

HOW OLD ARE FOSSILS? ROCKS REVEAL SECRETS

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ASTRONOMERS, GEOLOGISTS, and the U. S. Congress share a preoccupation with larger numbers than the average man has occasion to worry about and should be prepared to explain why their numbers have to be so big. Some time ago, the Museum published a popular handbook under the title, *How Old Are Fossils*, by

up to ground level: Channahon limestone, Kankakee limestone, Rockdale dolomite, Joliet dolomite, Bellwood dolomite, Racine dolomite, Port Byron dolomite. The fossils in each bed are somewhat different from their relatives above and below, indicating the evolutionary changes during the forming of the rocks.

However, a rough separation between the two limestones at the bottom and the five

ago; the Tertiary period began 60,000,000 years ago; the Cretaceous period began 140,000,000 years ago . . . the imposing dates roll back through fantastic stretches of time to the beginning of the earth itself, estimated at one to three billion years ago.

How is this possible? How can time have endured so long? How do you know? Naturally, such estimates shock some visitors, and of course some won't believe them.

RADIOACTIVITY GIVES ANSWER

In the geologic calendar exhibit there is space for only a brief explanation:

"Radioactive elements occur in the minerals of many rocks. The disintegration of their atoms, unaffected by heat, pressure, or any other conditions, produces atoms of lead. Chemists, knowing the rate of atomic decay and measuring the relative amounts of the lead and the parent element, have determined the age in years of rocks in many parts of the world. The age of other rocks is estimated from their geological relation with those of known age."

The determination of geologic age is one of the by-products of the investigation of the properties of radioactivity. Since the discovery of the phenomenon in 1896, many chemists and physicists have examined it in pursuing "pure science." As a result, geologists and paleontologists have acquired a wealth of information on which to draw. This is periodically summarized and made available by a Committee on the Age of the Earth, appointed by the National Research Council, and, indeed, certain rock analyses are now made for the express purpose of providing geologic age data. It is a complicated process: several different varieties of radioactive elements commonly occur together, disintegrating at different rates to form helium and different kinds of lead; the amounts of the elements present in a sample of mineral or rock are exceedingly minute; lead or uranium may have been added to or subtracted from the sample by underground water during the geologic past.

From time to time, with the refinement of technique, there have been many revisions of these results, each revision bringing us an enlarged estimate of the length of geologic time. But now it appears that the technique has about caught up with the intricacies of the problem and that future revisions will be minor.

DATING OF FOSSILS

The best age determinations now rest on analyses of mineral crystals contained in certain coarse-grained igneous rocks. How, then, can the age of fossils be estimated? Fossils, of course, are found almost exclusively in sedimentary rocks.

Sedimentary rocks are those formed by the settling of countless individual grains or



CHICAGOANS OF 365 MILLION YEARS AGO

The scene is not a flood after a heavy March rain. At the time reproduced in this habitat group in the Hall of Invertebrate Fossils (Hall 37) the land on which Chicago is now built had not yet risen from the sea. In fact, the bedrock beneath the city was still being formed by tiny grains of limy mud settling to the bottom of a shallow sea where the animal life shown here—cephalopods, cystoids, trilobites, and other creatures—lived in reef-like communities.

Sharat K. Roy, Chief Curator of Geology, explaining how geologists determine ages of millions of years for the earth's extinct plants and animals. Astronomers frequently publish clear accounts for the layman, showing why they have to work with billions of miles. And Congress—

But let us return to the fossils. Unfortunately, Dr. Roy's booklet is out of print; it will some day be revised with reference to the fossil exhibits in Frederick J. V. Skiff Hall (Hall 37) and Ernest R. Graham Hall (Hall 38) that are new since it was written. In the meantime it may not be amiss to anticipate some of its information for our readers.

