subjects, were both understood and appreciated by the community of maize geneticists. They became immediate objects of graduate seminar presentations, and the topics of controlling elements and transposition were rapidly incorporated into graduate and undergraduate courses in genetics and cytogenetics. As the author indicates, no one today questions the existence of mobile genetic elements; whether or not transportation plays a key role in embryological development in maize and other organisms, as McClintock implies, is for most researchers still an open question.

It is only fair to indicate here that biographer and subject were not in agreement about the publication of this book. In the prefatory material to the book the author takes note of McClintock's reluctance to be the subject of such a project and thanks her for "tolerating—even while trying her best to dissuade me from—the writing of this book." In a subsequent article in the *New York Times* (Long Island section, 16 Oct. 1983, p. 23) McClintock is quoted as saying, "I want nothing to do with a book about me. I do not like publicity."

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Geologic Thought

Great Geological Controversies. A. HALLAM. Oxford University Press, New York, 1983. x, 182 pp. $35; paper, $14.95.

This compact book has two objectives, namely to examine currently popular models of the development of science within the context of geology and to transmit "some fascinating pieces of intellectual history to a wider audience." The author focuses upon five celebrated controversies as case histories spanning the development of modern geology from the late 18th century to the 1970's. Although the book does not claim to be a comprehensive history of geology, it does cover the most important shifts in geologic thought and so serves as a good introduction. The emphasis upon controversy is justified because "underlying assumptions and attitudes of the protagonists [are] often brought out into the open. Furthermore, attention is concentrated on the matters most critical to growth and development of a given subject."

Historians of science may be skeptical of Hallam's selective approach. Initially, I was suspicious that the book would be too narrow and too gimmicky to serve much purpose other than fireside entertainment for a minuscule audience of curious laypersons. Before I was halfway into the first chapter, however, I realized that this is a thoughtful and carefully crafted, adequately footnoted, scholarly work, which must have had a long period of gestation.

Hallam devotes a separate chapter to each of five major controversies. These are "Neptunists, vulcanists and plutonists"; "Catastrophists and uniformitarians"; "The Ice Age"; "The age of the earth"; and "Continental drift." Each is a coherent entity that can be comprehended separately. A sixth chapter evaluates the ideas of Popper, Kuhn, Lakatos, and others. One can hardly quarrel with the choice of controversies, and, on the whole, the treatment of all five is very good; I gained new insights from each chapter.

Hallam's final chapter presents an overview that I wish were more extensive. After questioning the trendy external approach to historiography, which emphasizes sociological climate more than factors internal to science, Hallam argues that both a "persuasive advocacy" and new techniques are most important in establishing new theories. He then assesses several models of scientific development in light of his previous chapters. He is persuasive in stressing geology's historical emphasis upon inductive empiricism as opposed to the hypothetico-deductive approach advocated by Popper. Hallam sides with those who criticize Popper as too extreme in circumscribing a preferred scientific approach in purely epistemological terms. Instead he leans more toward Ziman, Polanyi, and Kuhn, who stress the importance of how scientists actually operate. Hallam then shows that none of his five controversies fits neatly any of their models; the scheme of Lakatos is preferred over these others. A *research programme* provides a core of universally held theory surrounded by *auxiliary hypotheses* that "bear the brunt of critical tests." In assessing the future of plate tectonics, Hallam then asks, "Are we now the victims of this success?" He doubts that the central research programme—like Newton's laws of gravity—will ever be completely superseded, but many auxiliary hypotheses certainly will yield to the scalpel.

Because our present students have grown up entirely with plate tectonics, it seems to me that a historical perspective on previous geologic thought is essential. Hallam's *Great Geological Controversies* together with Porter's *The Making of Geology: Earth Science in Britain 1660–1815* (1977), Albritton's *The Abyss of Time* (1980), Greene's *Geology in the Nineteenth Century* (1982), and the Fauls' *It Began with a Stone* (1983) provides an appealing choice of new, thematic references (mostly 200 to 300 pages long) both for teaching such history to our students and for diverting self-instruction at the fireside.

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Ocean Eddies

Eddies in Marine Science. ALLAN R. ROBINSON, Ed. Springer-Verlag, New York, 1983. xxvi, 609 pp., illus. $45. Topics in Atmospheric and Oceanographic Sciences.

Eddies in Marine Science is a compilation of chapters by a variety of authors dealing with a broad spectrum of characteristics of ocean eddies. Eddies, or low-frequency fluctuations in the current/temperature field, are ubiquitous and energetic oceanic features. The book, which is the first one devoted to a survey of the status of knowledge of ocean eddies, is a good and useful point of departure for anyone interested in becoming familiar with this subject.

There are sections of the book that should be useful for investigators in allied fields who are seeking an assessment of the impact of eddy research on their specialties as well as for those active in this field who are interested in identifying aspects of the subject for future study. There is a chapter on eddies and biological processes, as well as one on eddies and acoustics. Summaries of what is known about eddy dynamics (and general circulation) in the South Pacific and South Indian oceans make it clear that this hemisphere is sharply underexplored, as are tropical and higher-latitude regions in general.

Three chapters demonstrate considerable accomplishment in the last decade. Holland *et al.* survey the nature and relevance of eddy-resolving general circulation models and make the case that instability processes are the prominent energy sources for eddies in subtropical gyres. Bryden has possibly identified the essential role of eddies in the Antarctic circumpolar current. A chapter on Gulf Stream Rings by Richardson is a summary of what is known about the best-

documented single oceanic eddy phenomenon. A chapter by Rossby *et al.* is devoted to a description of selected accomplishments based on one new instrumental development that was widely exploited in the last decade. This review of SOFAR float results near the MODE and POLYMODE regions is particularly welcome.

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