BOOK REVIEWS

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BENJAMIN SILLIMAN: A LIFE IN THE YOUNG REPUBLIC. *Chandos Michael Brown. 1989. Princeton University Press, Princeton, New Jersey. 377 p. Hardcover, $29.95.*

This book is mostly not about Silliman as a scientist, his contributions, or his influence over the practice of natural history in the United States. Apparently, that will be the subject of another volume by the author. Presumably the future volume will relate Silliman's role in educating a whole generation of pioneer American geologists: Amos Eaton, Edward Hitchcock, Charles Upham Shepard, James Dwight Dana, Denison Olmsted and others. The present volume, therefore, serves as a necessary foundation for what it to come, recounting such practices as how one acquired scientific knowledge in the early part of the 19th century in America (by attending lectures of famous experts, wherever they might be, in a self-guided program); further, it delves into how a science curriculum and later a medical school were established at Yale College. The life of Benjamin Silliman is intimately associated with the history of both of these events. Historians of science interested in the incipience and organization of collegiate curricula and institutions would find the early history of Yale College illuminating and rather marvelous.

Chandos Brown states in his Preface that his purpose is "to evoke and maintain the sense of change, continuity, contingency, and chance that Silliman confronted as he effectively *improvised* both a private self and a public persona within a specific milieu." The milieu I find haphazardly presented; readers not versed in the political ramifications of the Jeffersonian age and the particular socio-political-intellectual climate of the Connecticut elite, or any general reader, could be quite lost in it. Historical and political events are sketchily, if at all, woven into the narrative. At the same time the author tries to relate everything he has uncovered in his research, some of which is only marginally relevant to Benjamin Silliman, while assuming the reader's knowledge of a myriad of New England names, places and other allusions, some quite provincial and obscure.

The persona of Silliman, however, shines through his own words as well as deftly and often entertainingly depicted by the author. Brown employs the technique of building a biographical substructure from the bottom up by using a massive amount of primary sources, mainly in the form of letters, supplying an extraordinary amount of detail in the personal arena. For readers who are familiar with the Yale scene and have some sort of attachment or connection with the place, as this reviewer has, it is a fascinating account. All the famous Connecticut names are there: Silliman, Dana, Dwight, Edwards, Day, Daggett, Trumbull, Hillhouse, Stiles, Davenport, Twining, Marsh, Ely, etc. The regret for me that this volume only covers 41 of Silliman's 85 years of life.

Other readers could perhaps find the book tedious and be overwhelmed with the feeling, "This author is telling me more about Benjamin Silliman than I wish to know." Brown uses an almost anecdotal, kitchen-sink approach to presenting a blow-by-blow, almost day-by-day account of events in Silliman's life, with many digressions, to the extent that focus and organization in this reconstruction are often illusive, especially in the first half of the book. Events quite distant from his life are related with equal emphasis as those that have direct and profound influence on Silliman. For example, one is exposed not only to his immediate family, his father General Gold Selleck Silliman, captured by the British during the Revolutionary War, his mother Mary and his siblings; one must also learn about details of the lives of distant cousins that stem from his mother's first husband's family.

If there were an overriding influence in the life of Benjamin Silliman, it was that of his mother Mary. In quoting Mary's letters, Brown brings out her unusually strong character. Her religiosity and constant urging in her voluminous letters upon Silliman to do good in this world was a driving force in many of his ventures—often to the point of detriment to his undertakings. When he and his partners were desperately trying to compete in the commercial world of carbonated and simulated spring water, for example, he refused to open his fountain on the Sabbath when his competitors did so with ne'er a qualm. Brown crams into the book much detailed information about this business and devotes many pages to this venture, mostly conducted by his colleague Jeremiah Day, that came to naught. A much more abbreviated account of the failure would have sufficed most readers, especially since it was of so little consequence to his main work as a professor and leader at Yale College.

