BOOK REVIEWS

Gretchen Luepke, Book Review Editor

DES FOSSILES ET DES HOMMES. *Eric Buffetaut. 1991. Preface by Yves Coppens. "La Fontaine des Sciences" Series. Robert Laffont, Paris. 329 p. Softcover, 135 French Francs.*

Since the time of the ancient Babylonians and maybe even before, mankind has been speculating concerning our history and our origins. Though there have been a few earlier glimmerings through the veil of misunderstanding and conjecture on the latter theme, it is only since the time of Cuvier that the veil has been drawn back, to reveal the rich and fascinating sequence of faunas inhabiting the earth before Adam evolved from his Primate ancestors in that pre-Quaternary African Eden.

The full story of this development from fable to facts is a fascinating one, yet it has not caught the public imagination in the same fashion as has (for example) the history of archaeological discovery. Yes, parts of the tale have been told lucidly and attractively; examples are Edwin Colbert's *Men and Dinosaurs* (1968), George Gaylord Simpson's *Discoverers of the Lost World* (1984), and the recountings by Sharon and Thomas McKern (*Tracking Fossil Man,* 1972) and John Reader (*Missing Links,* 1981) of the palaeontological quest for man's origins. Willy Ley, one of this century's greatest popular writers on science, reported particular episodes in a most entertaining fashion (*The Lungfish, the Dodo and the Unicorn,* 1948; *Dragons in Amber,* 1951), and Bjorn Kurtén was beginning to do so (*Hur man tryse in en mammut* [How to Deep-Freeze a Mammoth], 1981) at the time of his too-early death.

Yet, though Dr. Buffetaut has himself produced an elegant review of the history of vertebrate palaeontology for an informed readership of geologists and biologists (1987), there has been no comparable work in language suited to the general reader—and this, despite the fact that, as Dr. Buffetaut notes in his new work (pp. 8–9), extinct vertebrates exercise so powerful a fascination nowadays that the names of dinosaurs are more familiar to schoolchildren than those of many living animals, while the mammoth even serves as emblem for a French chain of superstores!

The book here reviewed fills this literary void most admirably. It is written in French so lucid and economical that even a reader with only a limited knowledge of that language, such as the present reviewer, can read it with enjoyment and ease. As in Dr. Buffetaut's earlier work, though due attention is given to the numerous major French contributions to palaeontological discovery, these are presented and assessed in a properly judicial fashion—a fashion creditably different from the extreme Francocentric attitude so evident in a recent and greatly overpraised French history of geology!

The historical coverage is set forth very precisely in the preamble:

> Ce livre suit l'histoire de la paléontologie des vertébrés depuis les premières interrogations de l'Antiquité jusque vers les premières décennies du XX^{e} siècle. Les developpements ultérieurs ne sont qu' évoqués, dans le dernier chapître. [This book follows the history of vertebrate palaeontology from the first enquiries of Antiquity to the first decades of the 20th Century. Later developments are considered only briefly, in the last chapter.]

The story begins with St. Paul in Malta, in a chapter surveying the folklore of fossils; thence it moves forward through the Dark and Middle Ages of Europe, with tales of giants, unicorns and dragons based upon fossil bone finds, to examine the belief that these were instead the remains of victims of the Noachian Flood. The story of their scientific study begins in France—no, not with Cuvier or Buffon, but with Jean-Étienne Guettard's finding, around 1750, of bones of reindeer and hippopotami, and the controversy this evoked. Other near-forgotten discoveries that gain mention are the discovery of a fossil crocodile near Whitby, Yorkshire, in 1758, in what are now known to be Jurassic strata, and the earlier finds in Ireland of the bones and immense horns of the great, or Irish, elk (*Megaceros*).

Much other work on vertebrates that has almost passed from scientific memory is brought back to mind—the belief of the German savant Messerschmidt that frozen mammoth remains in Siberia were those of the biblical Behemoth (p. 76); Fortis's work on the fossil fishes of Italy (pp. 91–94); the *Basilosaurus* controversy (pp. 160–161); the dispute between Gideon Mantell and Richard Owen whether bones from Elgin, Scotland, were those of an amphibian or a lizard (p. 163)—Mantell was right and Owen unforgiving; Darwin's observation of mass mortality of cattle in the Paraná River (p. 178); the fabulous *Missourium* (pp. 234–235); and Ludwig Leichhardt's confident expectation of encountering living *Diprotodons* during his explorations in northeast Australia (p. 274).

Particularly valuable is the survey of palaeontological work in the British, French and German colonies and in independent non-European countries prior to

the First World War; particularly entertaining are the illuminations in sidelight of literary and poetic responses to fossil discoveries (e.g., pp. 150, 191, 207, 280–281). I was also pleased to find the early studies of vertebrate footprints given reasonable attention (pp. 164–167 and elsewhere), though regretting that the earliest scientific work on them, in Scotland, and William Buckland's experiments in track simulation did not gain mention.

Greatly to Dr. Buffetaut's credit are his very balanced assessments of two particular French controversies—Cuvier versus Lamarck (p. 125) and Cuvier versus Geoffroy Saint-Hilaire (p. 131)—and of the contributions of Hugh Miller (p. 168) and Albert Gaudry (pp. 195–198, 224). It was amusing also to be reminded how Louis Agassiz and Richard Owen, though both passionate anti-evolutionists, inadvertently furnished crucial data in support of Darwin's theory (pp. 157, 190). I was less happy with the analysis of Alcide d'Orbigny's stratigraphical ideas (p. 170) which, as Michel Rioult has demonstrated ("Alcide d'Orbigny and the stages of the Jurassic," *Mercian Geologist,* v. 3, 1969), were more percipient than Dr. Buffetaut recognizes.

In a work of such broad compass, a few errors and omissions are inevitable. The name of the biblicist Archbishop of Armagh was, I believe, properly James Usher, though the alternative spelling "Ussher" is found in some contemporary documents. However, contrary to the statement on p. 53, Usher determined only the year of the Creation, 4004 B.C.; it was John Lightfoot of Cambridge University whose even more refined scholarship identified the month and day. The Thurso baker who collected fossil fishes was Robert, not Richard Dick (p. 156). "Marsch" (p. 8) is unquestionably a mere misprint of the surname of Othniel Charles Marsh, while the date "1930," given on p. 276 for Colenso's work in New Zealand, must be a misprint for 1830. However, the misspelling "ichtyosaure" occurs so often (e.g., pp. 11, 140) that it is surely the author's error. I would question that Gideon Mantell was beyond all doubt ("sans nul doute," p. 137) the greatest contributor to the study of vertebrate fossils in the early nineteenth century; as is recognized later (p. 145), William Buckland discovered *Megalosaurus* earlier and described that dinosaur earlier, as well as recovering the earliest sauropod bones, making the first major studies of cave faunas and of coprolites, and (through his association in correspondence with Joseph Pentland, long working at Cuvier's laboratory in Paris though gaining no mention in this volume), contributing also to the early studies of fossil marine reptiles and other vertebrates.

In terms of presentation, the lack of any index presents a serious problem for users of this book, while the paucity of illustration makes it definitely less attractive. However, the illustrations that are included are both well-chosen and, in many instances, unfamiliar.

This book eminently deserves to be fully translated into English and published in a more lavish format, with both an index and more generous illustration; the title *Fossils and Man* would do well, if not preoccupied. Because of its readability and in the absence of any comparable work, ample sales are surely guaranteed. Go to it, you North American publishers!

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SCIENCE AS A PROCESS: An Evolutionary Account of the Social and Conceptual Development of Science. *David Hull. 1988. University of Chicago Press. 586 p. Softcover, $23.95.*

Hull's *Science as a Process* is the result of fifteen years of empirical and theoretical research. During this time Hull, as an historian and sociologist of science, has been undertaking an empirical investigation of a major controversy in systematics about the correct aim and methods of the science. Hull began studying the development of one of the participating schools, the pheneticists, or numerical taxonomists, which began in the middle 1950's and continued to develop at the University of Kansas. He soon realized that another school was forming, namely, the cladists, or phylogeneticists, centered at the American Museum of Natural History. Added to these two schools are the evolutionary systematists who have attempted to regain their reigning position in systematics, a position they held before the rise of the cladists and pheneticists.

Evolutionary systematists are attempting to incorporate the insights of the other two schools into a new variant of their position. Hull has been in an ideal position to undertake this empirical study. Indeed, it is hard to think of anyone who is in a better position, for Hull is highly respected by systematists, as evidenced by his election as President of the Society of Systematic Zoology in 1984–1985. Hull not only knows all of the participants in the controversy and has extensively interviewed them, but also has had access to the editors' files of *Systematic Zoology.* Much of Hull's theoretical research during the last fifteen years has centered around the development and expansion of the idea that science is best viewed as a selection process. Again, it is hard to think of a better philosopher of science to pursue and to detail an analysis of scientific change in terms of evolution, for Hull is among the leading philosophers of biology who have concentrated upon articulating various concepts such as "species" which are central to the theory of evolution. Thus, Hull provides readers with a highly detailed case study of the controversy between the pheneticists and cladists, and the most detailed analysis of science as an evolutionary process that readers have yet to encounter. Moreover, Hull views his case study as providing the data for his theory of science as an evolutionary process.

