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Life or death in amber?

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Introduction

Because I've studied Dominican Amber for 25 years, this article began as a simple request for me to review a recent book: "Life in Amber" by George O. Poinar, Jr., Stanford University Press. 350p.; 37 color and 154 black and white photos; 8 maps. Publication date: Sept. 25, 1992. Price: \$55.00.

It was soon obvious that the volume and nature of my comments precluded a simple review. My paraphrased title is a minor semantic difference with Dr. Poinar's, although I doubt that he would write of "Life in Egyptian Tombs". Creatures preserved for 30 to 40 million years should at least be "Former Life in Amber". So much for trivia.

The nature of amber

Amber is fossil resin from various plant sources. When it actually becomes a fossil, versus copal which is said to be recently deposited, is admittedly a difficult point. Poinar spends 4 pages trying to distinguish the two with a finite time frame. Unfortunately, resins vary in plant source, time of exposure to the atmosphere, conditions of burial, nature and depth of the sediments, and many other factors. This variation occurs in hardness, refractive index, specific gravity, solubility, melting point, etc. Poinar defines "recently deposited resin...from when it hardens...up until 3 to 4 million years." He therefore excludes any fossils in resin from the Pliocene and Pleistocene as being "amber", as shown in his chart of Cenozoic amber deposits (Fig. 2). Because of the variables above and the imprecise definitions of amber versus copal, I believe it is misleading to attach a significant time scale to the

terms, although they are sometimes useful. It is confusing when Poinar (p. 4) states that his book treats "...amber from both resin and copal", at the same time pointing out that the word "copal" comes from the Aztec "copalli", meaning "resin".

Insect inclusions are common in both copal and amber. Certain more recently evolved groups may be used as indicators to suggest that one piece of resin is older than another (e.g., few higher Diptera in the older Dominican amber). Poinar says (p. 8) that "Copals will contain contemporary (extant) insects or *occasionally* extinct species (Hills, 1957). Amber *normally* contains insect species that are now extinct." The italicized (mine) words indicate how nebulous is the distinction on biological grounds.

The nature of the book

Amber has long been considered valuable, beautiful, and of great scientific importance. There is currently a special resurgence of interest generated in part by this book, a recent article in "Smithsonian" (Ross, 1993), Michael Crichton's (1990) "Jurassic Park", with a Steven Spielberg movie hit of the same title, coupled with the ready availability of Dominican amber.

Because Poinar's book was known to be in preparation for more than 10 years, amber lovers eagerly awaited its publication. His goal (p. vii) was to provide "a synthesis of the biological inclusions in amber" and "by covering *all life* (ital. mine) in amber (down to the generic level) it provides a guide to those interested in identifying organisms found in amber..." We were expecting a Bible (or at least a New Testament).

Unfortunately the book falls far short of the goals! It is beautifully produced with 37 color photos on 8 plates of exceptional fossils. It will fill a niche on the bookshelves of both laymen and

scientist, but it falls short of satisfying either. To the amateur it will be too technical and boring, with the morass of taxonomic terms and scientific names. To the scientist it has even more serious shortcomings--insufficient attention to detail, too many generalizations, lack of documentation for many statements, and the incomplete references section. It provides a great service by consolidating information and bibliographic citations, but disappoints by the lack of thoroughness expected.

Part of the problem in working with fossils of such diverse organisms is the expertise limitations. Taxonomists of modern insects must narrow their specialty down to a size that can be mastered in a lifetime (often overestimated), but usually limited to a Family or Genus, or possibly a small Order. The complexity and limits are magnified many times when considering the nature of fossil preservation, the visibility of taxonomic characters, the diversity of the organisms, and the availability of comparative modern specimens.

Dr. Poinar is a nematologist by training and expertise, but he has tried to become master of all in amber. He has published on or described species in as diverse groups as nematodes, mushrooms, ticks, Zoraptera, Hemiptera, Ichneumonidae, frogs, mites, snails, and Solpugida. Perhaps this is possible with the expertise of co-authors, but I know of no taxonomist who would do this with the modern fauna. His most pretentious paper (1991D) has to be the description of the tree (*Hymenaea protera*), thought to be responsible for Dominican amber, as a new species. Two well-known paleobotanists (Hueber & Langenheim) who have extensively studied the tree and fossil resins did not feel justified in doing so.