Nevertheless, if one persists one discovers that Silliman's life eventually finds focus, as does the book. By birth "a gentleman from a good family" in an emerging republic, Benjamin Silliman (1779–1864) led a life replete with historical events and personal en-

deavors that impinged on his development. His interests ranged from societal ills, such as slavery, to literature and philosophy and finally to science. Though genteely impecunious, because of patronage and friendship from President Timothy Dwight of Yale, he moved among the famous intellectuals as well as politically important people of the time. Typically, he was made a professor of chemistry for his potential as such rather than for his qualifications and expertise, and although he had some anxious moments, there was never a doubt in his mind that he could handle the job. He travelled first to Philadelphia, a more intellectually advanced metropolis than New Haven at the time, and later to Europe during the Napoleonic Wars, to acquire scientific and medical knowledge and books to establish his status as gentleman professor of chemistry at Yale College. He married Harriet Trumbull, daughter of the Governor of Connecticut. Respectability marked his entire career.

Brown shows that Silliman's gentleman status gained him entrée into the most distinguished circles both at home and abroad. In Philadelphia he studied chemistry under James Woodhouse, Robert Hare, Benjamin Barton, and Caspar Wistar. In London he met such virtuosi as James Watt, Robert Fulton, Thomas Thomson, William Wollaston, Henry Cavendish and Sir Joseph Banks and was invited to attend a meeting of the Royal Society. Of interest to geologists and historians of geology, Silliman in Edinburgh attended both the lectures of John Playfair, touting the Huttonian Theory and those of John Murray, espousing the Neptunian or Wernerian Theory. Much later in his life, Silliman realized that "he had witnessed the rare occasion of a science thrashing out its origins." He was, therefore, privileged and at a distinct advantage over the ordinary man, over even the average academician, of the young Republic. But the author wishes to make the claim that Silliman was a "representative man," among the first of many. "What begged for attention," Brown writes, "was not his *exceptionality* but his *representativeness.*" It may be that there were many young men of Silliman's caliber in the young Republic who went on to distinguished careers. But if Brown intended to show the "representativeness" of Silliman, perhaps in an effort to divorce himself from the out-moded "great-man" theme, he has not succeeded in this volume. Almost everything related by the author reveals Silliman's extraordinary situation—his birth, his connections, his own innate intelligence, good looks, personality, and instincts, the ingredients that assured him success in life and made him not just a representative American but an influential and catalytic one, enjoying esteem both in his own country and abroad.

He was quick to take advantage of opportunities as they came his way. He scurried to publish the first scientific account of the Weston meteorite, which brought him some recognition at an early age. He turned his European tour, mostly to England and Scotland, into a money-making venture by publishing his travel journal with the help of his friend Daniel Wadsworth. He established mineralogy as a proper course in a science curriculum, improving upon Robert Hare's blowpipe analytical technique, but he badly needed a mineral collection to accompany his brilliant lectures. Consequently, when everyone who was anyone had heard of Benjamin Silliman through his journal, he succeeded in acquiring for Yale the extensive mineralogy cabinet of Colonel George Gibbs of more than 10,000 specimens—much to the pride and joy of his patron, President Dwight, and the disappointment of the latter's counterpart at Harvard, President John Kirkland. He helped to found the *American* Geological Society. He founded the *American Journal of Science* in 1818 and was its sole editor for 20 years. The journal became widely known as "Silliman's Journal" and represented the coming of age of *American* science. The journal, without a break since Silliman's days, is still being published at Yale today. At the same time that Silliman was contributing to the reputation of Yale and country, his sense of self-preservation also worked well for him personally. He instituted selling tickets, thus charging admission to his lectures at Yale, a practice he learned from academicians in Edinburgh and one that made him one of the highest paid professors in America.

Silliman also played a key role in founding the medical school at Yale. The politics and intrigues in assembling the faculty for the fledgling medical school are shown to be not too different from what they are at universities today, affirmative action notwithstanding. The enticement of a big name (in this case Dr. Nathan Smith from Dartmouth), while keeping other candidates in the dark, is a coup enjoyed by many a search committee. But the care with which Silliman and his committee members accomplished the task paid off in that a medical school was created that was far advanced for the time in its approach to medicine, in showing restraint, for example, in the widespread use of purgatives and blood-letting for treatment of various illnesses. Silliman's instincts on behalf of Mother Yale were often correct. Yale remembers him fondly by naming a college after him. But his obscurity almost everywhere else is rather underserved. His role in establishing respectability for American science in the young Republic was no small task.