Hull presents his historical analysis in the first half of the book. His central case study is, of course, the controversy in systematics between the pheneticists and cladists. The reader is presented with an account of science in the raw. Hull concentrates upon the social development of both schools or research groups as well as the ideas advanced by the members of each group. The interactions among participants within the same schools and between both schools are vividly chronicled. Hull portrays his subjects as human beings rather than as mythological objective students of nature. Although those who believe in myth might be put off by Hull's account, I suspect that most scientists, especially those whose work relates to systematics, which includes many readers of HESS, will relish Hull's narrative, even if they view it, as one botanist from Kansas who was not involved in the controversy recently described it, to be the "Peyton Place" of systematics.

Although Hull's account of systematics during the late 1950's through the 1980's constitutes the major part of his historical analysis, Hull also traces various aspects of the development of evolutionary theory from Darwin to the Modern Synthesis, gives a brief but highly informative account of systematics from Aristotle through Darwin to the New Synthesis, and reviews some of the differences among evolutionists concerning the role of natural selection, the rate of evolutionary change, and the levels at which selection can occur. Finally, he looks at biogeography. Of course, biogeography and paleobiogeography are important areas of evolutionary biology. But, Hull has another reason to look at biogeography, namely, the interaction between one of the most controversial figures in the history of biogeography, Leon Croizat, the founder of panbiogeography, and some of the key cladists.

Hull's account of scientific growth and change in terms of evolutionary theory is much more developed than other accounts. Some of the key elements are as follows: Concepts, be they partially developed ideas, hypotheses or full blown theories, are conceptual replicators. They are analogous to genes. Scientists transmit concepts, just as organisms transmit genes. Scientists are both vehicles and interactors. Similarly, organisms are vehicles and interactors. Scientists, or their brains, are vehicles for concepts. Other vehicles include books, journals, and computer tapes. Scientists are also interactors, for they interact with each other and their environment. Concepts and scientists form lineages. There is cladism, and there are cladists. Successful ideas, like successful genes, are replicated, and are replicated to a greater extent than competing ideas. Selection comes about with the differential replication of concepts by the scientists, who form research groups. Success for a scientist is a function of the use of his or her ideas.

The key ideas in Hull's book will themselves be a matter of controversy in the years to come. They will be replicated in varying degrees of fidelity by Hull and other philosophers, historians and sociologists of science. Indeed, Hull will continue to be a major interactor of the research group that views science as an evolutionary process. Whether Hull's ideas, or a variation of them, will triumph as cladism has triumphed over phenetics, is an open question. However, Hull's ideas will be taken seriously; they will be used by other students of scientific growth and change. He already is receiving, as he well deserves, substantial credit, as witnessed by the vast number of reviews and articles his book has already received. With this, he should be pleased, since credit in the form of use is what, according to Hull's account of science, scientists want. Readers of HESS should read Hull's book; they may become vehicles for the transmission of his ideas.

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SCIENCE AND RUSSIAN CULTURE IN AN AGE OF REVOLUTION: V. I. Vernadsky and His Scientific School, 1863–1945. *Kendall E. Bailes. 1990. Indiana University Press, Bloomington, Indiana. 238 p. Hardcover, $29.50.*

V. I. Vernadsky (1863–1945) was a very important Russian geologist who battled Tsarist and Stalinist repression, founded the field of biogeochemistry, and philosophized about man's place in the biosphere. As the first full-length English-language biography devoted to Vernadsky and his school, this book is a significant contribution to the history of science. It is very readable and provides a rich account of the relationship between science, universities, and the government in Russia and the USSR during the late 19th and early 20th centuries.

In post-Stalin years Vernadsky became immensely popular in the USSR. He was not a Communist Party member and never embraced dialectical materialism (the politically correct approach to science under Soviet rule), so, like Andrei Sakharov, Vernadsky symbolizes personal integrity and Slavic native ability. In the years to come, as the Russian and Ukrainian people look for sources of cultural pride, Vernadsky's stature is certain to grow. Already named in his honor are a mineral (vernadite), a geologic museum, the Ukrainian central science library, several mountain peaks and ranges, a peninsula in East Antarctica, a submarine volcano, a crater on the back side of the moon, a mine in Siberia, a scientific research vessel, a steamship, a village in Ukraine (Vernadovka), a street in Moscow (Vernadsky Prospekt), and a species of diatoms.

The fact that most Western scientists do not know of Vernadsky's work is due to the general isolation of Russian science and also to the fact that his major contributions cut across the boundaries of geology, chemistry, and biology and are out of the mainstream of Western science. It has only been in recent years, stimulated by the concern about global change and also by the Gaia writings of James Lovelock, that Western

scientists have begun to investigate global scale interactions between the earth's biota and nonliving matter. Vernadsky began to study this topic in 1917. The term *biosphere* was popularized by Vernadsky; it was coined by Austrian geologist Eduard Suess, whom Vernadsky visited in Vienna in 1910, and Vernadsky began using this term in his publications in 1914. He gave it a precise definition as that part of the atmosphere and surface of the earth where life exists. In 1926 Vernadsky published a book titled *The Biosphere,* with a French edition published in 1929; an English translation was just published in 1986.

The following quote from *The Biosphere,* one of several included by Bailes (p. 196), exemplifies why the Russian environmental movement finds much inspiration in Vernadsky's writings:

> The face of the planet—the biosphere—is being sharply changed chemically by man both consciously and even more so unconsciously. Man is changing physically the atmosphere and all the waters of nature. As a result of the growth of human culture in the twentieth century, the shores of the sea and part of the ocean are changing more and more radically (chemically and biologically). Man must now take greater measures in order to conserve for future generations the riches of the oceans which belong to no one.

Vernadsky attended St. Petersburg University where he studied chemistry with D. I. Mendeleev, inventer of the periodic table of elements, and mineralogy with V. V. Dokuchaev. At the time, Dokuchaev was addressing the serious economic problem of soil exhaustion. Vernadsky became involved in this research, which concerned regional variations in the chemical composition of soils throughout Russia. Most important for Vernadsky's future career, Dokuchaev was interested in the interaction between soils, organisms, and the atmosphere—a topic to which Vernadsky returned three decades later when he began to study the interaction of living and nonliving matter.

Vernadsky began his scientific career studying mineralogy. His undergraduate thesis, titled "On the physical properties of isomorphic mixtures," impressed Dokuchaev enough for him to propose that Vernadsky stay at the university to prepare for a career as a professor. It was traditional at that time for prospective Russian professors to study abroad for a year or two before completing an advanced degree in Russia; Vernadsky studied for one year with Paul Groth at the University of Munich and then he spent a year in Paris studying with Henri Louis Le Chatelier and Ferdinand André Fouqué. While in Paris he carried out an experimental study of silicate minerals. He succeeded in producing synthetic sillimanite, which had never been done before. He unexpectedly synthesized two different crystalline forms of sillimanite, which led him to address the problem of polymorphism in general for his *magister* dissertation. Vernadsky demonstrated the presence of a fundamental radical in most aluminosilicates, thereby uniting nearly all silicates into a unified system. A few years later, for his doctoral dissertation, he studied the phenomenon of gliding in crystals. His first major scientific book was *The Fundamentals of Crystallography,* published in 1903.

The strength of Bailes's book is indicated in the first part of the title: *Science and Russian Culture in an Age of Revolutions.* Bailes masterfully weaves the thread of Vernadsky's career into the fabric of Russia's tumultuous history. The weakness of the book is in the coverage of Vernadsky's scientific work. We learn almost nothing, for example, about his experimental work on silicate minerals—what he really did and what equipment he used. More significantly, his biogeochemical research is covered only superficially. Kendall Bailes was dying of AIDS as he was writing this book; I supposed that he just didn't have the energy and time to probe deeply into scientific details.

Vernadsky is famous in Russia for his insights into the way the biosphere works. One modern Russian scientist mentions Vernadsky in the same breath with Einstein in terms of his contribution to 20th century science, and one of Vernadsky's Russian biographers referred to him as the "Darwin of mineralogy." Such comparisons will seem wildly excessive to most non-Russians, but they capture the sense of respect and importance that Russian scientists feel for Vernadsky. There is, in fact, a parallel between the Darwinian view of genetic continuity among all past and present life on earth, and the Vernadskian view of spatial continuity among all living and nonliving matter in the biosphere—"Darwinian time and Vernadskian space" (to borrow a phrase from Lynn Margulis). Like Darwin, Vernadsky had plenty of detractors among the scientific establishment. According to his most famous student, A. P. Winogradov, Vernadsky's new field of biogeochemistry was derided by some Soviet scientists as the "geochemistry of the soul of the mosquito" (p. 187).

Was Vernadsky really a brilliantly insightful scientist in a class with Einstein and Darwin, from whom we still have much to learn? Or was he merely a very competent, historically interesting scientist whose accomplishments have been eclipsed by subsequent workers? I had hoped that Bailes's book would help me resolve this question, but it didn't. Bailes himself did not clearly understand which of Vernadsky's contributions have been incorporated into the scientific mainstream, which have been rejected, and which are still premature. The most striking example is Vernadsky's principle concerning the direction of evolution, which states that the "evolution of species during geologic time goes in the direction of increasing the biogenic migration of atoms in the biosphere" (p. 195). Bailes uses this as an example of one of Vernadsky's principles that have "withstood the test of time and have become part of world science" (p. 195). In fact, Vernadsky's ideas about direction in evolution are not compatible with modern evolutionary theory and have been completely ignored. For a summary of Vernadsky's ideas on evolution and biogeochemistry, see the 1986 paper by A. V. Lapo published in this journal (v. 5, no. 2, p. 124–127).

