

THE AGE OF THE EARTH

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How old is the earth and how may one know its age? This question has perplexed humanity for centuries. James Hutton, one of the founders of geological science, despairingly declared, "No vestige of a beginning—no prospect of an end." Since his time, however, geology has progressed rapidly, and various methods have been advanced to estimate the earth's age.

The oldest method was based on the rate at which land was eroded and deposited in the seas, estimates being made by taking the observed thickness of the entire geologic column and dividing by the rate at which sediments are now being laid down. Early in this century several such estimates were made, and the earth's age, since solidification from its molten stage, was computed at 100,000,000 years. However, this figure was challenged because, to begin with, there is no trustworthy starting point for reckoning the total thickness of the sediments. Secondly, the rate of sedimentation, due to changes in climate and in the elevation of land, has varied through the ages. Finally, there is no record of the vast length of time that has elapsed between the periods of sedimentation.

Another method once used by geologists and geo-chemists was based on the rate at which salts were dissolved from the lands and accumulated in the oceans. The total amount of salts in the oceans was divided by the present rate of annual supply. This method gives an age estimate about the same as that based on the rate of sedimentation. But again difficulties appear. Neither the area of the continents nor their relief in the past was the same as today. Hence, the stream gradient and its power of dissolving salts from the land surfaces have not been the same. Also, it is not known how much salt the ocean derived from other sources, such as the shore line, ocean beds, and volcanic actions. Nor is it known if the oceans were essentially uniform in volume throughout the ages or if they grew to their present volume from a small beginning.

Still another method of computation was based on the rate at which one species of life changed to another in successive geological periods. The physical history of the earth was divided into twelve periods, and it was assumed that 20,000,000 years were required for an entire change in the species of each period, or 240,000,000 years in all. This, however, did not include the time before life existed on the earth. Furthermore, while our conception of the passage of one species to another is well founded, the rate of change has varied according to species. On the one hand we have records of species which have withstood all possible environmental changes, and, on the contrary, we know of types of life which have yielded so rapidly to change that their evolution is almost explosive. With these conflicting evidences, it is hardly possible to use this paleontological record as a basis for a concrete expression of geologic time.

Other methods likewise have been used but were unable to withstand critical analyses, because the uniformity of the rate of action which is the criterion for computing geological time could not be relied upon. Nevertheless, the search for a process in nature that takes place in direction only, and does not change its rate of action, eventually was discovered. Not long ago, it was experimentally proved

that such a process was present in the atomic disintegration of various radio-active elements contained in certain rocks and minerals. This opportune and valuable discovery has become the present accepted basis for measuring the age of the earth, and has given excellent results.

The radio-active minerals are commonly found in igneous rocks. The parents of the whole series of radio-active minerals are uranium and thorium. Each of these parental elements transforms through a succession of changes. The final products of uranium are helium and an isotope of lead. The rate of this transformation is known, and data for calculating the age of the mineral and with it the rock formation of which it is a part, can be obtained by measuring the quantities of helium and lead in the rock and comparing them with a quantity of uranium in the same volume of material. Helium, however, is a gas, and probably a portion of it leaks out. Consequently, estimates of age on the basis of helium ratios should be regarded as minimum. But estimates based on the lead ratios, when the mineral is fresh and primary, offer results that carry great weight as reliable indicators of age.

Up to the present time, the highest reliable lead ratio indicates the passage of 1,460,000,000 years. This has been computed from the Keystone uraninite of the Black Hills, South Dakota, the most ancient uraninite yet discovered. Its age, however, does not represent the maximum age of the earth, as the mineral occurs in a pegmatite dike which is intrusive into a still older rock. What the age of the older rock is, cannot be estimated from the available geological data. All that can be stated definitely now is that the age of the earth far exceeds 1,460,000,000 years.

Material from Utah Cliff-Houses

An unusual and excellent collection of archaeological material from cliff-houses of Utah has been installed in Hall 7. It comes from cliff-houses built about A.D. 900-1300. The exhibit includes crutches, a cane, baskets, beans, squash seeds, raw cotton and cotton products, yucca sandals, cordage, cradles, agricultural implements, a bow-drill, and a wooden head rest. The remarkable preservation of these perishable articles is due to the extreme and permanent aridity of the large caves in which they were buried.

"Three Kingdoms of Indo-China"

An excellent account of the journeys into remote places and the adventures experienced by members of the William V. Kelley-Roosevelts Expedition to Eastern Asia for Field Museum is to be found in a book, *Three Kingdoms of Indo-China*, recently published. The authors are Harold J. Coolidge, Jr., leader of the Indo-Chinese division of the expedition, and Colonel Theodore Roosevelt, who was one of the leaders of the expedition as a whole. The book is written in popular style, giving to the lay reader a clear idea of how a large scientific expedition conducts its work, and the many difficulties and problems that beset it. The book is copiously illustrated with photographs taken by the explorers. The Thomas Y. Crowell Company is the publisher.

For purposes of comparison, an exhibit of specimens of fossil and modern forms of life of similar species is on view in Stanley Field Hall.

HOPI DOLLS

By PAUL S. MARTIN

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A case of Hopi dolls or katchinas has been placed on exhibition in Hall 7. These dolls are carefully made so as to show in miniature the headdresses, symbolic masks, ornaments, and clothing worn by the masked dancers who impersonate supernatural beings or katchinas. Such figures are never worshiped and are not idols in any sense.

At the conclusion of one of the great rain-making ceremonies, the masked dancers run through the village streets, distributing dolls like these and other presents to the young children.

The reason for impersonating the supernatural beings is explained in the following Hopi legend:

Long ago, the gods or katchinas used to live with the people and teach them how to hunt, plant seeds, make pottery and baskets, and build houses of stone. After a time they became displeased with the people and withdrew from the villages to the high mountains. Then no rain fell, the fields became dry and thirsty, and desolation and misery spread over the land. After the

Hopi Doll
On the headdress are representations of ears of maize.

people had suffered a long time, the gods relented somewhat and told them that they might wear masks and costumes to represent the gods who had formerly dwelt with them, and that they might dance the katchina dances which bring the rain. If all instructions were honorably carried out, the katchina would "possess" the dancers and rain would surely fall.

So now, every year, with great faithfulness, the Indians wear costumes and masks to represent the gods and dance their dances so that rain will fall and the harvest will be bountiful.

Rare Book Presented to Library

A monumental work of the greatest rarity has just been presented to the Museum Library from the estate of John B. Lord by Mrs. Robert E. Ross, Mrs. Joseph H. King, and Mrs. William E. Pratt. It is the catalogue of the famous collection of Oriental porcelains of William T. Walters in Baltimore, and was published in 1897. It consists of ten superbly bound volumes (17 x 23 inches), arranged in five portfolios, and containing 116 exquisite plates in colors and more than 400 reproductions in black and white. The text, written by S. W. Bushell, has been reprinted in a handy octavo volume. The edition was limited to 500 copies, most of which were distributed among the subscribers. The work has been out of print for more than twenty years.

Fishes of Florida and other Gulf Coast waters are represented in an exhibit in Albert W. Harris Hall.



Martin, Paul S. 1933. "Hopi Dolls." *Field Museum news* 4(4), 3-3.

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