Overall, I enjoyed reading this book, in spite of having to sift through much excess detail, but perhaps largely because of my close association with Yale as daughter, sister, wife, mother, and aunt of Yale graduates as well as long-time former resident of New Haven. And I look forward to seeing the promised succeeding book. In some ways, Chandos Brown depicts a life in a society that still lives on, one that is not well understood by many "outsiders." For this reason, I am uncertain of the propensity for reading this book, however instructive, by those who do not have close connections to that part of the country, to Yale and its history.

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LORD KELVIN AND THE AGE OF THE EARTH. *Joe D. Burchfield. 1990 (Reprinting of 1975 ed.). University of Chicago Press, Chicago. 267 p. Softcover, $15.95.*

This is a welcome reprinting of a 1975 book that discusses and documents the enormous influence of William Thomson, who eventually became Lord Kelvin, Baron of Largs, on the debate about the age of the Earth, a controversy that occupied scientists for more than a century. The text of the book is identical to the earlier edition with the exception of the addition by the author of an Afterword and a Bibliography of Works Published Since 1974. Even though this new edition is a paperback with glued signatures, it has been produced in a 6″ × 9″ format with a handsome cover, good quality paper, and a pleasing design. With reasonable use, it should prove to be sufficiently durable for nearly any reader.

Kelvin was one of the most influential and productive scientists and inventors of the late 19th century. Among his many noteworthy accomplishments was the formulation of the laws of thermodynamics. His study of the implications of these laws, especially the Second Law, led him to conclude that the Earth and Sun had finite lifetimes whose duration might be determined by the application of physical principles. In the early 1860's Kelvin published two papers, the first on the Sun and the second on the Earth, in which he argued that both bodies must be cooling. Assuming what then seemed to be reasonable initial conditions, he calculated that the age of neither body was likely to exceed a few hundred millions of years. In doing so he boldly challenged the notion, conceived in the 18th century by James Hutton and made popular in the early 19th century by Charles Lyell, that geologic time was inconceivably (but not infinitely) vast. Hutton and Lyell had convincingly argued that the rocks and landforms of the Earth had required time of incomprehensible duration to form, far more time than had been previously supposed. This welcome new concept freed geologists and biologists from the confining limits imposed by biblical chronology and the length of the human lifetime. But Kelvin's calculations, combined with his enormous influence and prestige, imposed new limits on the extent of geologic time. Instead of limitless time, he proceeded to demonstrate, incorrectly as it turned out, that the lifetimes of the Earth and Sun could be measured in a few tens, or at most a few hundreds, of millions of years. Geologic time had been freed from the shackles of theology only to be confronted by new constraints forged by Kelvin from the steel of quantitative physics. Most geologists and biologists of the time were ill-equipped to handle this new challenge.

Burchfield leads the reader from Kelvin's entry into the realm of geology—an intrusion described by Archibald Geike as ". . . a bold irruption into their [geologists] camp from the side of physics"—through 40 years of Kelvin's persistent dominance of the debate about the age of the Earth, culminating in his eventual but private admission to J. J. Thomson that his ideas had been made untenable by the discovery of the substantial energy released from atoms by radioactivity. Burchfield describes and analyzes the effect of Kelvin's arguments on late 19th century geological and evolutionary thinking, the "rush" by many geologists and biologists to accommodate Kelvin's limits on the age of the Earth, and the rebellion by those like T. C. Chamberlain and John Perry who, even before the discovery of radioactivity, saw the weaknesses in Kelvin's calculations and demonstrated that the short time scale suggested by Kelvin and his followers was anything but certain.