From the perspective of post-Soviet Russian scientists the most compelling aspect of Vernadsky's career may not be his biogeochemical principles or his environmental philosophy, but rather his ability to survive and carry on during times of political upheaval and dwindling financial support. As Vernadsky's wife Natasha once wrote in a letter to friends in Paris: "In Russia, it is difficult to be a scientist. The surrounding life swallows one up."

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HISTORY OF GEOMORPHOLOGY: From Hutton to Hack. *Keith J. Tinkler, editor. 1989. Unwin Hyman, Boston. 344 p. Hardcover, $75.00.*

This book is not, as the subtitle implies, a chronological review of the development of geomorphology as a discipline. Rather, as is the case with many collections of commissioned or solicited contributions, it is a mixed bag of individual contributions without a strong connecting theme. Nevertheless, like the curates's egg, parts of it are excellent.

Professor Tinkler, a notable historian of geomorphology, intentionally planned and organized the Nineteenth Binghamton Symposium in 1988 to commemorate the bicentennial of the publication of Hutton's "Theory of the Earth" as a paper in the Transactions of the Royal Society of Edinburgh. This paper became Chapter 1 of Hutton's better known 1795 book of the same name. In his preface, Tinkler notes with deserved pride that a generous part of the funding for the symposium was provided by the Social Science and Humanities Research Council of Canada, in a competition reviewed by a panel of historians, not geologists. The selection of speakers and subsequent editing of the papers for this interesting volume must be credited to Professor Tinkler, but the fact that he has such a fine selection of speakers available to him is a tribute to the growing activity of a dedicated group of historians of earth science, especially in North America.

Although this book carries a heavy British emphasis, as is often the case with Canadian geomorphological collections, it has a special overtone of the role of national geological surveys in restricting the scope of earth science scholarship, and in contrast, the importance of independent and often polynational field parties in the study of such isolated places as the Karakoram. Professor Starkel, in Chapter 12, gives a case study of the development of geomorphology in Poland, where borrowed ideas and textbooks inhibited the development of an indigenous geomorphology until scholars such as Lozinski began developing periglacial geomorphology and a broader climatic geomorphology in the first decade of this century. A striking commentary on the development of national "schools" of geomorphology is that the first Polish textbook of geomorphology appeared only in 1961!

Professor David Stoddart's review of coral-reef research in Australia and other parts of the South Pacific (Chapter 8) takes a similar dim view of nationalistic geomorphology, this time in Australia. Although Australia's Great Barrier Reef(s) offered a fruitful ground for geomorphic research, after the initial exploration by British crown expeditions, most of the subsequent work for two hundred years was done by foreigners, and not by the growing corps of Australian earth scientists. As Stoddart is one of the leading such scientists today, his remarks about the "melancholy picture of initiatives unseized and opportunities lost on the Australian reefs" (p. 161) will not be gently accepted by our Australian colleagues. It should be noted that his criticisms do not apply to his Australian contemporaries, who are actively producing monographs and technical papers about the Great Barrier Reef(s).

In spite of the alliterative subtitle "From Hutton to Hack," some unusual and not entirely compatible papers were selected for the symposium. The tribute to John Hack by his friends and colleagues, compiled by W. R. Ostercamp (Chapter 13) is a sentimental biography of a much admired and appreciated doyen of the profession, recently deceased. It is a very personal tribute, with no attempt of any connection with the rest of the book except to provide a justification for the subtitle. As deserved as the tribute was, it would have better been published in another place. John Vitek's Chapter 14, a perspective on [American] geomorphology in the Twentieth Century, is also not quite appropriate here. It has a useful compilation of the meeting dates and conference leaders of current geomorphological societies and groups, but uses total graduate enrollments in the U.S. as a proxy for data on student geomorphologists in a dubious comparison. Vitek reviews the current activity of geomorphologists as measured by the role of universities, libraries, professional societies, informal groups, symposia, and publications. He makes no mention of the role of national and state agencies in providing employment and research opportunities for geomorphologists, which is especially regrettable considering that John Hack was a member of the U.S. Geological Survey for almost his entire career.

In addition to several interesting accounts of eighteenth and nineteenth century geomorphologic research in Europe, including Forbes' research on the Mer de Glace in 1842 (Chapter 6, Cunningham), seismic-induced mass movements in Italy (Chapter 7, Alexander), and a commentary on Hutton's influence on geomorphology (Chapter 4, Dean), the book contains an excellent review of the history of research on the Lake Bonneville shorelines (Chapter 11, Sack). Hers is the best review I have read of the pre-Gilbert, Gilbert, and post-Gilbert writings on this classic topic. It should be read by any geomorphologist or Quaternarist interested in pluvial morphology and chronology.

This volume is unusual in that it contains a seven-page "Afterword" (Chapter 15) by Mott T. Greene, which is effectively a self-contained book review. A

browsing reader would do well to read Greene's chapter first, for it not only reviews the other chapters, but comments on each of them from the perspective of a well-known historian of science. No other reviews of the book are likely to be as perceptive as Greene's.

What are the main lessons from this collection of papers on the history of geomorphology? First, the British tradition of geomorphology is alive and thriving in the new world, with constant reminders such as this book. However, in Chapter 2, Francois Ellenberger reviews the work of several notable seventeenth and eighteenth century French scholars who anticipated Hutton in the appreciation of landscape evolution and the processes of landscape change. Ellenberger (p. 15) confidently lists Nicolas-Antoine Boulanger (1722–1759) as "the greatest geomorphologist of the eighteenth century" although Boulanger's opus has never been published. The book circulated in manuscript form, and greatly influenced such better-known earth scientists as Desmarest. This fascinating account by Ellenberger of early French geomorphic scholarship ranks with Kenneth Hewitt's Chapter 9 on the history of geomorphic exploration in the Karakoram Himalaya before 1939 as the outstanding historical contributions of this monograph. Both depart from the British tradition and open our Anglophile eyes to the many geomorphic contributions by other Europeans.

That leads to my second point: What was happening in the rest of the world? Starkel demonstrates that the history of geomorphology in Poland was dominated by imported ideas. What about Germany, where nineteenth and twentieth century geomorphology flourished under such giants as von Humboldt, von Richthofen, Suess, and Penck? If we are to follow the history of geomorphology from Hutton to Hack, surely there must be valuable mileposts engraved in languages other than English. I wonder what was being contemplated by scholars in Russia, the Middle East, China, and Japan? Clearly, their impact on the evolution of "western" geomorphology was negligible, but it would be interesting to know if they followed independent tracks or, like Poland, lived on borrowed scholarship.

Finally, although this was an American symposium, the impact of American exploration on European (read British) thought is not considered. The eighteenth and nineteenth century exploration of North America by European immigrant and later indigenous scholars laid the foundation for geomorphology as it is now taught and practiced everywhere. It is a striking fact that early European geologists found everything in order in eastern North America: The Old Red and New Red Sandstones were where they should be; the Ordovician was calcareous; the Silurian had evaporites; the Carboniferous was carboniferous. Thanks to plate tectonics, eastern North America was a near-perfect mirror image of the geology of Western Europe. Only when European geologists began to work in India, South Africa, and Australia (and to a regrettable lesser extent, in South America) did the specter of Gondwana arise to haunt and finally dominate the trans-North Atlantic dogma. Perhaps the Europeans who read and wrote about North American geomorphology were so comfortable with what they learned that they made no special effort to reevaluate their traditional theories. Perhaps it was by the exploration of places like the Karakoram or the coral reefs of the South Pacific that early European geomorphology matured.

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A HISTORY OF THE KANSAS GEOLOGICAL SURVEY, 1864-1989. *Rex Buchanan. 1989. Kansas Geological Survey Bulletin 227, Lawrence, Kansas. 96 p. Soft cover, $10.00.*

When one thinks of the Kansas Geological Survey, one immediately thinks of Raymond C. Moore, one of Kansas' most distinguished scientists and long-time director of the survey. In "A History of the Kansas Geological Survey, 1864–1989," Rex Buchanan does not dissuade one of Moore's massive role, but he does lay out the full role of leadership and staff that complements the history of the survey.

Buchanan's volume is a splendid, thoroughly readable work and a well-deserved tribute to a premier geological organization, the people who have led and staffed it, and those who continue to make it flourish.

Kansas, a state with a relatively small population but an abundance of natural resources, has historically supported geologic research and its geological survey well. Those distinguished scientists who led the survey had the essential and common good wisdom and the keen practical sense to meld basic research with public service and utility. In so doing, Kansas has always been able to boast one of the finest geological surveys in the nation and in the world.

Buchanan appropriately lays out the history of the KGS through the perspective of people. Events come into play—discovery of Western Kansas Chalk fossils (rock chalk, jayhawk, indeed), discovery of oil and gas in the early part of the century, the droughts of the late 1930's, and the emergence of ground water in supporting agriculture, among others. Still, it is people and how they shaped, paced, and reacted to events who are the stuff of Buchanan's history.

The Kansas Geological Survey, as many other state surveys, had its origin in the latter half of the 19th century. These early surveys were temporal things, poorly funded, or even unfunded. Kansas had its first surveys in 1864 and 1865 with total appropriations of $11,000, and a handful of staff, most of whom were not geologists. These early surveys covered everything from paleontology to sanitary relations (public health).

After a hiatus of 24 years, the Kansas Legislature created the University Geological Survey, and in 1907 the State Geological Survey was established. The early and historical ties with the University of Kansas served

both the survey and the university well. The tie allowed the survey to be research oriented and largely free of regulatory responsibility, functioning in the intellectual environment of the university but responsive to the basic charge of a state survey—public service.