Since the earliest scientific study of fossils, it has been abundantly shown that the fossils in successive beds of sedimentary rocks are different from those in higher or lower layers but similar to those in matching beds even some distance away. At any one place, the sedimentary record is incomplete. For example, in northeastern Illinois, the succession of formations runs, as seen in part in the wall of a quarry, going from the floor

dolomites above indicates that some beds are missing and that the story is incomplete. Therefore we search elsewhere for beds of the missing age and find in a dolomite in eastern Wisconsin some fossils similar to those in the Rockdale dolomite, with beds called Hendricks dolomite, Byron dolomite, and Mayville dolomite beneath. Looking further, we find in the northern peninsula of Michigan not only these three new beds of dolomite but also, lying smoothly beneath them, a bed called the Manitoulin dolomite, whose fossils show that it is of the same age as the Kankakee limestone here at home. Thus, in a roundabout way, the complete geologic record is unraveled and the succession of fossils made known. But though we can call all of these fossils "Silurian" in age and though we know their relative order within the Silurian period, we still haven't found out how old they are in years.

An exhibit in Hall 37 (Fossil Plants and Invertebrates) placed in duplicate at each end of the hall gives the calendar of geologic periods, with their duration in years. The Quaternary period began 1,000,000 years

particles upon a pre-existing surface. If that surface happens to be composed of a dated igneous rock, we can say only that the sedimentary rock is younger. And if the igneous rock is one that at some time in the past has penetrated a crack in a sedimentary one and there solidified, we can say that the sedimentary rock is older. If, then, a sample can be taken from an igneous body that cuts a sedimentary layer and is in turn overlain by another sedimentary layer, and if those layers contain fossils not widely separated in the known sequence of relative age, a date becomes available for transfer to the calendar of geologic periods.

At present, only a few points in the geologic time scale have been so neatly pinpointed, but those, combined with many radioactive dates quoted as "earlier than" or "later than" some point in the procession, have enabled us to record dates on the exhibits of fossils. While these dates may be subject to some revision as further information becomes available, the amount of change is not likely to be appreciable.

FOSSIL COLLECTORS BACK FROM TEXAS FIELD

The 1952 Texas Paleontological Expedition, continuing a collecting project that has been under way during two previous years, has returned to the Museum. The collectors, Chief Preparator Orville L. Gilpin and Preparator William D. Turnbull, brought back material that is expected to yield further specimens of several extinct orders of primitive mammals for addition to the collections obtained earlier.

This project had its origin in the fortunate discovery in 1949 near Forestburg in northern Texas of mammalian remains of Early Cretaceous age (about 125 million years ago) by Dr. Robert H. Denison, Curator of Fossil Fishes, and Dr. Rainer Zangerl, Curator of Fossil Reptiles. Collecting was undertaken in both 1950 and 1951 by Bryan Patterson, Curator of Fossil Mammals, who is studying and describing the mammalian remains.

The significance of this discovery becomes apparent when it is realized that in all the world only some half-dozen mammals of Early Cretaceous age had previously been found. Now, after intensive field and laboratory work in 1950 and 1951, the Museum may well be proud of a collection of more than 125 pieces of remains of tiny mammals from this Texas deposit. The specimens consist primarily of teeth, microscopic in size, many of which are fragmentary. In addition to the mammals, remains of turtles, dinosaurs, crocodiles, frogs, and fishes occur.

At least four mammalian orders are represented. The most abundant among these are triconodonts and multituberculates, extinct primitive mammals of small size only distantly related to modern mammalian

forms. Of greater importance, however, because they are more closely allied to most groups of later mammals, are the much rarer symmetrodonts and the representatives of a new order of mammals, as yet unnamed, related to the pantotheres. Thus, in terms of understanding early mammalian evolution, the value of the Museum's remarkable collection cannot be overestimated.

This year's collecting trip to Forestburg, like those of the previous years, was carried on in co-operation with Texas Memorial Museum. Chief Preparator Gilpin and Preparator Turnbull spent six weeks in the field and about one week in reconnaissance work in the eastern extension of the same Early Cretaceous formation in Oklahoma and Arkansas, but no promising areas were discovered there.