Kelvin's ideas about the cooling of the Earth and Sun were finally rendered obsolete within a few short years by the discovery of radioactivity in 1896 by Henri Becquerel and the discovery by Pierre Curie and Albert Laborde in 1903 that radioactivity released heat. With the enormous energy of the atomic nucleus available to fuel the Sun's fires and to provide thermal energy to the Earth's interior, it became clear that Kelvin's assumption that both the Sun's and the Earth's heat were due entirely to gravitational energy from accretion was incorrect. Radioactivity also provided physicists and geologists with a potential method for measuring the ages of rocks and minerals. Radiometric dating, first suggested by Ernest Rutherford in 1905 and exploited over the next few decades by B. B. Boltwood and Arthur Holmes, showed that the Earth was much older than the calculations of Kelvin had suggested.

Burchfield ends his history in 1931, the year in which Bulletin No. 80 of the National Research Council was published. This volume, titled *The Age of the Earth* and authored by a committee chaired by Adolph Knopf, brought an end, once and for all, to the 19th century limits on geologic time. Three-quarters of the book was devoted to radiometric dating while the rest discussed the problems and errors in the old methods. Cooling calculations, however, had by then been so discredited that they were not even discussed. The story, of course, did not end in 1931—the age of the Earth was not known until 1953—but 1931 was the end of the last vestige of the constraints imposed by Kelvin and the methods of the 19th century.

Even though he eventually was proved wrong about the age of the Earth, Kelvin's approach to the problem had a lasting effect on the science of geology. His use of physical principles and calculations based on available data forced geologists and biologists, perhaps for the first time, to think quantitatively and to realize that physics and mathematics had much to offer in studying the Earth. Kelvin had performed a "shotgun wedding" between the previously qualitative and historical science of geology and the rigorously quantitative science of physics and, to its benefit, geology would thereafter never be the same. We geologists are indebted to Lord

Kelvin for his profound contribution to our science, and to Joe Burchfield for reminding us of Kelvin's role in transforming geological methodology.

This is a good book. I enjoyed it when it first appeared and have consulted it from time to time on specific points. Moreover, I enjoyed it just as much in the rereading. The new references and the afterword are welcome additions, but the original text simply didn't need revision and the author and publisher have had the good sense to leave it alone. Anyone interested in geologic time, and that should include all geologists and a fair smattering of biologists, physicists, and chemists, should make Burchfield's commendable and time-tested volume part of their personal library.

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PRINCIPLES OF GEOLOGY. *Volume 2. Charles Lyell. (Facsimile of first edition 1832) 1991. University of Chicago Press, Chicago. 330 p. Softcover, $15.95.*

Charles Lyell published the first edition of his *Principles of Geology* in three volumes between 1830 and 1833, with the second volume completed in late 1831 and appearing in 1832. Although the work was to go through eleven editions before Lyell's death, the first edition remains the most significant for the history of geology, evolutionary biology, and science. Thus we're fortunate that the University of Chicago Press has undertaken to reprint it in facsimile edition. (An earlier facsimile printing by Verlag von J. Cramer has been difficult to find and expensive to purchase.) Indeed, the very conservative and the very daring can now adopt the *Principles* as a text for introductory geology, and, more to the point, it's now available as a source for courses in the history of geology and evolutionary theory.

The *Principles* was an immediate critical and popular success: critical not only as it received favorable reviews but also as it crystallized a major shift in geologic thought; popular as sales justified preparing (and printing) second editions of the first two volumes before publishing the first edition of the third volume. It was read by most professional geologists, influenced several generations of students (with the 11th edition appearing as late as 1871) and stimulated the interest of the educated public for half a century. Its success certainly lay in presentation as well as content; I remember vividly the sense of intellectual excitement and challenge that it conveyed when I encountered the work nearly 40 years ago.

Volume II of the *Principles* deals with the origin, distribution, and extinction of biological species and with the impact of biological processes on non-biological. It extends, of course, the Lyellian paradigm proclaimed and implied in its extended title, *An Attempt to Explain the Former Changes in the Earth's Surface by Reference to Causes Now in Operation.* It emphasizes historical explanation as the ultimate aim and argues for the primary tenets of "uniformitarianism", i.e., actualism, gradualism and the steady-state. It reveals (again, "of course") Lyell's world-view (episteme), a version of early 19th-Century Natural Theology with a strong flavor of Aristotelean philosophy.