The KGS has been endowed with strong leadership, from Haworth to Hamilton. Its history continues today with Lee Gerhardt and his associates, whose challenge it is to maintain the tradition and standing of the great survey they have inherited for a while.

Anyone interested in the history of geology and the function and maintenance of excellence in state geologic research should read Buchanan's history. And by all means, read Grace Muilenburg's incisive Foreword; it is truly a well said piece.

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GEOPHYSICAL HYDRODYNAMICS AND ERTEL'S POTENTIAL VORTICITY. Selected Papers of Hans Ertel. *Compiled and edited by Wilfried Schröder. 1991. Interdivisional Commission of History of the International Association of Geomagnetism and Aeronomy, Bremen-Rönnebeck. 218 p. Softcover.*

One of this century's most important contributors to theoretical fluid dynamics was Hans Ertel (1904–1971). From 1946 until 1969 he directed the Institute of Meteorology and Geophysics at the University of Berlin (renamed Humboldt University after the war). In the tradition of Herman Helmholtz, William Thomson, and Vilhelm Bjerknes, Ertel sought to develop Eulerian fluid dynamics as a useful basis for meteorology and oceanography. He made theoretical studies of convection, geostrophy and barotrophy, and turbulence. Among his best known results are the proof of a general vorticity theorem that included Bjerknes's circulation theorem as a special case, and the derivation (together with Carl-Gustaf Rossby) of a new conservation theorem for hydrodynamics.

The book in hand is a collection of 35 of Ertel's most important papers, many of which appeared originally in journals that are today not readily available. Twenty-five of the papers are in German, seven in Spanish (Ertel spent considerable time in Mexico and on Tenerife), and three in English. In addition, English translations are provided for the first time of three of the most important of the German-language papers. The papers are presented in chronological order (with one exception), from a 1933 paper on a new proof of Bjerknes's circulation theorem to a 1971 paper on a new invariant of motion in inertial currents. They are photoreproduced and presented without editorial commentary. The book does, however, provide some assessment of Ertel's work in a preface by the editor and in an introduction by Hans-Jürgen Treder.

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VULKANISMUSSTREIT UND GEOCHEMIE: DIE BEDEUTUNG DER CHEMIE UND DES EXPERIMENTS IN DER VULKANISMUS-NEPTUNISMUS-KONTROVERSE (Volcanism Controversy and Geochemistry: Significance of Chemistry and Experiments in the Volcanism-Neptunism Controversy). *Bernhard Fritscher. 1991. Franz Steiner Verlag, Stuttgart, Germany. 346 p. Softcover, DM 86.00.*

This book, a Ph.D. thesis in the Department of Mathematics of a university in Munich, Germany, examines the importance of chemistry and experimental studies in the controversy between volcanists and neptunists or, stated differently, the role of fire versus water in the origin and formation of rocks. The book includes an extensive bibliography, a glossary, and a register of the names mentioned in the book.

In his first chapter (introduction), the author sets the stage in providing a historical orientation on the nature of the controversy. The original embroilment between 1770 and 1830 concerned the origin of basalt, especially among German-speaking naturalists. Volcanism and plutonism defined the magmatic origin of basalt. By contrast the neptunists advocated that all rocks formed by water through chemical or mechanical processes. Although the origin of basalt seemed resolved in the 19th century, this reviewer experienced its extension with granites in the 1940's, listening to H. H. Read's "Meditations on Granite" which suggested that the controversy was still hot. Read (1944, p. 45) pronounced "igneous rocks are those, and only those, that have consolidated from a molten fluid." Here fire and fluids come together.

Fritscher's heading (in translation) "chemical and experimental methods in geosciences and the beginning of geochemistry" notes the many investigators who were involved in measurements, but it is not always clear what each did and how it impacted on the controversy.

The second chapter, titled (in translation) "evidence for fire" discusses vitrification, crystallization, melting, dissolution, experience with fire in volcanoes, and how rocks form in the dry state. In this last subject, the author relates the observations and experiments of Sir James Hall, Hall's visit in 1785 with Dolomieu (after whom the mineral dolomite has been named) to the volcano Vesuvius, and the objections against Hall's experiments, especially those of Kirwan (who, incidentally, named the mineral dolomite after Dolomieu). Additional topics under "evidence for fire" include calcination, lithification, melting and dissolution of calcined minerals, prevention of calcination, pressure, vitrification and the amorphous state, early geochemistry, contact effects, origin of veins, the granite prob-

lem, granitization, and metamorphism. The last major chapter deals with "chemistry, experiment, and experience" and discusses actualism, pressure, and chemical and mechanical forces.

Many interesting 18th century discoveries were rediscovered in the second half of the 19th century. In our 1967 co-authored chapter with J. E. Sanders on the "origin and occurrence of limestones," we discussed the work of G. Rose (1856) which Fritscher expands from 1837 through the 1860's. Rose's studies, the work of H. C. Sorby, and J. Walther, and in the early 19th century H. Klahn and J. Pia, were ahead of the 1980's, yet no one in the carbonate field today has heard of any of them, except Sorby who wrote in English, and Walther who is known only through his contribution to the facies concept. Significantly, F. Cohn (1862) whose gravestone appears on the cover page of *Earth Sciences History,* v. 8, No. 1 (1989), related how algae are responsible for the origin of pisolites and travertine; about 125 years later, others have matched his original discovery but never cited him nor even realized that he existed. Taking off from Fritscher's book, I can cite many such examples. The wheel needs to be reinvented.

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FIRE UNDER THE SEA. The Discovery of the Most Extraordinary Environment on Earth—Volcanic Hot Springs on the Ocean Floor. *Joseph Cone. 1991. William Morrow & Co., New York. 285 p. Hardcover, $25.00.*

Science writer Joseph Cone, a writer for Oregon Sea Grant (based at Oregon State University in Corvallis), has heretofore specialized in writing about scientific discoveries for magazines, public broadcasts, and educational film scripts. Now he makes an impressive hardcover debut with his book, *Fire Under the Sea,* which deals with the discovery and exploration of hydrothermal vents on the seafloor. The story is told from the points of view of different scientists and different ocean ridges. His writing style, which combines science with unabashed adventure, may be compared favorably with that of John McPhee.

The book begins with a well-conceived index map, followed by a chronology from the 1920's, with Alfred Wegener's theory of continental drift, to 1989, when Robert Ballard used a remotely-operated submersible to explore hot springs in the Mediterranean Sea. The book is then divided into 10 chapters, wherein the author interweaves present and past, providing significant scientific background to the study of the hydrothermal vents and how they fit in with global tectonics. Chapter 1 details the dive of July 10, 1984 by Steve Hammond, Alex Malahoff, and Ralph Hollis into the Escanaba Trough aboard the research submersible *Alvin.* Chapters 2 and 3 give historic background to undersea exploration and the revolution in the earth sciences. Chapter 4 discusses the Galapagos Expedition where undersea hot springs were first discovered, and Chapter 5 discusses the overall history and problems of mapping the seafloor.

Chapter 6 focuses on the hot springs of the Axial Volcano on Juan de Fuca Ridge. Chapter 7 starts with a discussion of serpentinites and ophiolites and ends with speculations on mining possibilities on Gorda Ridge. Chapter 8 on "Exotic Life" discusses the new life forms found at the undersea vents, and Chapter 9 deals with what the hydrothermal vents can tell us in speculation of the origin of life on earth. In Chapter 10, the author returns to the novelist's style, as he describes life aboard scientific ships in "Work at Sea."

An epilogue entitled "Broader Views" summarizes the work. There is then a section of Notes, a list of works cited, and an index. At the end of the "works cited" is a list of 70 interviewees. Because of Cone's Oregon State affiliations, it is perhaps not surprising that, of these 70, 15 are from OSU and another 7 from the NOAA group at the Marine Sciences Center at Newport. Other represented institutions include the U.S. Geological Survey, Woods Hole Oceanographic Institution, Scripps Institute of Oceanography, University of Washington, and Geological Survey of Canada. It would have helped if those interviewed had been listed with their affiliations, especially since not all of them are listed in the index. One error occurs in this list, where Randolph Koski is listed as "Randall Koski."

Some may quarrel with the author's liberal use of dialogue throughout the book. Although Cone personally interviewed many of the people featured in this book, it is difficult to know whether he is quoting them directly or inventing likely dialogue as would a novelist. All of the dialogue sounds authentic. I believe letting the scientists "speak" is clearly positive. Scientists are all too familiar with the negative image they hold among many young people, and Cone's technique helps to dispel unfavorable stereotypes.

The book is beautifully produced. Eighteen color photographs are grouped in Chapter 7. The book's dust jacket features U.S. Geological Survey scientist Robin Holcomb's photo of a chimney; the color scheme—in red, black, and gold—is a guaranteed eye-catcher.

This book is clearly aimed at nonscientists, although the scientific details are sufficient to entice any scientist looking for a broader background. I particularly recommend this book to budding scientists; indeed, it belongs in every high-school library. Historians of science would also do well to consult this book, even if they don't choose to emulate the writing style. The most important service a book of this kind accomplishes is the evoking of the atmosphere in which the work was performed.

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METEOROLOGY IN AMERICA, 1800-1870. *James Rodger Fleming. 1990. The Johns Hopkins University Press, Baltimore and London. 264 p. Hardcover, $45.*

Fleming's study of the growth and development of meteorology as a scientific discipline in nineteenth century America is the first comprehensive work of its kind and makes a welcome addition to the history of the earth sciences. The author of this work proves himself not only as a very competent scholar but a fine writer as well. His account is generally non-technical and can be read with profit by practically anyone. Formal training in meteorology is not a necessary prerequisite.

