fluted points have been dulled and smoothed by some sort of grinding.

USED TO HUNT MAMMOTHS

In the West, Clovis fluted points were used by Paleo-Indians who hunted mammoths (elephants) that lived in the lush grasslands that prevailed long ago in that region. There is some evidence indicating that the western Clovis points belong to a period older than 8000 B.C., and many archaeologists have assumed that the fluted points found in the eastern half of North America are as old as those found in the West.

Although large numbers of fluted points have been found in the eastern portions of the United States, there are very few known sites and these have not yet been radiocarbon-dated.

Upwards of 200 fluted points have been found in the Upper Great Lakes region. Unfortunately no sites attributable to the Paleo-Indians who used these points have been discovered so far. All of these points were surface finds.

Fortunately the distribution of these fluted points and the specific places they were found can be related to radiocarbon-dated geological events in such a way as to provide a generally dated period during which the Paleo-Indian makers of these fluted points lived.

For instance, where certain areas were covered by glacial ice or by waters of a glacial lake, they were inaccessible to Paleo-Indians. These first settlers could only have lived and hunted in regions available to them. Local areas of the Upper Great Lakes did become available to these Paleo-Indians as the ice retreated and the glacial lake waters receded. And by knowing where these first Paleo-Indians were and were not, it is possible to estimate the period during which they lived and hunted in the region.

AFTER 10,000 B.C.

Fluted points have never been found in Michigan north of the Port Huron Moraine, a system of glacial deposits that indicates the front of the glacial ice as late as about 10,000 B.C. So the Paleo-Indians who used fluted points could have been and presumably were inhabiting available areas south of the glacial ice at this time.

Some fluted points have been found in places on an old bed (Glenwood stage) of glacial Lake Chicago that was in existence until about 10,000 B.C. Therefore these particular points were left there some time after 10,000 B.C.

Other fluted points have been found in Wisconsin north of the southern limits of Valders till, reddish clay glacial deposits that were left by melting ice about 9000 B.C. These points could not have been placed where they were found until some time after the retreat of the Valders glacier. Therefore they date from a time later than about 9000 B.C.

One fluted point was found on an old bed (Calumet stage) of glacial Lake Chicago that

BIG GAME OF EARLY HUNTERS

Mastodons, now long extinct, were contemporary with Upper Great Lakes Paleo-Indians and undoubtedly were hunted by the early tribesmen. The photograph shows a restoration in a mural painting by Charles R. Knight. It is one of a series in Ernest R. Graham Hall of Historical Geology (Hall 38).

was coeval with the Valders glacier of 9000 B.C. This point, therefore, would have reached the spot where it was found some time after about 9000 B.C.

Some fluted points found on the old bed of later Lake Oshkosh, a glacial lake in Wisconsin formed by the retreating Valders glacier, must have been deposited after about 8500 B.C., the approximate terminal date of later Lake Oshkosh.

No fluted points have been found on the old bed of glacial Lake Algonquin, but fluted points have been found on the landward side

CHICAGO-AREA ARTIFACT

Fluted spearpoint of chipped flint from Great Lakes area near site of Chicago. The point is probably more than 9,000 years old. It is two and one-quarter inches long and typical of its genre.

of fossil beaches of this glacial lake. Since the Lake Algonquin stage was terminated about 7500 or 7000 B.C., fluted points must be earlier than this date.

ERA OF MASTODONS

The distribution of these fluted points and their relationships to radiocarbon-dated geological events as well as evidence gleaned elsewhere, indicates that the Paleo-Indians who used fluted points were in the Upper Great Lakes region in the period from about 10,000 B.C. to about 7500 or 7000 B.C. This is also the period in which mastodons were most abundant in the region.

Mastodons, like mammoths, were members of the elephant family and are now extinct. Those in the Upper Great Lakes area were similar in size and appearance to modern Indian elephants but lower and longer in relative proportions, and probably were hairy. Mastodons, unlike mammoths, were browsers. They ate leaves, stems, and twigs. They lived in forests and seem to have been most concentrated around swamps and the lowland areas near streams, rivers, and lakes.

