THE REVELATION OF PALYNOLOGY

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A brief description of the science of palynology is given. The science is possible because the ornamentation and sculpture of the outer pollen wall or exine is remarkably durable. Palynologists have been able to assign microspore of Cenozoic and Mesozoic rocks to modern families, genera and even species. In the last fifteen years spores of vascular plants have been reported from the Cambrian. Axelrod reports over 60 Cambrian spore genera are now on record. Leclerq believes the finding of spores of woody plants already in the Cambrian raises the question of the polyphyletic origin of vascular plants. This is another way of saying that, as far back as we can trace geologically, plants are as distinct from one another as now. This certainly is strong evidence for an original creation of them as distinctive kinds.

Introduction

It has frequently been admitted that the only real compulsive evidence for evolution (ameba to man form) must lie in the geological record. And yet that record often contains evidence that apparently mitigates against a history of phylogenetic developments, i.e. forms developing from simple to complex, which typifies the developmental schemes so prevalent in biology and geology texts in the past.

In recent years a new branch of plant science has developed which is called palynology. This is the study of microspore and pollen grains of plants. Palynology as an organized science is possible because of the ornamentation and sculpture of the surface of the pollen grains, a feature of great value for classification purposes.

Pollen grains have outer walk known as the exine. This is composed of an amazingly durable substance called sporopollenin. Since the outer walls of the spores are rather durable, they seldom undergo replacement or chemical alteration, and are also resistant to most forms of chemical and biological decay. Fossil pollen usually consists solely of this exine.

Among other features, these grains may have thin areas in their outer walls in the form of germinal pores or furrows, or both. The furrow is called the colpus. Pollen grains may then be classified as one of two possible types. The monocolpate, with one germinal furrow, occurs in monocotyledon, cycads, cycadeoids and seed ferns, as well as some woody dicotyledons. The tricolpate type with three germinal furrows, is found in most dicotyledons.

Preparation and Interpretation

Preparation of microspore for paleontological study is a rather lengthy process. Microfossils must be liberated from the sedimentary matrices and then concentrated by methods such as centrifugation and density gradients. Rigorous cleanliness is essential at all steps to guard against contamination by drifting present day samples. Once extraction is completed, the polleniferous material is mounted on a microscope slide. Good photomicrographs of the resulting samples require exposure at different focal planes so that all the detail of structure and sculpture may be observed.

After these features of pollen grains were recognized, attention was given to the Pleistocene peat and lacustrine (lake-bed) sediments in an attempt to reconstruct the flora of that time on the basis of the pollen grains present. This procedure was later extended for the same purpose to the Tertiary formations of Western Nebraska to similarly determine the grasses present at the time of deposition of these sediments.

Palynologists have been able to assign microspore that have been found in Cenozoic and Mesozoic rocks to modern families, modern genera, and sometimes to modern species of the plant world. Statistical comparisons of "pollen rains" of the present to fossil pollen distribution and counts have been the basis of attempts to estimate the abundance of fossil parent plants at the time of deposition of sediments. As the techniques of palynology were refined, it has been possible to extend the search for and study of fossil microspore into Paleozoic formations.

Palynology Extended to Paleozoic

Results of this extension have been rather startling. One can usually find statements in texts implying that the Cambrian plants are the simplest possible—namely, all algae, or that the whole life record of the Cambrian is marine.[1] Museum displays give the same message in their beautiful but imaginative reconstructions of Cambrian life.

But within the last 15 years, spores of vascular plants have been discovered in the Lower Cambrian of Kunda in Estonia; the Pre-Baltique of the U.S.S.R.; the Upper Cambrian of Kashmir and the Salt Range of India.[2] Such reports were usually met with skepticism and suspicions of contamination.

However, in 1953 Krychtofowitch reported the discovery of lycopodiaceous shoots in the Cam-

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brian of East-Siberia. In addition, various workers report the findings of small fragments of tracheids which show simple and bordered pits.

Agreement in Research Reports

Leclerq of the Department of Paleobotany at the University of Liege, Belgium, discusses these finds and others in an article "Evidence of Vascular Plants in the Cambrian."[3] Although holding to the concept of evolution, he believes that the presence of vascular (woody) plants in the Cambrian seems established. Axelrod, of the University of California,[4] agrees, pointing out that approximately 60 Cambrian spore genera are now on record.

Leclerq feels that these results definitely raise the question of the polyphyletic origin of the vascular plants. He also feels that the Psilophytales would seem to be eliminated from their usual position as the first land plants. The evidence for this rests not only on the Cambrian discoveries, but also the Silurian strata from Victoria, Australia, which have yielded vascular plant compressions associated with *Monograptus,* a graptolite.[5] Axelrod concurs, as is evident, when he says that the plants of the continental interiors were more highly evolved than the contemporaneous psilophytes which lived near the shore of seas.

Leclerq also discusses the remarkable difference in the vegetation of the Lower Devonian compared to that of the Middle and Upper Devonian. The Upper Devonian shows preserved structures of pteridophytes such as Filicales and Calamitales (ferns and related forms) and gymnosperms such as Coniferales and Cordaitales (conifers and related forms) including some tree forms. The Middle Devonian also shows the same groups represented, but not in the tree-form. The Lower Devonian shows essentially herbaceous and semi-aquatic psilophyte-like as well as lepidodendroid forms. What Leclerq finds so astonishing is the marked discrepancy in the latter two flora so close together in time. He considers that the Lower Devonian were also present during Middle Devonian while Middle Devonian forms were present during Lower Devonian.