The problems which early atmospheric scientists faced in the collection and analysis of data were almost overwhelming. Yet, due to the direction of the prevailing winds at our mid-northern latitudes, the great land-mass of the continental United States formed an excellent 'laboratory' over which a variety of phenomena—particularly violent storms that were practically unknown in much of western Europe—could be studied. As Fleming documents, early settlers to eastern North America were quick to recognize that the intensity and suddenness of weather changes were on a different scale here than in the ocean-moderated climates of their past experience. They frequently sought connections between the influence of local climate and the occurrence of sickness or mortality.

The "laws" which lay behind such storm systems (tornados and hurricanes) soon became the center of controversy in the 1830's and 40's between three protagonists: James Espy, who defended his centripetal theory of their winds; William Redfield, who postulated a centrifugal or rotary theory; and chemist Robert Hare, who favored an electrical origin as the storm's *primum mobile.* Fleming's treatment of the multiple-sided arguments is informative, fair and impartial. His documentation is also sufficient to dislodge one notable claim against early American meteorology—that it was strictly a "Baconian" endeavor, insistent upon mere fact collection and devoid of a theoretical basis. While the author's treatment of this dispute well accomplishes his purpose, it seems to me that the debate itself should become the focus of a more thorough study, based upon Fleming's preliminary analysis.

Largely in response to the scientific furor generated by the storm controversy, the newly-organized Smithsonian Institution, under Secretary Joseph Henry, created and sustained an extensive system of volunteer weather observers. Outfitted with instruments provided by the government, they recorded and transmitted meteorological data from around the country to Washington, D.C. for later analysis. The significant role of natural history collectors, who frequently complied with requests to furnish meteorological data, is newly revealed. Fleming relates the successes (and many problems) behind this large-scale venture with accuracy and much insight. Maps, tables, and statistical evaluations are included, along with a novel collective biography of active observers sampled at roughly ten-year intervals. Lasting from 1848 until its gradual replacement by the U.S. Weather Bureau in the 1870's, the Smithsonian Meteorological Project sought the cooperation of other federal agencies as diverse as branches of the military and the Surgeon General's Office. This led to occasional struggles over power and control which Fleming explores in detail.

From the vast compilations of data obtained, the first reliable charts of national rainfall, mean temperatures, and other climatological factors resulted. These studies apparently laid to rest conventional folk wisdom of the day which attributed changes in climate to the effects of settlement and deforestation. Ironically, the issue of storm generation that the project initially hoped to settle did not find its solution among the achievements of the endeavor.

Fleming also profiles the extensive labors of Joseph Henry as an active proponent and administrator of meteorological science. While not a participant in the storm controversy, Henry is revealed to be one of the leading figures behind American meteorology in this period. This assessment may come as a surprise, based upon Henry's ascribed reputation as strictly a physicist or geophysicist. Fleming demonstrates an impressive command of the important primary and secondary literature in backing up this claim.

American meteorologists made other signal contributions to the field. Although not a mainstream scientist, William Ferrel independently worked out the Coriolis acceleration and eventually demonstrated the tri-cellular distribution of global winds in each hemisphere. Likewise, James Coffin studied worldwide data which in his hands produced the first general atmospheric circulation model. Here are cases where American scientists had significantly outpaced their European counterparts by midcentury.

The advent of continental telegraphy and preliminary attempts to establish nationwide synoptic reporting round out the rest of the book. After the Civil War, these efforts were organized largely by Colonel Albert J. Myer of the U.S. Army Signal Office. This new era began to transform American meteorology from a largely passive intellectual discipline into an active public service whose value was quickly realized through the issuance of impending storm warnings.

Fleming's well-organized account of the seventy-year period during which these and other remarkable changes occurred in American meteorology is an excellent, approachable study that has wide appeal to many earth science historians. I recommend it wholeheartedly.

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THE HERITAGE OF ENGINEERING GEOLOGY; THE FIRST HUNDRED YEARS. *George A. Kiersch (Editor). 1991. Geological Society of America, Boulder, Colorado. 605 p. Hardcover, $62.50.*

The editorial and written contributions of George A. Kiersch and his over 30 authors is *must* reading for any geologist interested in the historical development of engineering geology and the role of engineering works on the development of our understanding of the earth and earth processes. Many of the significant scientific advances made in geology can be traced to some form of engineering project. Foundation problems at the New Croton dam in New York (1895), for example, led to the discovery that limestone solutioning can occur below the ground-water table. The Storm King crossing of the Catskill Aqueduct discovered an ancient glacial channel 500 ft below the bed of the Hudson River that changed geological thinking about glacial processes. The siting and design of nuclear power plants in the 1960's and 1970's provided the impetus to develop geologic techniques to determine recency of last fault movement, which led to major advances in dating geologic events. Without engineering projects that demanded public safety, many geologic discoveries over the past hundred years would not have been made.

The Heritage of Engineering Geology; The First Hundred Years is the Engineering Geology Division's contribution to the Geological Society of America's Decade of North American Geology (DNAG) Project. This volume (Centennial Special Volume 3) is one of four Centennial Special Volumes, and is a worthy contribution to the DNAG Project.

The volume opens with geology in antiquity and closes 25 chapters later with geology in the future. The book is divided into five distinct parts: History and Professional Development of Engineering Geology; Geologic Processes and Engineering Works; Construction Materials and the Environs of Engineering Works; Geological Investigations for Engineering Works; and Failures, Errors of Judgement, Litigation, and the Geologist's Responsibility. Each part is logically presented and written by nationally and internationally known members of the engineering geology profession. A number of authors are Past-Chairmen of the Engineering Geology Division of GSA or Past-Presidents of the Association of Engineering Geologists.

Each chapter follows a similar outline, making it easy to follow the subject from its historical development through the future outlook. Each uses numerous well illustrated case histories that maintain the reality, liability, and significance of the material presented.

The first two chapters, written by George Kiersch, begin with a discussion of early engineering works and geologic craft/lore that date back into antiquity and trace the development of engineering geology to the present. This historical review is followed by discussions of the history of research efforts by governments in North America. The history of the Engineering Geology Division of GSA written by Kiersch and Hatheway, two Past-Chairmen of the Division, provides a foundation for the younger members of the profession and for the future. This section ends with a chapter containing a short historical review of other professional organizations in engineering geology, such as the construction industry, the Joint Committee on Engineering Geology (ASCE-GSA), Highway Geology Symposium, Transportation Research Board, Association of Engineering Geologists, and the International Association of Engineering Geologists in North America.

Chapters 6 through 14 present excellent historical reviews and well documented case histories of the geologic processes and engineering works. Discussions of surface water and flooding, erosion, sedimentation, fluvial systems, coasts, slopes, volcanic activity, subsidence and uplift, faulting and seismicity, and permafrost are presented. Construction materials, glacial deposits, aggregates, and ice and snow, are discussed in the third section (Chapters 15–17). Each of the authors supports his story with excellent case histories and graphics.

The section on geological investigations (Chapters 18–21) traces the philosophy and technology of the maturing profession of engineering geology from the regional scale practice of selecting candidate sites to the detailed scale of documenting as-built conditions and post-construction maintenance and operation. Numerous case histories are used to demonstrate both what went wrong and what went right during the investigation process.

The final section—dealing with failures, errors, litigation, and the geologist's responsibility—should be required reading for *all* geologists, regardless of their specific field of geologic study. Although the case histories are based on engineering geology and engineering works, the principles of professional practice can be applied to any geologist's work. The important message in the last four chapters (22–25) is that we as a profession and as a society learn from our mistakes. Geology is a complex study of an earth system that is NOT homogeneous, isotropic, continuous, elastic, truly stochastic or ideally spherical. As a result, many of our most valuable lessons and significant advances have been gained through empirical observations of the interaction of humans and the earth. Failures lead to an enhanced understanding of this complex system. The value of failures in scientific advancement, however, must be matched against the value of human life, safety, and property, the economy and feasibility of engineered works, and the protection of the environment. James R. Dunn, author of Chapter 25, presents an excellent summary of the history and future of a geologist's responsibility.

This reviewer found very little to complain about. However, there are a few isolated editorial errors, mostly words left out, that occasionally make the reader stop to figure out a sentence. Placement of figures

throughout the text occasionally causes problems for a reader because the figure is a few pages away from where it is referenced. Hunting for a figure can be distracting at times. These inconveniences are just that and they do not detract from the message or contribution that this volume will make to our understanding of our heritage.

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BOOK COLLECTORS OF STANFORD: AN ECLECTIC EIGHT WHO SHAPED THE STANFORD UNIVERSITY LIBRARIES. *John Y. Cole. 1991. California State Library Foundation, Sacramento, California. 85 p. Softcover, $15.00.*

This rather different book shows that in the closing years of the nineteenth and the early years of the twentieth century, geologists had considerable impact on the growth and content of libraries at one developing university. From the pages of *Earth Sciences History* it is clear that nineteenth-and early twentieth-century geologists influenced the growth of other kinds of general intellectual institutions, such as museums and multidisciplinary academic societies. Studies that document a strong influence by geologists on turn-of-the-century libraries seems to be scarce. Thus Dr. Cole's small book may have special value for historians of geology.

