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LIVING FOSSILS

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THE simplest organisms, like bacteria and many protozoa and unicellular fresh-water green algae, probably have changed but little during the ages that have intervened since they first came into existence, as their aquatic environment has remained much the same.

A study of the fossil record indicates a similar conservatism in the land plants, including the angiospermous flowering plants, whose earliest known fossil remains from the Cretaceous belong to genera still existing. Of course they must have been preceded by earlier Mesozoic types, but as yet these are unknown.

The importance of fossils, both plant and animals, as indicators in geological formations is of course recognized, but the tendency to emphasize the greater importance of animal fossils might perhaps be questioned.

The fossils of the late Mesozoic and early Tertiary are especially important, since it was in these eras that the origin and evolution of the now dominant angiosperms and mammalia were inaugurated.

Many common American trees, like the sycamore, oak, elm, willow, beech, tulip-tree (*Liriodendron*) and others, are found in the Cretaceous, and it is probable that the forests of the Cretaceous and early Tertiary were not very different from those of the present eastern United States. Since these trees have remained practically unchanged since the late Mesozoic to the present time, they might be termed "living fossils."

The animal life, however, has altered radically. The dinosaurs, which reached their culmination in the Jurassic and Cretaceous, have given way completely to the mammals which at the period of the dinosaur dominance were apparently insignificant creatures whose fossil remains are relatively rare and whose relationships are uncertain.

Plant fossils, however, sometimes occur in great abundance, both as petrifactions, like fossil wood, or as leaf prints, which often are as clear as photographs from living leaves, and often may be referred to existing genera, *e.g., Platanus, Juglans, Liriodendron, Sassafras.*

The earliest land plants were probably small thallose forms like some of the simplest living liverworts (Hepaticae). Very few fossil hepaticae have been described, but they must have existed during the Paleozoic era. It is probable that a careful search would show spores which might be referred to hepaticae. The discovery of fossil spores in the Upper Cambrian[1] is the earliest known example of what may have been a terrestrial plant, possibly an amphibious liverwort, like the living *Ricciocarpus*. The structure of these Cambrian spores indicated they were formed in tetrads, like the spores of all land plants from the simplest liverwort to the most specialized flowering plant. The pollen spores are strictly homologous with spore-tetrads of the liverworts.

The earliest vascular plants that have been definitely recognized occur in the Devonian. Especially noteworthy are the Rhyniaceae, first described by Kidston and Lang[2] from the Middle Devonian of Scotland. The Rhyniaceae were very primitive plants without definite leaves or roots. In the later Devonian and Carboniferous were many types evidently related to the existing pteridophytes, *i.e.,* ferns, lycopods and horsetails (Equisetineae) some of which developed simple seeds.

Finally in the late Carboniferous or Permian, true seed-plants, some of which were related to the conifers and cycads, occur, and these gymnosperms became extensively developed in the Mesozoic. During the Mesozoic there was a marked development of the Cycadeoideae—cycad-like plants, some of which may possibly have anticipated the first angiosperms.

The latter part of the Mesozoic era marked one of the great geological revolutions, the Laramid Revolution, when there were extensive invasions by the sea and violent volcanic activity; and it was also a period of active mountain building, and probably marked movements of land masses—perhaps including continental drifting. Du Toit[3] believes that extensive continental drift—especially in the southern hemisphere—began in the late Mesozoic. The Cretaceous marks the beginning of a new era in the evolution of both plant and animal life. The two now dominant plant and animal groups—angiosperms and mammals, are first noted in the late Mesozoic.

All typical plants, from the microscopic unicellular alga to the 300-foot redwood, depend for their existence on the photosynthetic activity of their green cells. The chlorophyll tissue in the more specialized forms is segregated in a special organ, the leaf. In the flowering plants, especially the dicotyledons, the leaf, with its firm epidermis and framework of woody veins, is resistant to decay and the fossil leaf prints might have been made from living leaves—as they can often be referred to living genera. There seems to have been no essential change in leaf structure from the earliest Cretaceous dicotyledons to that of their living descendants.

Plants being incapable of locomotion, their migration must have been very gradual, and where either as fossils or living species, the same forms occur in widely separated regions, *e.g.,* Brazil and Equatorial West Africa, it must be assumed that these regions must sometime have been in direct contact; hence the importance of plant fossils as geological indicators. It is true that there are special instances of the rapid distribution of the seeds or fruits of certain plants by animals or by wind or water currents. These cases are exceptional and quite inadequate for transfer over such barriers as the oceans or high mountains.