Relevance to Creation versus Evolution

What has all this to do with creation versus evolution? The Lower and Middle Devonian situations would seem to indicate that, due to the shortness of time sufficient to allow Lower Devonian flora to "evolve" into Middle Devonian, we have instead the following situation:

(a) a Lower Devonian flora, which may have existed also in the Middle Devonian, but this particular flora has not yet been found as fossils.

(b) Conversely, the Middle Devonian flora also existed in the Lower Devonian, but no fossils have been discovered.

The distinctness of the two flora may be due to a shift in environment, bringing into the area a new flora, already in existence in other like environments, but not previously found as fossils, rather than an evolution from one flora to another. This explanation may well be validly applied to other fossil sequences.

Austin Clark[6] once wrote that on the basis of the fossil record, the creationist has all the better of the argument, since there is not the slightest evidence that any of the major groups arose from any other. He also has pointed out that this record does not support a tree of life, but rather presents the evolutionist with the necessity of explaining the development of a whole forest of trees (polyphyletic evolution).

This difficulty is not being eliminated, but rather amplified, hence the increasing appearance of the concept of polyphyletic evolution; and this concept is difficult to separate from creation with variation. It is to be noted that Leclerq in his article refers to the fact that the question of polyphyletic evolution is again raised by this new evidence. This would seem to support the persistence of types; as well as the sudden appearance of new types referred to at length by the German paleontologist, O. Kuhn.[7]

Furthermore, it is now legitimate to consider the existence of land animal forms, associated with these land plants., that might also have existed in the early Paleozoic, contrary to the present picture presented. Just as only fragmentary microfossils of land plants remain, so the animal remains would also either be absent or so small as to be unrecognizable as such.

Most of the early Paleozoic sedimentary rocks are marine, not continental, and so we should expect very few records of land life to be preserved in them. While such records might once have been present in the non-marine deposits, most of these might have been eroded, and the record thus lost. But certainly it should be clear that the reconstruction of biofacies presented in so many texts and museum displays as a complete representation of life at a given time may not really be completely representative at all, and thus be quite biased.

Conclusion

In conclusion, some of the new finds in the field of paleontology, rather than driving the last nail in the coffin of creation, would seem to continue to keep it alive as a viable alternate theory to that of evolution.

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SEED GERMINATION, SEA WATER, AND PLANT SURVIVAL IN THE GREAT FLOOD

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Seeds from the fruits of five different species and families of flowering plants were tested for germination after prolonged periods of soaking in sea water, fresh water, and mixed water baths. Seeds from three out of these five species germinated and grew after 140 days of soaking in each of the solutions mentioned.

The effect of the Genesis Flood upon seed plant life in general is discussed. Several means of plant survival both inside and outside the ark are evaluated. On the basis of present experiments and those of Charles Darwin, it is concluded that seeds from many plants may have resisted the direct contact of flood waters and germinated vigorously after the waters subsided from the surface of the earth. Several unanswered questions and areas for further study are enumerated.

Introduction

The topics of seed dormancy, germination, and growth have challenged the minds of botanists for many years. Several thorough articles and monographs on these topics provide information about the longevity,[1] preservation,[2] and metabolism,[3] of seeds. Some of these references and certainly the paper by Ungar[4] provide information about the effect of salts in the soil water at time of germination. Boyko has investigated the use of salt water as a source for irrigation[5,6].

None of the above studies has dealt specifically with the effect of soaking during storage on the survival of seeds. Since this topic is of interest from the standpoint of experimental plant physiology and also from the vantage of seed germination after the flood recorded in Genesis, the present investigation was undertaken to determine some of the effects of previous soaking upon germination of the seeds. Charles Darwin studied this problem of soaking and floating seeds in order to determine how plants might have traveled across large stretches of ocean water.[7]

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Materials and Methods

Fresh fruits containing seeds of the five following different plants (from five different families) used in these studies were collected in weedy fields surrounding Westmont College, Santa Barbara, California in late June, 1967: *Raphanus sativus* L. (Brassicaceae or mustard family), *Rumex crispus* L. (Polygonaceae or buckwheat family), *Cirsium edule* Nutt. (Asteraceae or sunflower family), *Medicago hispida* Gaertn. (Fabaceae or legume family), and *Malva parviflora* L. (Malvaceae or hollyhock family).

All the specimens collected were dry and apparently ripe fruits from the current growing season (December through March, 1967). Fruit types involved were indehiscent silique *(Raphanus),* achenes *(Rumex* and *Cirsium),* legume *(Medicago),* and shizocarp *(Malva).* Taxonomic verification was conducted by the author, using Jepson[8] for genus and species and Porter[9] for family.

On June 24, 1967, fruits of each species were divided into four groups and treated as follows: (1) control fruits stored dry in paper sacs, (2) fruits soaked in sea water, (3) fruits soaked in sea water mixed with tap water, and (4) fruits soaked in tap water. Soaking baths were changed about every fourth day to prevent stag-