Cole tells eight separate tales of book-oriented philanthropy that influenced the Stanford libraries. "John Casper Branner: Bookman and University President" is the fifth essay. Branner was born in Tennessee in 1850 and died on the Stanford campus in 1922. He was Stanford's first Professor of Geology, arriving soon after the school opened in October 1891. He became the University's second president, serving from mid-1913 through the end of 1916. Before arriving at Stanford, Branner was a working geologist in Brazil, a scientist with the U.S. Department of Agriculture, a field man with the Pennsylvania State Geological Survey, State Geologist of Arkansas, and a professor of geology. He was also a book-lover and a prolific author. He wrote many books and over 400 articles. His books include a Portuguese grammar and articles promoting world peace. Still, much of what Branner wrote was geological.

Branner had an immense library. Its contents reflected both his own interests and the fact that he bought the personal libraries of other geologists, such as Charles A. White and S. F. Peckham. By 1915 he had more than 10,000 books and an equal number of maps and pamphlets. In 1915 this collection was purchased by the University. It now forms the core of the Branner Earth Science Library. After 1915, Branner continued to buy both books and libraries. Some of his later acquisitions were given to Cornell University, the school where he earned his Bachelor's degree. Most went to the Stanford libraries. Because John Branner was especially interested in Brazil and in seismic activity, the Stanford collection now has deep historical roots in these areas.

In 1892, Branner began to use Herbert Clark Hoover, a seventeen year-old freshman, as a library worker and office assistant. Perhaps this exposure encouraged Branner's student to become a geologist, a mining engineer, and a collector of books. "Herbert Hoover: Bibliophile and Ideal Stanford Man" is Chapter 6 in Dr. Cole's text. While it is just eight pages in length, and is dominated by bookish themes, this chapter shows one of the less well-known sides of a complex person who became the Thirty-First President of the United States. The chapter also introduces another bibliophile and geologist, Lou Henry, who became Mrs. Herbert Clark Hoover. She entered Stanford specifically to study geology with Dr. Branner. Then she wandered the world with a husband who developed a lucrative private practice, applying the knowledge they both gained at Stanford.

While still a student, Herbert Hoover gained professional experience with the Arkansas Geological Survey and with the U.S. Geological Survey. The early stages of his postgraduate career were largely in mining engineering, primarily overseas. As they traveled, he and Lou Henry Hoover assembled an impressive library stressing Africa, South and Central America, China, Russia, and Australia. In 1905, ten years after Herbert Hoover's graduation, they began a sustained effort to donate money and books to Stanford. Many of the books were geological, because each of the Hoovers retained a scholarly interest in geology and related fields.

One of their most ambitious academic projects was to translate Georgius Agricola's *De Re Metallica* from Latin into English. Printed in 1559, it was the first great book-length publication on mining. As they worked on the translation, on-and-off for about 5 years, the Hoovers amassed a library of very old books. To cite one example, they acquired copies of each of twelve pre-1500 imprints that were mentioned by Agicola. This material was part of a one-thousand-volume specialized library that the Hoovers valued greatly and kept during their lifetimes. A descendant eventually donated this unique collection to the library at Claremont College.

In 1903, when the Hoovers began their translation of Agricola, Herbert was eight years out of college, and in his middle twenties. Still, it seemed clear money would never be a problem. In 1914, as World War I threatened to involve most of the industrialized nations, Hoover had already made his fortune. He abandoned commercial activities to devote himself to the common good. Working out of London, he represented U.S. interests in Europe. He also emerged as a bibliophile of broadening tastes and as a major conservator of war-related documents. Eventually his war library, with its

unique collection of documents, was given to Stanford. By 1921, it totaled 80,000 items. As part of this donation, Hoover gave $100,000 in cash to help the University prepare the collection for use. On several other occasions he made very large donations of money and real estate, with much of it earmarked for library uses.

Lou Henry Hoover, Herbert Hoover, and John Casper Branner were geologists who influenced posterity by shaping the libraries of American colleges. The Hoovers left their imprint on Stanford and on Claremont College as well. Branner had a basic impact on the Stanford collection and supported the library at Cornell. Studies in the history of geology tend to emphasize contributors to theory and to organizations that are exclusively geological, such as college departments, state surveys, and geological societies. Less attention is paid to geologists who influence the intellectual environment through museums, general scientific societies, and libraries. For the person who is interested in the influence of geologists on intellectual life in the most general sense, essays on the Hoovers and on Branner in Dr. Cole's small book offer a unique perspective.

The other six essays in this volume may be less interesting to geologists. They concern 1) Leland Stanford, a wealthy senator, and his wife Jane, 2) Thomas Stanford, an expatriate American who made a fortune in Australia, 3) Timothy Hopkins, the adopted son of Leland Stanford's business partner, 4) David Starr Jordan, Stanford's first president, 5) Kate Felton Elkins, an heiress and bibliophile, and 6) a man of modest means, Frederick E. Brasch, who became Librarian of Congress. Dr. Cole's little book does not belong in most geological libraries. Yet it is an interesting source of insight for those who are concerned with the varied roles geologists have played in shaping the intellectual resources of our society.

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ERRATUM

Earth Sciences History, Vol. 12, No. 1, 1993, p. 74. The heading for the first book review incorrectly stated that The Rocks Speak (Essays in Geology, some Personal Responses of a Willing Listener) was published by the Australian Institute of Mining and Metallurgy. It should read the Australasian Institute of Mining and Metallurgy.

ANNOUNCEMENTS

Fifth International Conference on Paleoceanography

Oct. 10–14, 1995
Halifax, Nova Scotia, Canada

Theme: Linkages

Special Topics:
High Latitude–low latitude linkages
Ocean–atmosphere linkages
Seafloor–seawater linkages (JGOFS and flux records)
Physical Links—Gateways and short-term tectonic events
Continent–ocean linkages
The Arctic—The missing link
Modelling—The link between past, present and future
Tools and Proxies—Developments and applications
Remote Sensing
Ice Core Records

Abstract deadline: May 1, 1995

Contacts:
Larry Mayer or Frank Rack, Ocean Mapping Group, Dept. of Surveying Engineering, P.O. Box 4400, Fredericton, N.B., Canada E3B 5A3; David Piper, Atlantic Geoscience Centre, Bedford Inst. of Oceanography, P.O. Box 1006, Dartmouth, N.S., Canada B2Y 4A2

CALENDAR

1993

July 4-8—19th International Symposium on the History of the Geological Sciences in the Pacific Region, Sydney, Australia. Earth Resources Foundation Dept. of Geology and Geophysics, University of Sydney, New South Wales, Australia, 2006.

July 7-14—5th International Congress for the History of Oceanography (ICHO V), Scripps Institution of Oceanography, La Jolla, Calif. Deborah Day, Archivist, Scripps Institution of Oceanography, University of California, San Diego, La Jolla, Calif. 92093-0175.

July 17-24—Geological and Landscape Conservation, International Meeting, Great Malvern, United Kingdom. Margaret Phillips, The Company, St. John's Innovation Centre, Cowley Road, Cambridge CB4 4WS. Phone: (0223) 421124. Fax: (0223) 421158.

July 19-25—Geological Sciences in Latin America, International Meeting, Campinas and Ouro Preto, Brazil. International Union of Geological Sciences and others. M. M. Lopes, IG/UNICAMP, Box 6152, 13081, Campinas, Brazil. Phone: (55) (192) 39-7352. Fax: (55) (192) 39-4717.

Aug. 1-5—Hydrometallurgy, International Meeting, Salt Lake City, Utah. Society for Mining, Metallurgy, and Exploration, and the Minerals, Metals, and Materials Society. SME, Box 625002, Littleton, Colo. 80162. Phone: (303) 973-9550. Fax: (303) 979-3461.

Aug. 8-12—Stratigraphic Record of Global Change Meeting, University Park, Pa. Society for Sedimentary Geology. Julie Ball, SEPM, Box 4756, Tulsa, Okla. 74159. Phone: (918) 743-9756. Fax: (918) 743-2498.

Aug. 15-19—Carboniferous to Jurassic Pangea, International Meeting, Calgary, Alberta. Canadian Society of Petroleum Geologists, and Global Sedimentary Geology Program. Benoit Beauchamp, Geological Survey of Canada, 3303 33rd St. N.W., Calgary, Alberta T2L 2A7. Phone: (403) 292-7190. Fax: (403) 292-4961.

Aug. 23-29—Coastal Sedimentology Meeting, Hamilton, Ontario. William F. Tanner, Department of Geology, B-160, Florida State University, Tallahassee, Fla. 32306. Phone: (904) 644-3208.

Aug. 28-Sept. 15—Landslides, International Meeting and Workshop, Czech and Slovak Federal Republic. ICFL-C.S., Landslides '93, c/o NOVOSAD IG/EG, I. Sekaniny 1801, CS-70800 Ostrava-4, Czechslovakia. Phone: (42-69) 473028. Fax: (42-2) 381848.

Sept. 5-11—Nuclear Waste Management, International Meeting, Prague, Czech and Slovak Federal Republic. American Society of Mechanical Engineers, Czech and Slovak Mechanical Engineering Society, and the Czech and Slovak Nuclear Society. Radovan Kohout, Ontario Hydro (H11 A2), 700 University Ave., Toronto, Ontario M5G 1X6. Phone: (416) 592-5384. Fax: (416) 592-4485.

Sept. 12-15—Rocky Mountain Section, American Association of Petroleum Geologists, Meeting, Salt Lake City, Utah. American Association of Petroleum Geologists, Box 979, Tulsa, Okla. 74101. Phone: (918) 584-2555. Fax: (918) 584-0469.