The distribution of mastodon remains in the Upper Great Lakes Area indicates that they are all more recent than the maximum of the last glacial period. Some mastodon remains have been found in deposits on top of an old lake bed (Glenwood stage) of glacial Lake Chicago that was abandoned about 10,000 B.C. Such mastodon remains, being in place on top of the old lake bed, must date from a period more recent than 10,000 B.C.

Other mastodon remains have been found on top of a later bed of glacial Lake Chicago (Calumet stage) that was abandoned slightly after 9000 B.C. These particular mastodon remains, therefore, must represent mastodons that were living some time after 9000 B.C.

FOSSILS RADIOCARBON-DATED

Three fossil mastodons found in or near the Upper Great Lakes region have been radiocarbon-dated by the University of Michigan. One of these found in Noble County, Indiana, had a radiocarbon date of 10,676 B.C., another from Madison County, Ohio, has a date of 7645 B.C., and one from Lenawee County, Michigan, had a radiocarbon date of 7613 B.C.

Thus the evidence from distribution and geological situation as well as radiocarbon dates shows that mastodons lived in the Upper Great Lakes region during the period from about 10,000 B.C. to 7500 B.C. or 7000 B.C., the same period during which lived the Paleo-Indians who used fluted points.

Despite the lack of direct evidence, these Paleo-Indians who used fluted points must have been elephant (mastodon) hunters. The western Paleo-Indians who used fluted points were elephant (mammoth) hunters par excellence and it seems inconceivable that similar Paleo-Indians dwelling in the Upper Great Lakes during the time of the mastodons would not also be elephant hunters. Consequently it looks as if the first settlers of the Upper Great Lakes, the Paleo-Indians who used fluted points, were mastodon hunters.

These Paleo-Indians made their living by hunting. Among the animals available to them were not only the mastodons but also the giant beavers, deer, elk, and caribou.

NOMADIC TRIBES

The first settlers of the Upper Great Lakes were nomadic by necessity. In order to obtain food, shelter, and clothing by hunting, they would have had to range over wide areas of the region. Their shelters probably were made of sapling poles covered with bark or skins. They wore clothing made of animal skins and made tools and weapons of chipped stone and probably bone and wood. Nothing is yet known of their burial customs or of their physical appearance because no skeletal remains have been found.

What is known of their culture and habitat suggests that these Paleo-Indians were socially organized in small bands and that political and religious institutions were lacking. Probably they possessed simple religious ideas based upon awe of nature, attempts to control their luck in hunting, and philosophical adjustment to their habitat.

ENVIRONMENTAL FACTORS

At the time these Paleo-Indians lived in the Upper Great Lakes region the environment was much different from what it has been in recent times. A large continental-type glacier was present in the region throughout the period. This glacier, in retreat at about 10,000 B.C., advanced southward at about 9000 B.C. and then retreated northward leaving the northeast shore of Lake Superior about 7000 B.C.

The Lake Michigan and Lake Huron basins at first had high water-levels. In the Lake Michigan basin the surface water was 60 feet above its present level. With retreat of the glacier, low eastern outlets became available and the water levels in the lake basins were lowered some hundreds of feet by drainage. Then with the advance of the glacier and the subsequent closing of the low eastern outlets by ice, the water levels rose again. In the Lake Michigan basin the surface water stood 40 feet above its present level. During the final retreat of the glacier the surface water-levels in the Huron and Michigan basins became stabilized for a long time at a level 25 feet above the present one.

The climate was colder and moister than that of modern times. The forests were dominated by spruce and fir trees. The animals that lived in the forests included the mastodons, giant beavers, deer, elk, and caribou. In the Lake Huron basin there seemed to have been whales and walruses, probably in very small numbers.

ADVENT OF WARMER CLIMATE

By the end of the period, about 7000 B.C., the climate was getting warmer. The continental glacier was retreating rapidly and the spruce-fir forest was waning as pine trees advanced their hold over the land. The mastodons were disappearing, too, either becoming extinct or moving northward in decreased numbers.