Modern interest in this volume has derived primarily from its post-Lamarckian and pre-Darwinian treatment of the "origin of species" and its likely impact on Darwin's view of this "species problem". Briefly Lyell notes the critical aspects of of that problem, i.e., 1) the apparent gradations among varieties, races and species; 2) the affinities and unities in form among species; 3) the regular patterns in geographic distribution of species past as well as present; 4) the aptness of species for circumstances; 5) the appearance and disappearance of species in time. He rejects Lamarck's theory of evolution partly on theoretical and partly on empirical grounds. For the first he notes the lack of "causes now in operation" for Lamarck's progressive transformation of species and conversely for the metaphysical nature of Lamarck's causes. He also points out that those causes don't provide for the origin of species, only their transformation. For the second he argues from a) the absence of transitions among "good" species, b) the limits to variation in domesticated breeds, and c) the lack of species formation in those breeds to the conservative, essentialist view. He holds that variation within species is limited, that those limits are "essential" to the species, that variation however extreme doesn't generate new species, and therefore that species are basically stable, nontransmutable entities. He also argues that the fossil chronicle falsifies (in current terminology) Lamarckian theory since it denies extinction and requires progressive fossil sequences. Extinction can be demonstrated as can the presence of advanced forms at the beginning of the sequence. At the end of the argument, however, he remains a proto-evolutionist, calling for a theory for the origin of species by processes now in operation.

Could Lyell have transcended the intellectual achievement of the *Principles* and written an *Origin*? Obviously a full discussion of this question is beyond the scope of this review, but some possibilities are intriguing. Both Lyell and Darwin recognized variation within species, but Lyell saw it as limited, one aspect of the essence of the species. Darwin, however, saw it as effectively unlimited, extending ultimately and almost without discontinuity from variation among individuals to variation among species. Lyell recognized affinities in form among species but emphasized differences among them; Darwin recognized differences but emphasized affinities—including those of geographic and temporal distribution as well as of form. Thus Lyell saw species primarily as unattached twigs;

Darwin, as interconnected branches on a tree of life. Finally, Lyell viewed competition for places in nature as eliminating the unfit extremes and thus demonstrating the essential limits for species variation; Darwin, as selecting the most fit (or even the least unfit) and thus demonstrating the likely transcendence of such limits. The question then may be how Darwin managed to turn the Lyellian system, that of a conservative steady-state, on its head eight years after he became a disciple of Lyell.

But there's more to Volume II than Lyell's cautious, half step toward evolution, i.e., to extinction without origin. He explained the geographic distribution of species and their extinction by "causes now in operation". Both efforts involved extended consideration of what we now label ecology as well as biogeography. He argued that distribution is a consequence of history and is explained by a) ecologic processes affecting dispersal and survival, b) the geologic processes as they alter geography and circumstances, and c) the geographic origin of the species (however that might occur). This theory was obviously incomplete without an explanation for origins but did imply for him (as it did for Darwin) that both geographic and ecologic factors were critical to any satisfactory theory of evolution.

Lyell's theory for the extinction of species is, in some senses, the intellectual equivalent and counterpart to Darwin's for the origin of species, and certainly the two mirror each other to a considerable extent. In essence, species disappear because of changes in circumstances consequent on geological processes and of competition with other species for places in a new world order. One need add only the element of species survival to see it as an anticipation of current theories of evolution through species selection; Lyell's explanation of how "competitive extinction" may work seems more sophisticated than those embodied in many current hypotheses and deserves further consideration—at another time and in a different place.

Lyell concludes Volume II with consideration of what we'd now call taphonomy and of the impact of biologic processes on geologic (including his theory for the origin of coral reefs). The first anticipates Darwin on the "imperfections of the fossil record" but with an opposed conclusion: that those imperfections account for the absence of fossils representing advanced forms of life from the earliest rocks and thus for any apparent progress in the fossil sequence. But it's worth reading just as an introduction to the impact of taphonomic processes and factors on our interpretation of the fossil chronicle.