Sept. 12-17—Exploration and Development Models: Shifting Paradigms, Meeting, Banff, Alberta, Canada. University of Alberta and Canadian Society of Petroleum Geologists. Pat Latham, Faculty of Extension, University of Alberta, Edmonton, Alberta T6G 2T4. Phone: (403) 492-5038. Fax: (403) 492-1857.

Sept. 15-17—Mining Development, International Meeting, Philadelphia. Society for Mining, Metallurgy, and Exploration. SME, Meetings Department, Box 625002, Littleton, Colo. 80162. Phone: (303) 973-9550. Fax: (303) 979-3461.

Sept. 19-22—Eastern Section, American Association of Petroleum Geologists, Meeting, Williamsburg, Virginia. American Association of Petroleum Geologists, Box 979, Tulsa, Okla. 74101. Phone: (918) 584-2555. Fax: (918) 584-0469.

Sept. 19-24—International Symposium on Subsurface Microbiology, Bath, United Kingdom. Liz Hide, IBC Technical Services, Gilmoora House, 57-61 Mortimer St., London W1N 7TD. Phone: +44 71 637 4383. Fax: +44 71 631 3214.

Sept. 21-23—Andean Geodynamics, International Symposium, Oxford, England. University of Oxford and Institut Français de Recherche Scientifique pour le Développement en Coopération (Orstom). Pierre Soler, Orstom, CS1, 213 rue Lafayette, 75480 Paris Cédex 10, France. Fax: 33-1-48 03 08 29.

Sept. 25-Oct. 1—International Association of Volcanology and Chemistry of the Earth's Interior, Meeting,

Canberra, Australia. (AVCE) ACTS, GPO Box 2200, Canberra ACT 2601, Australia. Phone: 61/6/ 257-3299. Fax: 61/6 257-3256.

Sept. 26-29—Association of Earth Science Editors, Annual Meeting, Madison, Wis. Mindy James, Wisconsin Geological Survey, 3817 Mineral Point Road, Madison 53705.

Sept. 28-Oct. 1—Environmental Pollution, International Meeting, Barcelona, Spain. European Centre for Pollution Research and others. ICEP Conference Office, ICTR Secretariat, 11-12 Pall Mall, London SW1Y 5LU, England. Phone: 44 71 930 6825. Fax: 44 71 976 1587.

Oct. 13-16—Society of Vertebrate Paleontology Meeting, Annual Meeting, Albuquerque, N.M. Spencer G. Lucas, New Mexico Museum of Natural History and Science, 1801 Mountain Road N.W. Albuquerque 87104. Phone: (505) 841-8837. fax: (505) 841-8866.

Oct. 17-20—American Association of Petroleum Geologists, International Meeting, The Hague, Netherlands. American Association of Petroleum Geologists, Box 979, Tulsa, Okla. 74101. Phone: (918) 584-2555. Fax: (918) 584-0469.

Oct. 18-20—National Ground Water Association, Meeting, Kansas City, Mo. National Ground Water Association, 6375 Riverside Drive, Dublin, Ohio. Phone: (614) 761-1171. Fax: (614) 761-3446.

Oct. 20-22—Gulf Coast Section, American Association of Petroleum Geologists, Meeting, Shreveport. American Association of Petroleum Geologists, Box 979, Tulsa, Okla. 74101. Phone: (918) 584-2555. Fax: (918) 584-0469.

Oct. 25-28—Geological Society of America, and Affiliated Societies, Annual Meeting. Boston. Vanessa George, GSA, Box 9140, 3300 Penrose Place, Boulder, Colo. 80301. Phone: (303): 447-2020.

Nov. 7-9—Underwater Mining Institute, Annual Meeting, Estes Park, Colo. Karynne Chong Morgan, UMI, 811 Olomehani St., Honolulu, Hawaii 96813-5513. Phone: (808) 522-5611. Fax: (808) 522-5618.

Nov. 11-14—History of Science Society, Annual Meeting, Santa Fe, New Mexico. Paul Farber, Department of History, Oregon State University, Corvallis, Ore. 97331. Phone: (503) 737-4151. Fax: (503) 737-2434.

Nov. 15-30—International Geological Correlation Programme Meeting, Santiago, Chile. M. Vergara, Universidad de Chile, Departmento de Geologia y Geofisica, Casilla 13518-Correo 21, Santiago, Chile. Fax: 56-2-6963050.

1994

Jan. 10-14—Gondwana International Meeting, Hyderabad, India. Geological Survey of India. Organizing Secretary, Gondwana, % International Wing, Geological Survey of India, 27 J. L. Nehru Road, Calcutta, 700 016. Fax: 033-29-6958.

Feb. 18-23—American Association for the Advancement of Science, Annual Meeting, San Francisco, Calif. American Association for the Advancement of Science. 1333 H. St., N.W., Washington, D.C. 20005. Phone: (202) 326-6400.

Mar. 19-21—Interdisciplinary Perspectives on the History of the Earth Sciences, GSA Penrose Conference, San Diego. Léo Laporte, Sciences Department, University of California, Santa Cruz, 95064. Phone: (408) 459-2248. Fax: (409) 459-3074.

May 17-19—Geological Association of Canada/Mineralogical Association of Canada, Annual Meeting, Edmonton, Alberta. J. W. Kramers, Alberta Geological Survey, Box 8330, Station F, Edmonton, T6H 5X2. Phone: (403) 438-7644. Fax: (403) 438-3364.

June 6-10—Mining History Meeting, Golden, Colo. Colorado School of Mines. Mining History Association, Box 15030, Denver, 80215.

June 12-15—American Association of Petroleum Geologists, Annual Meeting, Denver. AAPG, Box 979, Tulsa, Okla. 74101. Phone: (918) 584-2555. Fax: (918) 584-0469.

June 19-24—American Nuclear Society, Annual Meeting, New Orleans. Meetings Department, American Nuclear Society, 555 N. Kensington Avenue, LaGrange Park, Ill. 60525. Phone: (312) 352-6611.

July 1-5—Hydrometallurgy International Meeting, Cambridge, England. Society of Chemical Industry and Institution of Mining and Metallurgy. SCI, 14/15 Belgrave Square, London, England SW1X 8PS Phone: 071 235-3681. Fax: 071 823-1698.

July 5-9—Foraminifera International Meeting, Berkeley, Calif. FORAMS '94, Museum of Paleontology, University of California, Berkeley 94720. Phone: (510) 642-1821. Fax: (510) 642-1822.

July 7-9—Third Annual Meeting of the Earth Sciences Society. Troy, N.Y. The Northeastern Science Foundation, 15 Third St., P.O. Box 746, Troy, N.Y. 12180. Phone: (518) 273-3247. Fax: (518) 273-3249.

July 10-15—Environmental Geotechnics, International Meeting, Edmonton, Alberta. International Society for Soil Mechanics and Foundation Engineering,

and Canadian Geotechnical Society. D. C. Sego, First International Congress on Environmental Geotechnics, Dept. of Civil Engineering, University of Alberta, Edmonton, Alberta T6G 2G7, Canada. Phone: (403) 492-7228. Fax: (403) 492-8198.

Aug. 21-24—American Association of Petroleum Geologists, International Meeting, Kuala Lumpur, Malaysia. AAPG, Box 979, Tulsa, Okla. 74101. Phone: (918) 584-2555. Fax: (918) 584-0469.

Oct. 24-27—Geological Society of America, Annual Meeting, Seattle. Vanessa George, GSA, 3300 Penrose Place, Boulder, Colo. 80301. Phone: (303) 447-2020. Fax: (303) 447-1133.

1995

Mar. 5-8—American Association of Petroleum Geologists, Annual Meeting, Houston. AAPG, Box 979, Tulsa, Okla. 74101. Phone: (918) 584-2555. Fax: (918) 584-0469.

May 15-19—Exploring the Tropics, International Meeting, Townsville, Queensland, Australia. Russell Myers, 171GES, National Key Centre in Economic Geology, James Cook University, Townsville, Q4814. Phone: 077 814486. Fax: 61-77-815522.

June 11-16—American Nuclear Society, Annual Meeting. Atlantic City, N.J. ANS 555 N. Kensington Avenue, LaGrange Park, Ill. 60525. Phone: (312) 352-6611.

June 12-16—Ordovician System, International Meeting, Las Vegas, Nev. Margaret Rees, Dept. of Geosciences, University of Nevada, Las Vegas 89154-4010. Phone: (702) 739-3262. Fax: (702) 597-4064.

Nov. 6-9—Geological Society of America, Annual Meeting. New Orleans. Vanessa George, GSA, 3300 Penrose Place, Boulder, Colo. 80301. Phone: (303) 447-2020. Fax: (303) 447-1133.

INTERESTING PUBLICATIONS

Since the start of this journal, Editor Gerald M. Friedman has prepared this column. Contributors wishing to list recent books and papers of interest to our membership are requested to send them to the Founding Editor Gerald M. Friedman, P.O. Box 746, Troy, NY 12181-0746 U.S.A.

Allégre, Claude, 1992, From stone to star: a view of modern geology. Harvard University Press, Cambridge, MA, 288 p. $39.95 (U.S.)

Bagnold, Ralph, 1990, Sand, wind and war, Memoirs of a desert explorer. University of Arizona Press, Tucson, 209 p.

Baker, V. R., 1993, Learning from the past: *Nature,* v. 361, p. 402–403.

Baker, V. R., and Twidale, C. R., 1991, The reenchantment of geomorphology: *Geomorphology,* v. 4, p. 73–100.

