

and enumerates future observatories that will facilitate multiwavelength work. I found the first two chapters particularly interesting in that they constitute a primer for conducting multiwavelength research. An infrared or submillimeter astronomer must find the third chapter disappointing because the author discusses only one infrared mission, SIRTf, and omits the European Space Agency's Infrared Space Observatory (ISO), scheduled for launch in 1993, and the planned NASA mission LDR and ESA mission FIRST.

Many of the papers in this volume provide outstanding examples of how an astrophysical picture emerges from a wealth of individually inconclusive indicators, intelligently gathered wherever technology provides opportunities and physical insight permits discrimination between competing ideas. Perhaps the most useful aspect of the book is that it tells the newcomer how to think in terms of multiwavelength observations. We don't find many tables compiling facts. Rather, we repeatedly become engrossed in discussions of how to derive astrophysically interesting conclusions. In the long run that may be the most valuable contribution this volume can make.

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A Biotic Transition

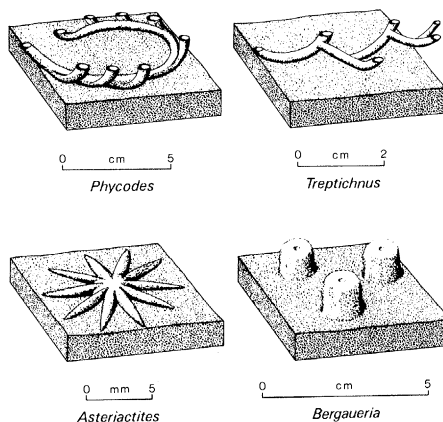
The Precambrian-Cambrian Boundary. J. W. COWIE and M. D. BRASIER, Eds. Clarendon (Oxford University Press), New York, 1989. x, 213 pp., illus. \$85. Oxford Monographs on Geology and Geophysics, vol. 12.

The most important events in the history of life arguably occurred during the few tens of millions of years that encompass the transition from Precambrian to Cambrian time. It was then that the body plans of most of the major groups of animals were developed during a period of unparalleled evolutionary invention; those metazoan diversifications cast the parts for the great play of life.

Despite the clear intrinsic interest of those seminal events, it has only been within the last couple of decades that a broad scientific effort has been mounted to explore the geologic and paleontologic record of that time; reasonably complete sections across the transition are rare, trace fossil studies had been in their infancy, and body fossils are relatively rare and are so primitive or allied so remotely to living groups that their interpretation is difficult. Furthermore, the temporal relations of fossil occurrences are

uncertain. Fortunately, progress in studies of transition events has been accelerating steadily. One of the principal driving forces has been, of all things, the attempt to establish international agreement on a reference horizon and locale (a "Global Stratotype Section and Point"—GSSP) for the Precambrian-Cambrian boundary. This effort has led to the careful examination of a number of sections that embrace the boundary, with an eye to discovering the most complete, most fossiliferous, and generally most useful GSSP. From these (and to be sure many other) studies has come a flood of new information bearing on the early metazoan radiation.

The Precambrian-Cambrian Boundary is a collection of essay-reviews, rich in data, written by several British members of a Working Group established under the International Geological Correlation Programme to recommend a GSSP. At present there are three major candidate sections: one is in Yunnan Province, one in Siberia, and one in Newfoundland. These and other important sections are described in some detail in a series of chapters. The biostratigraphy of the earliest fossils with mineralized skeletons, which appear near the boundary (more cannot be said until the boundary is selected), is reviewed on a global scale, as is the sequence of trace fossils from their earliest appearance through the Lower Cambrian. These two groups of fossils are promising as stratigraphic tools, although they lead to slightly different results when used to correlate geologic formations. The most serious deficiency is in the coverage of the biostratigraphic record of the phytoplanktonic acritarchs, which may prove to be especially useful in Precambrian-Cambrian correlations. There is reason to hope that these three fossil groups will provide the correlations needed to certify the sequence of events during the transition.



"Some of the trace fossils which first appear before the earliest trilobites in Tommotian and Atdabanian strata." [From T. P. Crimes, "Trace fossils," in *The Precambrian-Cambrian Boundary*]

Two papers consider the absolute ages of the rocks near the boundary. These discussions are sobering. By convention the boundary age is usually taken as 570 million years. The possible age, however, for the base of the Tommotian Stage, the horizon most likely to be chosen as the boundary, ranges at least from 600 to 530 million years. Recent evidence tends to favor an age nearer the younger end of this large range, but clearly the issue is not decided.

This volume brings together a wealth of biostratigraphic and chronostratigraphic information. For readers with a good working knowledge of the principles of biostratigraphy and a reason to inquire into the nature of the stratigraphic record during the early metazoan radiations, access to this volume is indispensable.

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Reprints of Books Previously Reviewed

Pyroclastic Rocks. R. V. Fisher and H.-U. Schminke. Springer-Verlag, New York, 1989. Paper, \$65. Reviewed 227, 48 (1985).

The Strategy of Life. Teleology and Mechanics in Nineteenth-Century German Biology. Timothy Lenoir. University of Chicago Press, Chicago, 1989. Paper, \$14.95. Reviewed 221, 146 (1983).

The Visible College. A Collective Biography of British Scientists and Socialists of the 1930s. Gary Werskey. Free Association Books, London, 1988 (U.S. distributor, Columbia University Press, New York). \$60. Reviewed 206, 674 (1979).

Books Received

Advanced Information Technology in the New Industrial Society. The Kingston Seminars. Arthur Cotterell, Ed. Oxford University Press, New York, 1988. xiv, 113 pp., illus. \$29.95; paper, \$18.95.

Advanced Power Sources for Space Missions. National Research Council. National Academy Press, Washington, DC, 1989. xii, 140 pp. Paper, \$23.50.

The Biology of the Brain. From Neurons to Networks. Rodolfo R. Llinás, Ed. Freeman, New York, 1989. xii, 170 pp., illus. Paper, \$10.95. Readings from *Scientific American*.

The Challenge of Global Warming. Dean Edwin Abrahamson, Ed. Island Press, Washington, DC, 1989. xviii, 356 pp. \$34.95; paper, \$19.95.

The Facts on File Dictionary of Artificial Intelligence. Raoul Smith. Facts on File, New York, 1989. viii, 211 pp., illus. \$24.95.

The Geology of Iztaccihuatl Volcano and Adjacent Areas of the Sierra Nevada and Valley of Mexico. Graham T. Nixon. Geological Society of America, Boulder, CO, 1989. viii, 58 pp., illus., + map in pocket. Paper, \$20. GSA Special Paper 219.

Low Temperature Detectors for Neutrinos and Dark Matter II. L. Gonzales-Mestres and D. Perret-Gallix, Eds. Editions Frontières, Gif sur Yvette, France, 1988. x, 518 pp., illus. \$63. From a workshop, Annecy-Le-Vieux, France, May 1988.

Macroevolutionary Dynamics. Species, Niches, and Adaptive Peaks. Niles Eldredge. McGraw-Hill, New York, 1989. xii, 226 pp., illus. \$28.95; paper, \$14.95.

The Oblique Derivative Problem of Potential Theory. A. I. Yanushauskas. Consultants Bureau (Plenum), New York, 1989. viii, 251 pp. \$79.50. Contemporary Soviet Mathematics. Translated from the Russian by Norman Stein.