A somewhat unusual method has proved successful in these loosely consolidated sands. The "bone level" is dug out and separated from the remaining sediments; it is then washed through sieves to concentrate the fragments of bone, teeth, and fish scales. The washing process involves two steps. The first is the field operation that serves to eliminate nearly all of the sand and clay (a ton of the original matrix is reduced to about 90 pounds of "bony" concentrate). The 1952 collection yielded 1,750 pounds of concentrate. Back in the laboratory the concentrate is washed again thoroughly so that great quantities of extremely "clean" residue can be examined microscopically to sort the fossil remains.

The machine in which this final washing is accomplished was especially built for this purpose by Preparator Stanley Kuczek. A slow-speed motor causes a series of concentric sieves to revolve so gently through a water-bath that the delicate fossils are never damaged by the tumble action.

Rare Volumes on Butterflies Acquired by the Library

The Library of the Museum recently received as a gift, from Cyril F. dos Passos, of Mendham, New Jersey, a copy of the rare second edition of Eugenius Johann Christoph Esper's comprehensive illustrated publication on European butterflies and moths entitled *Die Schmetterlinge in Abbildungen nach der Natur mit Beschreibungen*. This edition, consisting of six quarto volumes with 441 hand-colored plates, was issued with supplements by Toussaint von Charpentier in the period 1929-39.

Columbus Newsboys Visit Museum

A group of 352 carrier boys from Columbus, Ohio, was brought to the Museum recently under the auspices of their newspaper, the *Citizen*.

Several Museum halls are devoted to plant economics.

NEW TURTLE EXHIBITS

The exhibit of the amphibians and reptiles of the Chicago area was completed last month by the addition of the screen of local turtles to Albert W. Harris Hall (Hall 18—amphibian and reptile section).

Lack of space made it impossible to put the turtle screen with the rest of the Chicago area exhibits, but it is placed nearby although on the opposite side of the hall. The March, 1950, BULLETIN has a full account of this exhibit of local species, including a description of the special techniques used in making most of the models as well as in making the segments of the natural surroundings on which each one stands.

Typical turtles from various parts of the world are shown on the other side of the screen of local turtles. The screens are prepared in the new manner with painted background and raised letters.

STAFF NOTES

Karl P. Schmidt, Chief Curator of Zoology, will represent the Museum on the American Committee for International Wildlife Protection, a post that was formerly held by **Stanley Field**, President of the Museum **Dr. Alexander Spoehr**, Curator of Oceanic Ethnology, recently attended a two-week international symposium on anthropology held in New York under the sponsorship of the Wenner-Gren Foundation, where he served as chairman of one session . . . **Clifford H. Pope**, Curator of Amphibians and Reptiles, was recently interviewed by Tony Weitzel, "Town Crier" columnist of the *Chicago Daily News*, and Mrs. (Dorothy) Weitzel on their radio program over station WMAQ . . . Pictures in which **Miss Nancy Worsham**, Raymond Foundation guide-lecturer, **Miss Lilly Liu Ho**, of the Department of Botany, and **Miss Christine Tardy**, Assistant in Public Relations, posed as brides in exotic costumes from the Museum's anthropological collections were shown on Chuck Acree's WNBQ television program in a June feature on wedding customs.

Technical Publications

The following technical publications were issued recently by Chicago Natural History Museum:

Fieldiana: Botany, Vol. 24, Part III. *Flora of Guatemala*. By Paul C. Standley and Julian A. Steyermark. April 25, 1952. 432 pages. \$4.50

Fieldiana: Anthropology, Vol. 37, No. 2. *Bibliography of African Anthropology, 1937-1949. Supplement to Source Book of African Anthropology, 1937*. By Wilfrid D. Hambly. 142 pages. \$1.50



Richardson, Eugene S. 1952. "How Old Are Fossils? Rocks Reveal Secrets." *Bulletin* 23(7), 4-5.

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