With the disappearance of the spruce-fir forests and mastodons, fluted points also disappeared. Perhaps some of the Paleo-Indians who used fluted points went northward following the spruce-fir forest and the dwindling supply of mastodons. Others remaining in their old areas underwent cultural change in response to changes of habitat and the arrival of other Paleo-Indians with a different technological tradition.

Whatever the cause, the cultural stage based on fluted points, mastodons, and spruce-fir forest ended by about 7000 B.C. and was succeeded by the Aqua-Plano cultural stage of Paleo-Indians in the Upper Great Lakes region.

De-salting Nasal Gland

The nasal gland of cormorants acts as an accessory kidney, and is important in excreting salt from the body, according to experimenters from Duke University. This function of the gland in birds is unique among higher vertebrates. It may be an adaptation for cormorants living on the edge of the sea, where they are said to drink salt water.

—*American Journal of Physiology, 1958*

2 LECTURE-TOURS DAILY IN JULY AND AUGUST

Morning guide-lecture tours, as well as the usual daily afternoon tours, will be given during July and August. There will be no tours on Saturdays or Sundays (or on July 4), but the Museum will welcome visitors on those days during the regular hours, 9 A.M. to 6 P.M.

The morning tours, at 11 o'clock, will be devoted, except on Thursdays, to the exhibits of a single department. All the afternoon tours, at 2 o'clock, and also the 11 o'clock tour on Thursday mornings, will include outstanding exhibits in all departments. Lecturers of the Raymond Foundation staff conduct the tours. Following is the schedule for each week during July and August:

Mondays: 11 A.M.—The World of Plants
2 P.M.—Highlights of the Exhibits

Tuesdays: 11 A.M.—The Earth's Story
2 P.M.—Highlights of the Exhibits

Wednesdays: 11 A.M.—The Animal Kingdom
2 P.M.—Highlights of the Exhibits

Thursdays: 11 A.M. and 2 P.M.—Highlights of the Exhibits

Fridays: 11 A.M.—People and Places
2 P.M.—Highlights of the Exhibits

Museum a Summer Spot for All Children

With the closing on June 27 of Chicago public schools, the Museum issued its annual invitation to children and parents to use its facilities during the long summer vacation. Dr. Clifford C. Gregg, Director, calls the attention of fathers and mothers to the Museum as a safe, cool, and absorbingly interesting haven where children may visit for a few hours or for a whole day.

The forty-nine large exhibition halls offer a world to discover and explore. Indians, dinosaurs, strange animals and plants, mummies, and countless other things provide endless adventure for active minds. Admission to the Museum is always free to children, and there is ample material to occupy them for as many Museum visits as they can make.

PURSUIT OF DARKNESS—

(Continued from page 2)

then measured and recorded the amount of reflection of the standard illumination from the various prepared surfaces. This was somewhat complicated by casual variations in the city electrical voltage and by a fairly rapid "aging" of the light bulb in the Ultrapak when it was freshly installed. But by adjusting the light meter and by frequently referring to a block of standard blackness, we finally developed a chart of the darkness of the shale.

As we expected, the darkness is significant. We are still exploring the conclusions that may be drawn from comparing it with the amount of fossil debris in our many levels of black shale, but we have come to some tentative conclusions that promise to be very helpful. Using the darkness curve in combination with other data that we have accumulated in the laboratory and in the field, we think that it may be possible to say how long it took to deposit the shale, when there were periods of high and of low water, and what the biological condition of the muddy sea-bottom may have been at various times during the deposition.

In this case, we feel that a search for darkness has helped us to cast some light on a difficult aspect of our total problem.