My recommendation? Buy it and read it. I learned from my reading and perhaps you may also. Discover, as Lyell did, "the present through the past" as well as "the past through the present".

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FROM SEA CHARTS TO SATELLITE IMAGES, INTERPRETING NORTH AMERICAN HISTORY THROUGH MAPS. *David Buisseret, ed. 1990. University of Chicago Press, Chicago. 324 pp. Softcover, $24.95.*

In 1980 and 1982, the Newberry Library hosted National Endowment for the Humanities Summer Institutes with the objective of encouraging and educating historians and map librarians in the use of maps in the study of history. This book is an attempt to reach a wider audience with the message.

The book is divided into twelve chapters plus an Introduction, each focusing on a different map type and by a different authority. Each chapter has an introductory essay on the map type with a bibliography and a discussion of 8–10 separate maps. The illustrations include 8 color plates, plus halftones and line drawings of a wide variety of map types, from a Ptolemaic world view to an 1892 bicycle route map of Illinois, from Medieval sea charts to bird's-eye views of cities. Most of the principal maps have a modern map showing location. The chapters are in roughly chronological order, beginning with European Antecedents of New World Maps and Maps of the Age of European Expansion and proceeding to Aerial Imagery including LANDSAT images and conventional aerial photographs in Chapter 12. The first two chapters are illustrated with European-produced maps, but the remaining sections utilize maps produced in North America.

Because the book is designed for the non-cartographer there is a 2-page glossary that defines different map types, printing methods and some geographical terms. An appendix provides sources of general land office maps.

The 10 contributors constitute an impressive list of authorities in history, historical geography, history of cartography, and librarianship.

If one reads no more than J. B. Harley's Introduction, the book is well worth having. In this essay Harley examines the nature of maps and focuses on "What is a map?" as it applies to historical research. Too often, he believes, historians (and historians of geography, one might add) only consult maps for locations and if a map is not accurate in this respect it is deemed worthless. Harley points out that maps are not merely graphic representations of some aspects of the real world, but also reflections of cultures and societies. "Far from holding up a simple mirror of nature that is true or false, maps redescribe the world . . ." Harley suggests that maps be treated as texts rather than mirrors of nature, as are other non-verbal sign systems such as paintings, prints, theater, films, television, and music. He then details the methodology of using maps as texts and points out the influence of real maps upon our mental images of the world. "Since the age of Columbus, maps have helped to create some of the most

pervasive stereotypes of our world." This impact for some reason has often been ignored and yet, when studying the history of an area, understanding the cognitive map held by a culture is vital. One cannot understand fully the decisions made 100 years ago simply by consulting a modern map.

Although the book is designed to demonstrate to historians and others in the humanities and social sciences how maps can be used as primary documents in interpreting history, and as such should be required reading for historical methods courses, it is also a fascinating book for the lay reader who simply enjoys maps.

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HISTOIRE DES PÉDOLOGUES ET DE LA SCIENCE DES SOLS. *Jean Boulaine. 1989. Institut National de la Recherche Agronomique (INRA), Paris, France. 298 p. Softcover, 110 FF. (Available from INRA Service des Publications, Route de St.-Cyr, F-78026 Versailles Cedex, France.)*

The history of soil science is a recent interest both as a branch of the history of science and as a subdiscipline within soil science itself. Within the past decade, two professional organizations representing that science created sections within themselves concerned with history: the International Society of Soil Science formed a Working Group on the History, Philosophy and Sociology of Soil Science in 1982; and the Soil Science Society of America organized a Council on the History of Soil Science in 1989. It is fair to say that interest in the history of soil science is growing within the discipline and will grow within the history of earth sciences in general.

