technology to the social soul in the machine and to remind us that with artifacts, as with all outcomes of human action, it could have been otherwise. The task is to understand the roads not taken and why.

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The Invertebrate Record

Fossil Invertebrates. RICHARD S. BOARDMAN, ALAN H. CHEETHAM, and ALBERT J. ROWELL, Eds. Blackwell Scientific, Palo Alto, CA, 1987. xii, 713 pp., illus. $49.95.

The potential audience for paleontological information is larger than ever before. Not only are there more geologically oriented workers using paleontological data for such traditional tasks as biostratigraphic correlation and environmental reconstruction, there is a host of biologists and paleobiologists intrigued by the possibilities offered by the fossil record's rich document of evolutionary histories and past ecologies. Thus a major new textbook edited by three prominent paleontologists and collectively written by these and 24 more is most welcome.

The book is organized taxonomically and after a rather rushed treatment (occupying less than 10 percent of the volume) of such general topics as evolution, ecology, and preservation gets down to the business of reviewing the morphology, classification, evolution, and geologic history of all the major invertebrate contributors to the fossil record. These chapters are well written and superbly illustrated, and the authors are indeed world-class specialists in their fields. The book suffers from few of the failings of multiauthored works: the chapters are written in a consistent style and yet are not forced into a rigidly standardized format. The chapters are in large part up-to-date, although I could find only two post-1984 references (both on p. 293): the topics emphasized here are not evolving and shifting so rapidly as the more theoretical side of paleontology.

One surprise is the minimal reflection of the present upheaval in systematics, the advent of cladistic methodology and classification. The controversy engendered by cladistics is anything but a musty debate of interest only to archivists. For better or worse, cladistics is changing the ways in which systematics and evolutionists pursue their science and even, for some of the more dogmatic advocates, the kinds of questions viewed as legitimate subjects for research. Cladistic analysis is discussed in the chapter on classification at the beginning of the book but is conspicuously absent from most of the taxonomic chapters, although the approach is used to good effect in Rowell and Grant's treatment of the origins and interrelationships of the major groups of brachiopods. Clearly cladistics has not yet made many inroads into the core of invertebrate paleontology, which is unfortunate because an explicit cladistic analysis of character states among taxa is of great use regardless of the nature of the formal classification derived (in part or solely) from that analysis. Part of the problem may derive from the uncertainty—indeed occasional hostility—among cladists regarding the use of paleontological data. However, such workers as C. R. C. Paul and A. B. Smith (*Biol. Rev.* **59**, 443 [1984], an important reference absent from this book) are attempting to apply cladistic methodologies to even the most knotty phylogenetic problems in the fossil record, such as the relationships and rank of stem groups and the pattern of adaptive radiation during times of explosive evolution. There is still plenty of controversy, but the approach is bound to aid in the focusing of discussion.

The fossil record is certainly rich in data on evolutionary originations, and this is reflected in *Fossil Invertebrates*, particularly for higher taxa. The origins of most phyla and classes are given at least brief treatment, and groups of lower rank are often discussed as well. It is impossible not to be impressed by the exuberance of form in the fossil record as documented here. Some general messages on evolutionary process emerge, simply from a working through of the taxonomic chapters. For example, heterochrony—evolutionary changes in the timing of development—is a recurrent theme. The authors note that this process played a role in the origin of major groups of bryozoans, crinoids, trilobites, brachiopods, and cnidarians, and no doubt this pathway has been exploited by many other higher taxa over the past 600 million years.

The book may be a bit intimidating and massive (it weighs well over 4 pounds) as an introductory textbook, and the condensed treatment of general principles will probably prompt the collateral use of Raup and Stanley's classic *Principles of Paleontology*. But its value extends far beyond this single application. Here at last is a single volume to which paleontologists can refer geological or biological colleagues—not to mention one another—in the face of the spectacular diversity of the fossil record.

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Exemplars

Women of Mathematics. A Biobibliographic Sourcebook. LOUISE S. GRINSTEIN and PAUL J. CAMPBELL, Eds. Greenwood, Westport, CT, 1987. xxii, 292 pp. $45.

In the latter part of the 19th century, women in mathematics pioneered in breaking down barriers to higher education for women in many fields. Nearly a century later, however, women still confronted discrimination in the mathematical community. Such was the context for the founding of the Association of Women in Mathematics in the early 1970s, which, like committees appointed by the professional organizations, has labored "to combat discrimination against women in mathematics" (p. xi).

Recent calls for more biographical information about "women mathematicians of the past and the present" (p. xii) are in some ways a measure of progress on this front. *Women of Mathematics: A Biobibliographic Sourcebook*, with its 43 biographical essays, is meant to answer such calls. Its intended audience includes professional mathematicians, those interested in history of mathematics or history of women, and high school and college students in need of "inspirational reading" (p. xii) and positive role models.

The entries, many written by women mathematicians, follow a set formula with sections on biography, work, and bibliography. The entries vary considerably in length, depth, and technical content. The editors warn readers, however, that the length of an essay is not necessarily to be taken as an index of fame or importance. The bibliographical section in each entry offers a chronological ordering of "works by," abridged if a list of the subject's publications is easily accessible elsewhere, and a selection, sometimes annotated, of "works about." Some entries also refer to available manuscript sources. The entries are supplemented by a list of references in biographical dictionaries and other compilations; a graph depicting birth date and lifespan for the 43 subjects; a tabular summary of information about place of birth, highest degree, place of work, and mathematical specialties; indexes of personal names and subjects; and brief descriptions of the contributors.

The women featured in this volume all satisfied several of the following criteria for inclusion: advanced degrees despite social or family pressures; innovative research; influence through teaching; significant participation in professional societies; extensive publications; service on editorial boards for mathematical journals. The earliest is Hypatia (370?–415), "first woman known to have written on mathematical subjects" (p. 76). Agnesi and Chatelet represent the 18th