NEW MEMBERS

(May 16 to June 15)

Life Members

Tappan Gregory, Mrs. Frank P. Hixon, Lester B. Knight

Associate Members

John D. Andersen, Dr. Robert W. Carton, Clarence T. Gregg, Mrs. Robert Hixon, George S. Isham, Mrs. Edward Boylston Lanman, Creighton S. Miller, Edward A. Mosher, Dr. Paul J. Patchen, Alfred B. Solomon, Dr. Sol Tax, Dr. John T. Wegrzyn, Mrs. Ernest B. Zeisler, Russell A. Zimmermann

Sustaining Member

Eric Bender

Annual Members

Varian B. Adams, Eugene M. Adler, Miss Lilace Reid Barnes, Charles J. Barnhill, Carl J. Bohne, Jr., Leonard R. Capuli, Raymond W. Clifton, E. T. Collinsworth, Jr., Charles M. Fallon, Norman E. Heyne, Ralph Holmes, Miss Martha Imes, William E. James, James H. Jarrell, Ernest L. Johnson, Karl S. Kiszely, Jr., Henry B. Kreer, Glen E. Massnick, Andrew McNally III, Clarence Mohr, Mrs. F. M. O'Callaghan, O. Earl Palmer, A. B. Rand, Norbert G. Rennicke, George S. Rieg, Owen Rogers, Frank B. Sanders, Elroy C. Sandquist, Jr., Percy Sawyer, Gilbert H. Scribner, Jr., Charles M. Stafford, A. O. Turek, A. W. Vaughan, Jr., Mrs. Willoughby G. Walling, John Wielgus, Grant H. Wier, Albert D. Williams, George H. White, Philip J. Wood

GIFTS TO THE MUSEUM

Following is a list of the principal gifts received during the past month:

Department of Anthropology

From: H. Otley Beyer, Manila—stone implements, Philippine Islands; E. D. Hester, Chicago—3 stone implements; Dr. Fred Eggan and E. D. Hester, Chicago—sherds, Thailand; E. J. Grumbecker, Chicago—modern Japanese sword and sheath, Japan

Department of Botany

From: Holly Reed Bennett, Chicago—230 phanerogams, Montana; Florida State University, Tallahassee—40 phanerogams; Dr. E. E. Sherff, Hastings, Mich.—33 phanerogams, Hawaii, and 32 herbarium specimens, Arkansas; Dr. Alfred Traverse, Houston, Texas—313 phanerogams

Department of Zoology

From: C. E. Dawson, Wadmalaw Id., S. C.—one sea-snake, Persian Gulf; Sgt. Edward Fobes, Chicago—collection of marine shells; Harry Hoogstraal, Cairo, Egypt—80 mammals; A. Lindar, Chicago—2 landsnails, Haiti; J. I. Menzies, London—77 frogs, Sierra Leone; Dr. William W. Milstead, Lubbock, Texas—23 frogs, Brazil and Argentina; Dr. Jeanne S. Schwengel, Scarsdale, N. Y.—collection of shells; Miss Nancy Traylor, Winnetka, Ill.—cottontail rabbit; U. S. Fish and Wildlife Service, Brunswick, Ga.—2 fish specimens; Vernon L. Wesby, Chicago—a fish specimen, Alaska

MOVIES FOR CHILDREN ON 6 THURSDAYS

Children are invited to six free programs of color motion-pictures to be presented by Raymond Foundation in James Simpson Theatre of the Museum on six Thursday mornings in July and August. The series will open on July 10. There will be two showings of each program, the first at 10 and the second at 11 or 11:15 (see schedule below). No tickets are needed. Children may come alone, accompanied by parents or other adults, or in organized groups. Following are the dates and titles:

July 10—THE LIVING DESERT
(10 and 11:15 a.m.)
One of Disney's "True-Life Adventure" movies *(repeated by request)*

July 17—SINBAD THE SAILOR
(10 and 11 a.m.)
The adventures of Sinbad, the beggar boy of Baghdad
Also a cartoon

July 24—DUMBO *(10 and 11:15 a.m.)*
Disney's story of a baby circus-elephant *(repeated by request)*

July 31—BEAR COUNTRY *(10 and 11 a.m.)*
One of Disney's "True-Life Adventure" movies *(repeated by request)*
Also a cartoon

August 7—A TRIP TO THE MOON
(for older children)
(10 and 11:15 a.m.)
Also a cartoon

August 14—VACATION SPECIAL
(10 and 11 a.m.)
Vacation fun in your own backyard and in the wilderness
Also a cartoon

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