of crucial questions in the application of evolutionary biology to human groups, answers to which can be taken for granted when species are the units. For humans we need to know not only the degree of polygamy in the group but the depth of time in generations or in years that the practice has had a chance to act upon the gene pool. And even the height measures are problematic; changes in diet and medical care have altered height for both sexes radically in the recent past for many or most groups, so the year of measurement is important.

The biologists differ from anthropologists in their treatment of motivation of behavior, too. While anthropologists cautiously distinguish what people say from what they do, and define their own task variously as etic or emic, biologists cheerfully attribute causal significance to motives that people deny having or that are attributed to creatures whose motives cannot possibly be known. For instance, Bernds and Barash discuss as a cause of fetal death the altruism of one identical twin, who maximizes inclusive fitness by dying. In anthropology this sort of thing is referred to as a "just so story," and it is odd to see it offered as a part of what is undoubtedly a different and valuable perspective.

E. O. Wilson's own contribution is a brief concluding statement entitled "Biology and anthropology: a mutual transformation?" in which he suggests that biochemistry may serve as a model for a new hybrid field that may emerge to deal with the interrelations of genetics, environment, and social behavior. At least in the short run, it is far more likely that disciplinary boundaries will persist, while the thinking of scientists on both sides is influenced by contact with the other. The biologists bring to the problems a body of literature and models that have thus far proven to be highly productive of new research and stimulating of new ideas. At the same time they seem to be innocently ignorant of much of the complexity of human social life and cultures that sociobiology sets out to explain. The anthropologists seem to be resisting biological reductionism while accepting questions from biology. In this context, William Durham's ambitious theoretical essay in which he attempts to broaden evolutionary theory to include joint effects of both Darwinian genetic evolution and Lamarckian cultural evolution, to be evaluated by the same criteria of adaptation, is intriguing, if not entirely convincing. One looks forward to a fuller treatment in the future.

The final word in the volume is properly Chagnon's. Reflecting upon the philosophical traditions of anthropology and the ways in which these intersected with assertions in sociobiology to generate controversy, Chagnon insists that the only principles needed to pursue biological questions in anthropology have been widely accepted long ago. Nature and culture cannot be mutually exclusive; "causeless spontaneity" cannot be an explanation; and evolutionary biology, which is granted to be the major causal force of all the varied forms of life, must apply to human life as well. Investigation of just how these simple forces apply to or are evaded by human beings is a major challenge.

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## Geology and Culture

**Images of the Earth**. Essays in the History of the Environmental Sciences. Papers from a conference, Cambridge, England, April 1977. L. J. JORDANOVA and ROY S. PORTER, Eds. British Society for the History of Science, Chalfont St. Giles, England, 1979. xxii, 282 pp., illus. £6.55. BSHS Monographs, 1.

This collection of papers prepared for a conference intended to represent new perspectives in the history of geology raises questions of considerable urgency in the history of science. Historians of science used to find their problems within science itself. They studied clearly defined events, such as the 19th-century controversy over the age of the earth, constructed narrative accounts of the evidence cited and the hypotheses advanced, and offered explanations why the individuals involved took the positions they did. Studies of this sort stimulated lively exchanges over the relative importance of logical and evidential factors, which were labeled "internal," as opposed to cultural and social factors, labeled "external." While this debate occasionally became confused, it helped bring about the recent reconceptualization of the nature of science and of the ways in which old theories are displaced by new ideas. It now appears that, if this book's call for a new departure is heeded, that phase of the history of science is at an end.

The one theme that binds these essays together is the desire to free the history of science from the order of knowledge created by science itself. The essays are grouped into sections on Geology and Belief, The Language of Environmental Science, Earth Science and Discipline Boundaries, and The Social History of Geology. The editors distance themselves from other works on these subjects by proclaiming their desire to transcend "the conventional straightjacket of the 'history of geology.' " The biographical examination of individual achievements is eschewed, as is the explication of historic controversies, while the more elusive linkages between science and its surrounding culture are emphasized. In short, exploration of the long history of geology has been replaced by a series of episodic forays into the hinterland.

Apparently the ultimate goal of this endeavor is to dissolve science itself into its cultural context. The editors call for greater emphasis on the "fundamental political and economic questions which are commonplace in the general historical literature," and historians of science are once again urged to make greater use of "the tools developed by historians, indeed by social scientists generally." Then, having insisted that all aspects of their subject, and indeed their subject itself, are historically problematic, the editors praise their collaborators for their intentions. Hugh Torrens's essay on geological communication in the Bath area and Paul Weindling's on the importance of utility in early-19th-century English geology may not be as "pioneering" as is claimed, but both are valuable additions to the history of British geology. Several other authors, such as G. N. Cantor and David Allen, attempt to transform their competent special investigations into case studies by invoking theories of language and of the sociology of disciplines. Such efforts, like the editors' obligatory mention of Foucault's archeology of knowledge, are better evidence of the contributors' ambitions than of the power of their method.

The individual essays vary considerably in quality. All are based on detailed historical research, much of it carried out during the preparation of doctoral dissertations, and several, such as Martin Rudwick's on Lyell's use of concepts drawn from the human sciences and W. H. Brock's on the shifting boundary between geology and chemistry, reflect the maturity of their authors. Students of 18th- and 19th-century British geology should note that the range of subjects examined is quite broad. R. Grant and John Brooke provide two studies of the relations between natural theology and geological theory, and Marcia Pointon and L. J. Jordanova examine the connections between geology and landscape painting and geology and environmental medicine. The level of theo-

retical aspiration in these essays, like the theories appealed to, varies considerably.

