

LITERATURE REVIEWS

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MISBEHAVING FOSSILS

THE QUEST FOR LIFE IN AMBER. George and Roberta Poinar. 1994. Reading, MD: Addison-Wesley Publ. Co. 219 p. Hardcover, \$25.00.

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When the behavior of a stubborn child fails to meet expectations, frustrated parents often plead, “Why don’t you act your age?”

An increasing number of fossils do not “behave” in accord with expectations for their presumed age. These troublesome fossils contain DNA in concentrations that should be expected only in specimens less than 10,000 years old; yet they have been assigned ages that extend beyond 125 million years (Brown 1991, Wieland 1994).

George and Roberta Poinar have provided an up-to-date, comprehensive, and authoritative treatment of fossil DNA in amber (fossil pitch). In addition to covering the technical data, they outline the fascinating history of trade in amber, and narrate their world-wide search for amber in which ancient insects have been preserved. As they state in their preface:

This book is a chronological account of our adventures in the amber world, including travels to remote areas in search of amber, meetings with people along the way, and efforts to research and study organisms, cells, nuclei, and the oldest known DNA.

In one episode the senior author ingenuously escaped confinement by a North African entrepreneur who evidently expected to obtain ransom money. The authors are good scientists as well as highly skilled writers. They have produced a book that, aside from its technical value, is exceptionally enjoyable to read. Many individuals will prize this book just for its 22 color micrographs of insect specimens in amber.

The list of organism types for which fossil specimens have been found in amber is amazingly long: algae, amoebae, ants, beetles, centipedes, dragonflies, feathers, fleas, flies, frogs, fruitflies, fungi, lacewings, land snails, leaflets, leaves, lizards, millipedes, mites, petals, pollen, protozoa, pseudoscorpions, rotifers, roundworms, seeds, spores, stoneflies, strepsiterones, walkingsticks, wasps, zoroapterones. In addition to their reference to leaves in amber, the authors also review the data on DNA in fossil leaves from the *Clarkia* beds (putative age of 17-20 million years) in northern Idaho.

Since the publication of *The Quest for Life in Amber*, conclusive evidence has been obtained for the survival of not only DNA, but also of viable bacteria in amber presumed to be 25-40 million years old. The enzymatic, biochemical, and DNA characteristics of a bacterium from the gut of an amber-enclosed fossil bee has a close relationship with its modern equivalent (Cano and Borucki 1995).

On p 194 of Chapter 23, the authors state: "That ancient DNA exists at all is astonishing." However, DNA has been found in an amber-preserved weevil from Cretaceous (120-135 million-year conventional age) deposits in Lebanon. On the other hand, a biblical flood model for the geologic column is consistent with remnant DNA in at least some fossils from *all* Phanerozoic levels. The amount of DNA, and the degree of base-pair sequence preservation, in a specific specimen would depend on temperature, association with moisture and oxygen, and other factors that determine the rate of degradation.

In their preface the Poinars assert that "the discovery of nuclei and DNA in amber inclusions ... disproved earlier theories on the limited life span of [DNA]...." Another specialist, in comments on fossil DNA research (Goldberg 1994), made a significant statement of basic principle: "... establishing the validity of empirical results by determining how well they fit theoretical expectation, is at best arrogant, and at worst, regressive." Goldberg evidently was castigating individuals who challenged the claims for discovery of DNA greater than 17 million years old. The extreme unlikelihood of appropriate types of modern DNA penetrating the amber enclosure of a fossil insect, and the minor mutational differences between the fossil DNA and the corresponding modern equivalent, definitely exclude contamination as an appropriate explanation for DNA found in fossil specimens.

But, age estimates in the 17-225 million year range (see p 181 for 225 My) are theoretical. Whether correct or incorrect, they are based

on presumptions which are beyond direct experimental validation. The detection of DNA in fossils with such age assignments can call the age assignments into question. They can also be interpreted as “proof” for DNA survival $^{3}10,000$ times longer than can be expected on the basis of observations of DNA degradation over the historical time range. The scientific community is so adamantly committed to a uniform process development of the Phanerozoic portion of the geologic column over ~600 million years, that it is blind to the implication of residual amino acids and DNA. This evidence suggests the existence of life on planet Earth for only a relatively short span of time more closely in agreement with the chronological specifications in the Bible.

REFERENCES

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