Basham, P. W., and Newitt, L. R., 1993, A historical summary of Geological Survey of Canada studies of earthquake seismology and geomagnetism: *Canadian Journal of Earth Sciences,* v. 30, p. 372–390.

Campbell, C. J., 1991, The golden century of oil 1950–2050. Kluwer Academic Publishers, P.O. Box 17, 3300 AA Dordrecht, the Netherlands. $99.00 (U.S.)

Carozzi, A. V., 1992, De Maillet's Telliamed (1748): The diminution of the sea or the fall portion of a complete cosmic eustatic cycle: *Geological Society of America Memoir* 180, p. 17–24.

Carozzi, A. V., 1992, Horace-Benedict De Saussure, a forerunner in 1794–95 of experimental weathering: *Clays and Clay Minerals,* v. 40, p. 323–326.

Carozzi, A. V., 1992, H. B. De Saussure, pionnier de la geologie moderne: *La Recherche,* v. 23, p. 414–422.

Cleevely, R. J., and Chapman, S. D., 1992, The accumulation and disposal of Gideon Mantell's fossil collections and their role in the history of British palaeontology: *Archives of Natural History,* v. 19, No. 3, p. 307–364.

Cooper, J. A., 1992, The life and work of George Bax Holms (1803–1887) of Horsham, Sussex: A Quaker vertebrate fossil collector: *Archives of Natural History,* v. 19, No. 3, p. 379–400.

Dalrymple, G. B., 1991, The age of the earth. Stanford, California, Stanford University Press, 474 p. $49.50.

Davis, E. E., and Currie, R. G., 1993, Geophysical observations of the northern Juan de Fuca Ridge system: lessons in sea-floor spreading: *Canadian Journal of Earth Sciences,* v. 30, p. 278–300.

Devorkin, D. H., 1992, Science with a vengeance: How the military created the U.S. space sciences after world war II. New York, Springer-Verlag, 404 p.

Embry, A. F., 1993, Transgressive-regressive (T-R) sequence analysis of the Jurassic succession of the Sverdrup Basin, Canadian Arctic Archipelago: *Canadian Journal of Earth Sciences,* v. 30, p. 301–320.

Fielding, C. R., 1993, A review of recent research in fluvial sedimentology: *Sedimentary Geology,* v. 85, p. 3–14.

Forty, R. A., 1993, Charles Lapworth and the biostratigraphic paradigm: *Journal of the Geological Society,* v. 150, p. 209–218.

Fulton, R. J., 1993, Surficial geology mapping at the Geological Survey of Canada: its evolution to meet Canada's changing needs: *Canadian Journal of Earth Sciences,* v. 30, p. 232–242.

Gohau, Gabriel, 1990, Les sciences de la terre aux XVIIe et XVIIIe siecles: Naissance de la geologie. Paris, Albin Michel, 420 p. Fr. 180 (paper).

Guruswamy, Lakshman, ed., 1992, Energy and the environment: intersecting global issues: *Arizona Jour. International and Comparative Law,* v. 9, No. 1, p. 253–258.

Hatley, A. G., ed., 1992, The oil finders: A collection of stories about exploration. The American Association of Petroleum Geologists, ISBN: 0-89181-816-2, 134 p.

Herbert, Sandra, 1991, Charles Darwin as a prospective geological author: *British Journal of the History of Science,* v. 24, p. 159–192.

Kerr, Aubrey, 1991, Leduc. Calgary, Alberta, Canada, S. A Kerr, 912-80 Ave. S. W., Calgary, Canada T2V 0V3 312 p., $35.95 (Canadian).

Kiersch, G. A., editor, 1991, The heritage of engineering geology: the first hundred years: Geol. Soc. America, Centennial Special v. 3, 619 p., $62.50 (U.S.)

Lee, P. J., 1993, Two decades of Geological Survey of Canada petroleum resource assessments: *Canadian Journal of Earth Sciences,* v. 30, p. 321–332.

Lightman, Alan, 1992, Ancient light: Our changing view of the universe. Harvard University Press, Cambridge, MA, 184 p., $18.95 (U.S.)

Lilley, F. E. M., and Day, A. A., 1993, D'Entrecasteaux, 1792: celebrating a bicentennial in geomagnetism: *EOS,* v. 74, No. 9, p. 97, 102–103.

Marvin, Ursula, 1992, The meteorite of Ensisheim: *Meteoritics,* v. 27, p. 28–72.

Marx, R. F., 1990, History of underwater exploration. New York, Dover Publications, 198 p.

McKerrow, W. S., 1993, The development of early Palaeozoic global stratigraphy: *Journal of the Geological Society,* v. 150, p. 21–28.

Monger, J. W. H., 1993, Canadian Cordilleran tectonics: from geosynclines to crustal collage: *Canadian Journal of Earth Sciences,* v. 30, p. 209–231.

Norford, Brian, 1992, Proud past, bright future (Geological Survey of Canada 150th Anniversary): *Geotimes,* v. 37, No. 8, p. 5.

Oldroyd, D. R., 1992, The Archaean controversy in Britain: Part II The Malverns and Shropshire: *Annals of Science,* v. 49, p. 401–460.

Rainger, Ronald, 1991, An agenda for antiquity. Henry Fairfield Osborn and vertebrate Paleontology at the American Museum of Natural History, 1890–1935, University of Alabama Press, Tuscaloosa and London, 360 p., $37.95 (U.S.)

Rehbock, P. F., ed., 1993, At sea with the scientifics: The Challenger letters of Joseph Matkin, University of Hawaii Press, Honolulu, 415 p.

Robinson, Eric, editor, 1993, John Phillips honored: Geologists' Association Circular, No. 896, p. 11–12.

Rose, E. P. F., and Rosenbaum, M. S., 1993, British military geologists: the formative years to the end of the First World War: *Proceedings of the Geologists' Association,* v. 104, p. 41–49.

Rudwick, Martin, J. S., 1992, Scenes from deep time: Early pictorial representations of the prehistoric world. 296 p., ISBN: 0-226-73104-9, $45.00 (U.S.)

Rudwick, Martin, J. S., 1993, Historical origins of the Geological Society's Journal: *Jour. of the Geological Society, London,* v. 150, p. 3–6.

Sabine, Peter, 1992, Geology in the First World War: *Geologist's Association Circular,* No. 893, p. 10.

Sarjeant, W. A., 1992, Cuvier vs. Geoffrey: the big fight of 1830: *Modern Geology,* v. 16, p. 375–380.

Schmidt, Peter, 1992, Kolloquium für Alexander von Humboldt in Freiberg (Sachsen): *Nachrichten Deutsche Geologische Gesellschaft,* Heft 47, p. 73–75.

Seibold, I., and Seibold, E., 1992, Neues aus dem Geologen-Archiv (1991). Mit Erinnerungen an Alfred Wegener und Otto Ampferer (News from the geologists' archives—with special reminiscences of Alfred Wegener and Otto Ampferer): *Geologische Rundschau,* v. 81, p. 267–273.

Shilts, W. W., 1993, Geological Survey of Canada's contributions to understanding the composition of glacial sediments: *Canadian Journal of Earth Sciences,* v. 30, p. 333–353.

Syvitski, J. P. M., 1993, Glaciomarine environments in Canada: an overview: *Canadian Journal of Earth Sciences,* v. 30, p. 354–371.

Teskey, D. J., Hood, P. J., Morley, L. W., Gibb, R. A., Sawatzky, P., Bower, M., Ready, E. E., 1993, The aeromagnetic survey program of the Geological Survey of Canada: contribution to regional geological mapping and mineral exploration: *Canadian Journal of Earth Sciences,* v. 30, p. 243–260.

Tesmer, I. S., 1989, History of geology of westernmost New York State (Niagara, Erie, Chataugua and Cattaraugui Counties). Madison, Wisconsin. Omni Press, 215 p. Available from the Buffalo Society of Natural Sciences, Humboldt Parkway, Buffalo, New York $19.95.

Verhoef, Jacob, and Roest, W. R., 1993, Reading the stripes: offshore discoveries in plate tectonics with example from eastern Canada: *Canadian Journal of Earth Sciences,* v. 30, p. 261–277.

Villey, F. E. M., and Day, A. A., 1993, D'Entrecasteaux, 1792: celebrating a bicentennial in geomagnetism: *EOS,* v. 74, No. 9, p. 97, 102–103.

Vodden, Christy, 1992, 150 years in the history of the Geological Survey of Canada: *Episodes,* v. 15, p. 101–108.

Ward, P. D., 1992, On Methuselah's trail: living fossils and the great extinctions. W.H. Freeman, New York, $18.95.

Wheeler, J. O., 1993, Introduction to the Geological Survey of Canada's 150th anniversary issue: *Canadian Journal of Earth Sciences,* v. 30, p. 203–208.

Windley, B. F., 1993, Uniformitarianism today: plate tectonics is the key to the past: *Journal of the Geological Society,* v. 150, p. 7–9.

Wright, T. L., Takahashi, Taeko, Jane, Griggs, J. D., 1992, Hawai'i volcano watch: A pictorial history, 1779–1991. University of Hawaii Press and Hawaii Natural History Association, 162 p.

Yaalon, D. H., 1992, The earliest geological map of the Near East—1751: *Israel Jour. Earth Sci.,* v. 40, p. 251–254.

Yeomans, D. K., 1991, Comets: a chronological history of observation, science, myth and folklore. New York, John Wiley and Sons, $35.00.

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