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REVIEW OF PALAEOBOTANY AND PALYNOLOGY

Book Reviews

Basic Questions in Paleontology: Geologic Time, Organic Evolution, and Biological Systematics, by Otto H. Schindewolf (translated by Judith Schaefer, edited with an Afterward by Wolf-Ernst Reif, with a Forward by Stephen Jay Gould). University of Chicago Press, Chicago. 1994, 486 pp. ISBN 0-226-73834-5 (cloth); ISBN 0-226-73835-3 (paper). Price US$75.00/29.95 £59.95/23.95.

We English speaking paleobotanists have long been very conservative in our view of the evolutionary process, variously in agreement or at odds with our brothers and sisters in invertebrate and vertebrate paleontology depending on the decade in question (their views change more rapidly than ours). The dominant themes among students of fossil vegetables have been gradual evolution, the expectation of numerous intermediate forms, interspecific competition as the main driving force of phenotypic change, and ever increasing functional efficiency within evolutionary lineages. "Selective pressures" have often been invoked as ad hoc agents of change, leading to scenarios that border on Lamarkian in many instances, and that are clearly circular in most (structure A exists, therefore there must have been a selective pressure "for" structure A). With the rise of interest among paleobotanists in developmental biology, cladistic analysis of phylogeny, and paleoecology there has been increasing focus on macroevolutionary dynamics and stochastic factors in evolution, and the field has moved forward rapidly in the last 10 to 15 years.

The Telome Theory of Walter Zimmermann was, and remains in the minds of some, the principal model for the evolution of the vascular-plant phenotype. The Telome Theory fits nicely into the thinking of the major, English-speaking architects of the neo-Darwinian synthesis that coagulated in the 1940s and 1950s. We never really saw the gulf that separated German-speaking evolutionary biologists from their English-speaking counterparts. German contemporaries of Zimmermann included two thinkers of enormous intellect and importance who were either caricaturized or little appreciated further to the west: geneticist Richard Goldschmidt published in English and is (unfairly) renowned for his concepts of systemic mutations and hopeful monsters, and paleontologist Otto Schindewolf is known dimly, because he published only in German, as a proponent of orthogenesis. Unorthodox terminology or clearly incorrect explanatory mechanisms for parts of the larger, well integrated theories of these men, led to the wholesale dismissal of many important parts of their ideas.

Like most Anglophones I had heard of Schindewolf but never read a word of his writing, even though his anti-Darwinian views dominated German evolutionary paleontology from the 1950s through the early 1970s. Thus, the University of Chicago Press has done a great service in bringing out this excellent translation of Schindewolf's classic 1950 synthesis. A Forward by S.J. Gould, and an Afterward by W.-E. Reif provide excellent background reading to the main text, and give the reader a feel for Schindewolf's time and place, and the impact of his work. The translator, Judith Schaefer, has produced a marvelously readable, even quotable, text that should be an excellent supplement to courses in evolutionary biology.

For paleobotanists, *Basic Questions in Paleontology* is an invitation to look into a time warp

and see that all serious, knowledgeable paleontological thinkers of the 1940s and 1950s did not sign up for the ranks of the New Synthesis, only to deny some of the basic patterns of the fossil record or attribute them to missing data. Schindewolf saw that the main architectures found within an evolutionary lineage, at whatever taxonomic rank, tended to originate early and nearly synchronously without transitional forms, thus defining a morphological envelope. Speciation on the major themes then filled out the diversity within these early-established limits. Radiations within major constructional themes generally followed the same patterns as those at higher taxonomic levels— there is a fractal component to the shape of evolution. Major differences in design do not appear during a gradual unfolding of form.

With this pattern in mind Schindewolf developed his concept of Typostrophism, which circumscribed a three-part, periodic, cyclic model of the evolutionary process, heavy on the idea that lineages were predestined to go through a life cycle dictated by factors internal to the organisms. During the initial phase of typogenesis, "there is a brief period of the abrupt development of forms", which happens in large transformational steps. The second phase, typostasis, is a period of "progressive elaboration, diversification, and differentiation within the framework of the basic form." During the third and final phase, typolysis, the lineage undergoes "decline, degeneration, and the loosening of the morphological constraints embodied in the type", including overspecialization and gigantism. Developmental factors were invoked as the root of these larger patterns, and natural selection was rejected as the principal architect of phenotype.

Most of the examples in the book are zoological, but many interesting discussions of fossil and extant plants are sprinkled throughout the text. Pages 165–176 include a spirited, logical defense of evolution in the face of creationist ideas that remain applicable today, and there are many other gems of logic sprinkled throughout the text. Clearly, Schindewolf was a critical thinker who largely rejected mystical, non-mechanistic explanations of the evolutionary process. Yet his views on species scenescence and his overt rejection of natural selection cloud the basic patterns he was attempting to explain. In many cases the patient reader will find, buried in unfamiliar terms, the concept of selection as a filter, description of the contingent nature of the interaction between ecological opportunity and structural capability, the concept of developmental canalization, and many other familiar concepts from the lexicon of macroevolution.

Paleobotanists should enjoy reading this book with its unorthodox rendering of the evolutionary process. Given that theory-free observation is an impossibility, there is no better way to come face to face with one's own presuppositions than to study alternative interpretations of the basic patterns in the fossil record.

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Pollen Grains of New Zealand Dicotyledonous Plants, by Neville T. Moar. Manaaki Whenua Press. 1993, 200 pp. ISSN 0-487-04500-X. Price US$ 60.00.

The diverse flora of New Zealand extends from subtropical to subantarctic latitudes. Although the flora has a high degree of endemism, it shares many components with Australia and other austral land masses as had been recognised by Darwin and Hooker over a century ago. Resolving the history of the flora, and particularly of the angiosperm flora, with its Gondwanic origins overlain by a diverse element that developed in isolation for much of the Tertiary and Quaternary, has been aided significantly by pollen analyses. In this context, pollen analyses have provided a series of "snapshots" of past vegetation reconstructed from pollen assemblages preserved in sequences of Cretaceous–Recent age. Identification of plant taxa has relied heavily on comparative studies between the fossil pollen and those of the extant flora. Yet, by contrast to the wealth of detailed descriptions and superb illustrations of fossil pollen taxa, there was no comprehensive illustrative account of New Zealand's present-day pollen flora apart from the manuals produced by Lucy Cranwell half a century ago (Cranwell, 1942,