While the fossil record, especially in the southern continents, is still very incomplete, it is clear that the fossils are closely related to existing species of the same areas, and there is no intrusion of alien genera. Thus the fossils of the temperate zones of North and South America are essentially different. For example, the great order of conifers, so conspicuous a feature of the North Temperate Zone, has no northern genera represented in the South Temperate where the familiar pines, firs, cedars, etc., are replaced by the austral genera, *Araucaria, Podocarpus, Fitzroya,* etc., quite unknown in North America. There is also complete absence in South America of the common North American trees, *e.g.,* oaks, elms, maples, beech, chestnut, magnolia and many others. This essential difference in the temperate floras of the two continents and the fact that most of the existing forms can be traced back to the end of the Mesozoic era, is a strong confirmation of the recent theory of Du Toit—that there were two primordial continents, Gondwana and Laurasia, which remained completely separated until the end of the Mesozoic, when Gondwana divided into the present southern continents, which drifted apart to their present positions, carrying with them many of the unchanged descendants of the original Gondwana flora.

The existing remnants of the Gondwana flora occur in regions separated by vast expanses of ocean. There are many instances among the so-called sub-Antarctic

[1] W. C. Darrah, SCIENCE, 86: August, 1937.

[2] R. Kidston and W. H. Lang, *Trans. Roy. Soc. Edinb.,* 1–5, 1917–1921.

[3] A. L. Du Toit, "Our Wandering Continents," London, 1937.

floras of common genera in New Zealand, Tasmania and Southern Chile, and between Brazil and Equatorial West Africa are numerous common tropical genera and even species. Perhaps most remarkable is the presence in South America of two species of *Araucaria,* primitive conifers, found elsewhere only in Australia.

Du Toit's theory of Continental Drift is the only plausible explanation of the present distribution of plants, especially in the Southern Hemisphere.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

FINAL REPORT ON THE REVISION OF THE CONSTITUTION BY THE SPECIAL COMMITTEE ON REVISION OF CONSTITUTION AND BYLAWS

YOUR special committee on revision of the Constitution and Bylaws submits herewith a proposal for a new Constitution. This document is the result of long-continued study, which began in 1939.

The committee first consisted of Livingston, Long and Moulton. Dr. Long resigned in 1942 because of pressing duties connected with national defense and the war. The Executive Committee accepted his resignation with regret and subsequently named Dr. O. W. Caldwell to succeed him. Throughout its long period of study, the special committee has held many sessions and has employed both correspondence and consultation by telephone. Many suggestions and proposals have been received and considered, some of which were brought forward by members of the Secretaries' Conference at its Dallas session.

In submitting this report, your special committee formally moves:

1. That the Executive Committee accept the report and instruct the special committee to submit a later report on the revision of the Bylaws.
2. That the Executive Committee approve the proposed new Constitution and refer it to the Council for action at the approaching Cleveland meeting of the Association.
3. That the Executive Committee recommend to the Council that the proposed new Constitution be presented at a general session of the approaching Cleveland meeting, with the Council's recommendation that it be adopted as an amendment to the Constitution of 1919, according to the provisions of Article Eleven of that Constitution.

Respectfully submitted,

BURTON E. LIVINGSTON, *Chairman*
O. W. CALDWELL
F. R. MOULTON

July 24, 1944

Unanimously approved by the Executive Committee at a meeting held August 6, 1944.

REVISED CONSTITUTION

ARTICLE I—OBJECTS

The objects of the American Association for the Advancement of Science are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress. The Association is a non-profit scientific and educational organization. It aims to conduct meetings and conferences of those interested in the various branches of science and education, to produce and distribute publications, to administer gifts and bequests as prescribed by the donors thereof, to provide support for research, to arrange awards for the accomplishment of scientific work, to cooperate with other organizations in the advancement of science and to engage in such other activities as shall have been authorized by the Council.

ARTICLE II—MEMBERS

Section 1. The membership of the Association shall consist of Annual Members, Life Members, Sustaining Members, Honorary Members and Emeritus Members. Admission to each of these five classes of membership shall be in accordance with the provisions of Section 2 of this Article and with such relevant rules as the Council shall have prescribed. The Council may establish additional classes of membership.

Section 2 (a). *Annual Members.* Any person, institution or organization may be admitted to annual membership. Each Annual Member shall have such rights and privileges and shall pay such annual dues as the Council shall have prescribed.

(b). *Life Members.* Any person making to the Trust Funds of the Association a life-membership contribution of such amount as the Council shall have prescribed may be admitted to life membership. Each Life Member shall be exempt from the payment of annual dues and shall have all the privileges of an annual member throughout life.

(c). *Sustaining Members.* Any person making to the Trust Funds of the Association a sustaining-membership contribution of such amount as the Council shall have prescribed shall be the founder of a Sustaining Membership, which shall bear his name and shall be maintained in perpetuity as a trust. Each incumbent of a sustaining membership shall have all the privileges of a life member. The first incumbent of a sustaining membership may be either the founder himself or another person named by him, as he may choose. On the death or resignation of an incumbent, the Executive Committee shall name another person to hold the membership throughout life.