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The Paleobiology of Trace Fossils

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The Paleobiology of Trace Fossils

Edited by Stephen K. Donovan
Johns Hopkins Press
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1994, 308 p., US $49.00

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When Derek Ager published his seminal *Principles of Paleoecology* back in 1963, trace fossils were only starting to be a subject for proper research and, in consequence, gained almost no mention. However, Adolf Seilacher was already beginning his advocacy of their virtures as paleoecological indices, serving (like Huxley for Darwin) as publicist for the almost reclusive Walter Häntzschel's discoveries (1960 and other papers) and enlarging them with his own far-reaching research. Next came Peter Crimes's and John Harper's symposium volume on *Trace Fossils* (1970) and, even more importantly, Robert Frey's editing of the first overview of paleoichnology, *The Study of Trace-Fossils* (1975). Since that time, the pace of discovery has increased to an almost awesome extent.

However, while there have been some useful course works on trace fossils and while Richard Bromley's *Trace Fossils. Biology and Taphonomy* (1990) valuably epitomized and expanded our knowledge of traces in aquatic environments, not until this volume has there been a fresh overview of marine and terrestrial traces. Even the long-neglected field of plant trace fossils is included.

Stephen Donovan, in his introduction, states that the "literature of ichnology extends back at least... to 1881." In fact, it extends much farther back, to the discovery of vertebrate footprints in Scotland in 1826. Within the ensuing few years, William Buckland not only conducted the earliest experiments to identify the trackmakers, but also investigated the genesis of bite marks on bones from caverns. Indeed, there was a profuse literature on terrestrial trace fossils, long before Darwin published his observations of earthworms in 1881 (see Sarjeant, 1994).

All the ensuing papers are of high merit. Ron Pickerill gives an excellent account of the evolution of trace fossil nomenclature (p. 3-40), although perhaps not giving a full enough analysis of the ongoing problem of classifying plant trace fossils; these still have no status under the *International Code of Botanical Nomenclature*. Enrico Savazzi's treatment (p. 43-82) of the functional morphology of boring and burrowing invertebrates will surely become classic, while Allen Curran's study of trace fossils from Bahamian-style carbonate deposits (p. 83-102) treats that more limited theme very clearly.

Peter Crimes's account of "The period of early evolutionary failure and the dawn of evolutionary success" — a treatment of the changes in biotas across the Precambrian-Cambrian boundary — will certainly arouse interest, but will surely also generate controversy. For me, his concurrence (p. 114) with an earlier statement that there are no trace fossils older than 700 million years caused an elevation of eyebrows. That may be true of *animal* traces, but stromatolites — which Crimes seems to regard, incorrectly, as body fossils (p. 123) — certainly occur at vastly earlier dates in the fossil record. I was puzzled by the apparent contradiction in the statement that *Archaeichnium* is "not a trace fossil, but worm tubes" (p. 116); surely a worm tube *is* a trace fossil? I was also startled by his suggestion that "animal life expectancy was much greater" in the Precambrian (p. 125), since this is a claim not reinforced by any evidence presented. Most of all, I was left unconvinced by his conclusion that the late Precambrian was a time of evolutionary failure, and I shall await, with interest, the responses (surely adverse?) that this hypothesis will arouse.

Richard Bromley's account of "The palaeoecology of bioerosion" (p. 135--154) is predictably lucid and well illustrated. That by David Bottjer and Mary Drossler of "The history of Phanerozoic bioturbation" (p. 155-176) treats this difficult theme somewhat less lucidly; their accounting of tiering, however, is good.

I was delighted to read Fredrik Bockelie's account of "Plant roots in core" (p. 176-199). Since my own attempt at an overview of plant trace fossils in 1975, this field has remained sadly neglected. Equally valuable is Stephen Donovan's own account (p. 206-220) of trace makers in non-marine environments, illustrating as it does the massive advances made since Kent Chamberlain's overview (also 1975) of an even more neglected field for research.

Two papers deal with vertebrate traces. Adrian Hunt and co-authors give an interesting account of the paleobiology of vertebrate coprolites (p. 221--240), although their history of study is too brief to be useful. The ensuing treatment by Martin Lockley and co-authors of "Vertebrate tracks and the ichnofacies concept" (p. 241-268) is very heavily slanted to North American studies, with a bibliography in which citations of their own works number 27 out of 102: scarcely a balanced survey of a very extensive world literature. Their concept of ichnofacies is an interesting one, but merited a broader international base for its use to be justified in environments so much less functionally and faunistically static than aqueous facies. The final work, by Karl Hirsch on fossil vertebrate eggs (p. 269-294), stretches the concept of trace fossils somewhat, but remains a very useful survey.

All in all, then, this book merits purchase, perusal and thorough reading by all paleoichnologists. Moreover, it will surely serve as a valuable reference for student classes in paleoecology, that most exciting of fields in paleontology and paleobotany.

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