In order to be more specific and document my critique, I have itemized my comments in the following section. It is then followed by a section with additions to the bibliographic section.

Errata

- p.1. "Amber amulets dating from 35,000 to 1,800 B.C. have been found..." This is an example, repeated frequently, where there is no documentation for the source. It also falsely implies that no amber amulets have been found since 1,800 B.C.
- p.2 & 17. The first reference to amber production in the Baltic (p.2, again without documentation) states that a single factory produced between 225,000 and 500,000 tons per year, between 1875 and 1914 (39 years). My math (39 yrs. x 450,000,000 lbs. minimum/yr.) provides a total of 17,550,000,000 lbs. minimum during 39 years. On p.17 (still no citation) he states that since the 1800's "...over half a million Kilograms of amber has been retrieved from the ground during the past century." This totals 1,100,000 lbs. in 100 years, versus 17,550,000,000 lbs. for a 39 year period. Obviously something is awry, but no sources are cited to check.
- p.4. A quote from Alexander Pope (1688-1744) is appropriately used: "Pretty in amber to observe the forms of hairs, or straws, or dirt or grubs, or worms! The things, we know, are neither rich nor rare, but wonder how the devil they got there." A great quote, but it is not cited in the references.
- p.12. All biologists are concerned about fake fossils, and Poinar properly warns that "care should be taken to avoid confusing a manmade substitute for the real product." What a perfect place to list the tests and techniques on which he published in 1982 in *Gems & Minerals*; a magazine now defunct and difficult for the reader to acquire.
- p.34. A full page map of amber-producing areas of the Dominican Republic shows John Phillip's town *Sousa*, which should be *Sosua*.
- p.37. Dates for the softer amber from Cotui and Bayaguana (Dom. Rep.) are given as "15-17 Ma (mid-Miocene)." Although perhaps controversial, it is significant that Schlee (1984:35, see appended bibliography) published a date of 280 years for Cotui "amber" (using Carbon 14 techniques), but not mentioned by Poinar.
- p.39. The locality "Los Cruces" should be Las Cruces, and "Pacifcio" should be Pacifico.
- p.46. "San Cristobal de las Cases" should be Casas.
- p.63. In dealing with copal, he justifies exclusion from the book "...because the inclusions are *all* (my ital.) extant species..." (refer to copal vs. amber definitions discussed earlier).
- p.66. Table 6 lists public institutions with fossiliferous amber holdings, including the Florida State Collection of Arthropods (3,500 pieces). During the course of my early amber studies I established an "International Registry of Dominican Amber Fossils" with numbers assigned and preliminary identifications made for pieces while still in dealers hands, in order to track at least some of them. This Registry was established at the Florida State Collection of Arthropods in 1973 and now contains more than 15,000 numbers, including the Brodzinsky, Lopez-Penha collection of 5,000 pieces now in the Smithsonian. Although the Registry was described in Patty Rice's book (1980), and Dr. Poinar was

aware of its existence and purpose, it is not mentioned in his book--despite the many identifications extracted from it and included in his Appendix B (p.284-288).

p.67. "Herman Hagan" should be Hagen.

p.84-85. Treating the fossil Nematoda (Poinar's specialty) he does not cite a 1935 paper by Taylor, reviewing the fossil nematodes (see appended references).

p.85. The presence of amber Bdelloid rotifers, which are presently parthenogenetic, are said to provide "evidence of parthenogenetic continuity." Could they not have acquired the trait recently?

p.93 Although "an attempt was made to cite all of the insect genera that have been described or reported from amber...", the references here appended suggest that many were missed.

p.100. For Rohdendorf read Rodendorf.

p.111 & 126. Figure 59 (p.111) represents a Psyllidae (Homoptera), although the caption is for a book louse (Psocoptera) of the genus *Epipsocus*. Figure 69 (p.126) is a Psocoptera, although labelled as "A psyllid (family Psyllidae) in Dominican amber". I don't know the groups well enough to be sure, but it appears that the illustrations were reversed.