Does this muted polemic for what one of the authors calls the "macrocosmic positioning" of science within its social and cultural context point to the future toward which the history of science is moving? If so, there can be little hope that this specialty will provide a meeting ground for scientists interested in the history of their subject and professional historians of science. The new history of science happily ignores precisely those topics that scientists generally consider the most intriguing aspects of their work. Perhaps the evolution of the history of science as a distinct discipline has entered a second phase. If so, one can at this point note little more than the losses entailed and the hopes entertained. It is possible, however, that this most recent attempt to further desanctify science will have the unintended effect of forcing us to realize that science, while inescapably historical, is no less humanistic than poetry, painting, or music. Scientists, like other creative individuals, enrich our lives with specific products of great beauty. When seen in this light, science surely must be considered a constituent of a larger culture. But we should beware of histories that minimize the distinctiveness of the genre, the individuality of the creators, or the particular features of their achievements. Otherwise, we may end up with a history of science without science.

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## Plate Tectonics

**Geological and Geophysical Investigations of Continental Margins.** Papers from meetings, 1977. JOEL S. WATKINS, LUCIEN MONTADERT, and PATRICIA WOOD DICKERSON, Eds. American Association of Petroleum Geologists, Tulsa, Okla., 1979. viii, 472 pp., illus., + plates + index. $24; to AAPG-SEPM members, $19.50. AAPG Memoir 29.

The literature of tectonics is enjoying, or perhaps suffering, a continuing, seemingly exponential growth, which results from a number of factors. First, there is a now general understanding that plate tectonics forms the basic foundation on which we should be modeling global lithosphere kinematics and structural evolution. Consequently, an increased understanding of tectonic processes and relationships has led to a great increase in the number of scientists involved in tectonic research. Second, advances in materials science, coming from ceramics, metallurgy, and the aircraft and the new strong-materials industries, are being, albeit tentatively, applied to structural geology and tectonics. Third, multichannel seismic reflection with computer-based deconvolving techniques developed mainly by the oil industry and the deep-crustal reflection technique developed by Kaufman and Oliver at Cornell have yielded seismic-stratigraphic and crustal-structural data of a beauty and clarity that have enabled us to draw believable structure sections across continental margins and orogenic belts for the first time. Thematic books and data compendia are therefore on the increase and play a welcome and important role in providing concise, up-to-date summaries that make the data and current ideas of tectonics available to a wide audience who would otherwise need to wade through a morass of literature.

The present volume admirably fulfills this role and follows the fine tradition set by the volume edited by Burk and Drake and by the Maurice Ewing series. Four main topics are covered: rifted margins, convergent margins, small basins and their margins, and the natural resources of continental margins. A mistake, in the reviewer's opinion, was made in including a paper on the southwestern margin of Iceland, hardly the best example of any kind of continental margin.

The role of the new seismic stratigraphy is seen in the sequence of fine papers on the Gulf of Mexico and the eastern United States rifted margin. A notable omission in all these papers except for Bott's is any systematic discussion of the structure and petrology of the rifted-margin–continent-ocean transition, in particular the role of thinned, stretched, continental lithosphere beneath the upper continental rise, a phenomenon well displayed by the Jurassic history of the Alps and the northern margin of the Bay of Biscay.

Of fundamental importance is Pitman's paper relating the effect of sea-level change and the thermal subsidence of rifted margins to stratigraphic development. Pitman's work on stratigraphic modeling is probably the single most important piece of research ever done in stratigraphy. He computes sea-level changes from changing ridge volumes, superimposes this effect on a hinging, thermally subsiding rifted margin, and generates a theoretical stratigraphy with onlap and offlap, transgressive and regressive, sequences and disconformities that can be matched with the observed seismic stratigraphy on the eastern U.S. margin.

An imaginative and clever paper on the evolution of the Mediterranean oceanic basins by Biju-Duval, Letouzey, and Montadert ties the basins kinematically to the geometry and history of adjacent tectonically mobile zones. The paper is a fine illustration of how integrated tectonics should be done and is an important example of a new genre of integrative tectonics typified by the French school.

The book also contains papers that fill a useful role in providing up-to-date summaries of otherwise hard-to-find data on areas and topics of importance. Among these are papers by Ludwig *et al.* on the Falkland Plateau, Talwani *et al.* on the South Australian quiet zone, Karig *et al.* on the Sunda arc, and Duque-Caro on the structure and evolution of northwestern Colombia.

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## Chemistry in China

**Chemistry and Chemical Engineering in the People's Republic of China.** A Trip Report of the U.S. Delegation in Pure and Applied Chemistry. JOHN D. BALDESCHWIELER, Ed. American Chemical Society, Washington, D.C., 1979. xx, 266 pp., illus. Cloth, $15; paper, $9.50.

In mid-1978 a delegation of 12 American scientists chaired by Glenn T. Seaborg visited the People's Republic of China for a firsthand view of that nation's research, development, and teaching programs in chemistry and chemical engineering. The visit was the counterpart of one the previous year by Chinese scientists to the United States and covered some 30 sites, including research institutes, universities, and industrial operations. This book is a report of that trip.

The book summarizes the delegation's observations about basic research in organic, inorganic, physical, nuclear, and analytical chemistry and in chemical engineering and research in key areas of technology—petroleum and petrochemicals, catalysis, polymers and synthetic fibers, laser chemistry, isotope separation, instrumentation, and computers.

Part of the book is devoted to a review of the development of chemical science in China over the past 50 years and to a useful examination of the disruptions brought about by the Great Leap Forward and the Cultural Revolution.