p.114. For "Cocherell" read Cockerell; for "Hydrocorisae" read Hydrocorisidae.

p.130-131. A new suborder of Coleoptera ("Adelphaga") was created by 3 times misspelling the Adephaga.

p.132. "The species *Tetracha carolina* Linnaeus occurs today in the southern United States, West Indies, and Central America. The only *other* (my ital.) described tiger beetle from amber is *Pogonostoma chalybaeum* Handlirsch." We are not told if *T. carolina* was found in amber or where, but if not, why is it even mentioned? The words "today" and "other" imply that it is an amber fossil. In a later discussion of behavior he states "The adults of these beetles probably preyed on insects that lived under the bark of the amber tree. The larvae, like those of other tiger beetles, probably lived in burrows in the soil or plant stems and preyed on passing invertebrates." This is pure, unsupported speculation--the primitive species may have had entirely different biology and behavior.

p.137. For "Whittmer" read Wittmer.

p.139. For "Gresset" (also in bibliography) read Gressitt.

p.140. Discussing Coccinellidae he states "Because they must have been feeding on the aphids associated with the Baltic amber forest, it is strange that none has been described from amber." There is no evidence for the above and their absence even suggests that "must" is the wrong word.

p.147. Under Meloidae is mentioned a triungulin larva from Dominican amber "still attached to the 'neck' region of a worker bee..." Since no amber Meloidae are known, Rhipiphoridae are (Color photo pl. 6) and also have triungulin larvae with the same habits, this specimen should have also been mentioned on p. 151 under the Rhipiphoridae. There is certainly no evidence to label Fig. 136 as "Triungulin (Arrow), a modified larva of a meloid beetle..." without question or some mention of other possibilities. Later on p. 247 the same identity question should be mentioned in a discussion of the commensalism of this specimen.

p.164. For "Rhodendorf" read Rodendorf.

p.181. "When describing *Succinatherix*, Stuckenberg (1974) placed it in a new family Athericidae, which he had erected earlier;" It is difficult to understand how it could be new if it was erected earlier.

p.255. For "psocoptids" read psocopterans.

p.256-257. In a discussion of extinction, Poinar (p.256) states that "For Dominican amber forms, which were not subjected to any drastic climatic change, competition may have been the major factor responsible for extinction." I find no citation or evidence for this statement on climate.

p.279-288. Appendix A & B. The first of these lists the fossil Arthropoda from Mexican amber to species. The second does the same for Dominican amber, except that classes, orders, and families only are provided. No explanation or apology is given for not listing the known species as was done for the Mexican amber. Presumably it would have required more work.

Bibliography

One of the great frustrations of any researcher is locating all the published reports on a subject. Poinar claims (p.5) that "The present work brings together the scattered, varied, multilingual literature that is inaccessible to so many. In so doing, it serves as a compendium on fossil life in all of the world's amber deposits." As a researcher on amber I had accumulated (without thorough literature searches) a fairly extensive card and literature file on the subject. I hoped that Poinar's goal had been

achieved and most of my library searching was over.

Although the statement above implies completeness, the section is headed "References cited". There is no explanation about what is excluded nor why. One of the finest popular articles on amber, with copious color plates, appeared in National Geographics Magazine (Zahl, 1977), and the same author published a more scholarly paper a year later (Zahl, 1978). Neither is listed, although all of Poinar's articles in popular literature are (Nat. Hist., Gems & Minerals, Pacific Horticulture). One of his papers is in "IRCS Med. Sci.", whatever that is. He included unpublished theses (e.g., Legg, W.M. 1942. Senior Thesis, Dept. Biol., Princeton Univ.), but failed to cite a review of the fossil nematodes by Taylor (1935) which is his specialty. In fact, it is difficult to guess what governed his choices.

Realizing his 30 pages of references do not represent a bibliography, and one is not likely to be produced soon, I have added supplemental references below that I believe would be useful to the reader (as they are to me) and which were omitted by Poinar. I make no claims to completeness, but the reader may want to insert a copy of these in his book.

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