It is in regard to this growing interest in soil science history that the 1989 book by Professor Jean Boulaine, *Histoire des Pédologues et de la Science des Sols,* is such a welcome addition to the growing body of literature in this area. Previous literature consists of scattered articles, book fragments and monographs dealing with historical aspects of soil science beginning with V. V. Dokuchaiev's history of Russian soil investigations in his 1879 *Cartography of Russion Soils* (in Russian). J. Joffe's 1936 textbook *Pedology* contains a history chapter. M. Strzemski compiled background historical information on soil science in his monograph, *Ideas Underlying Soil Systematics,* which was translated from the Polish and published in 1975. Likewise did I. A. Krupenikov in his 1981 history of pedology (in Russian). However, these latter two works have not been widely distributed.

Professor Boulaine's *Histoire* is a compilation of people and ideas set in an historical framework of seven periods. Chapter 1 discusses works from prehistoric times, the Greek, Roman, and Arabic worlds to the European Renaissance, ending at 1600 of the common era. Chapter 2, "The Emergence of Problems" considers the emerging agricultural sciences from 1600 to 1750. "The Dawn of Modern Agronomy" from 1750 to 1840 is the subject of chapter 3. The publication of J. Liebig's landmark work on agricultural chemistry in 1840 marks the beginning of chapter 4, which considers the origins of pedology in Russia and elsewhere to 1880. The period of 1880 to 1910 is the focus of chapter 5, which is concerned with the rapid growth and development of pedology and the genetic emphasis in soil study. Chapter 6 discusses the rise of specialists in and organizers of subdisciplines of soil science in many different countries from 1905 to 1945. Lastly, the subject of chapter 7 is the evolution of science, the progress of agronomy and soil science, and current problems being grappled with by its practitioners within the period from 1945 to 1975 (the author, however, discusses work up to 1985).

There is a bibliography which includes general works about the history of soil science, soil science texts which contain historical material, serials which contain compilations of historical materials, scientific and biographic dictionaries, and specific references on soil science history. A chronology follows which lists important dates in the history of soil science. Lastly, there are both indexes of subjects and individuals.

Professor Boulaine intersperses his book with highlighted anecdotal and biographic information about individuals which adds to its interest. It is a valuable sourcebook, and could be strengthened by adding specific bibliographical references for each title or personage mentioned.

The *Histoire* fills a vital need in the history of soil science: the identification of significant personages and institutions. While this work cannot be considered as the last word, it is a starting point for inquiry. This work is similar in form to that produced in 1944 on the history of agricultural chemistry by the late eminent historian of chemistry C. A. Browne.

Readers in the history of science and of the disciplines from which soil science developed—geology, geography, physics, chemistry, botany and zoology—will find this work interesting and useful. I hope that the typographical errors, particularly the misspellings of names, can be overlooked in favor of the overall attempt to bring together under one roof an international compendium of soil science history.

Jean Boulaine is Professor of Pedology at l'Institut National Agronomique de Paris and his work is decidedly French not just in language but in emphasis and will give non-French readers an international perspective. The reader will see that soil science history is much more than two personages usually emphasized in soil science texts and in the classroom, V. V. Dokuchaiev and C. F. Marbut; the United States Department of Agriculture, Bureau of Soils and the Soil Conservation Service; and the new U.S.D.A. soil classification system, *Soil Taxonomy.*

Professor Boulaine's work is a starting point for more

detailed research into political and social concerns in the history of soil science, including international relationships and interactions which have enabled the science to grow and develop. This short encyclopedic dictionary of soil science history will certainly foster more research in this area.

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JAMES DAVID FORBES: PIONEER SCOTTISH GLACIOLOGIST. *Frank F. Cunningham. 1990. Scottish Academic Press, Edinburgh. 329 p. Hardcover, $49.95 (£27.50). (Available in North America from North American Publications Center, Old Post Road, Brookfield, VT 05036.)*

James David Forbes is little known to most glaciologists and glacial geologists today. Yet, as Frank F. Cunningham demonstrates, Forbes played a major and controversial role in the early development of glaciology during the 1840's and '50's. Forbes is hardly known today because his work is rarely given proper credit or is simply ignored in textbooks. For example, Paterson (1981) mentioned Forbes only once in the context of early controversy over theories of glacier movement. Cunningham's stated intention of writing this book was to recognize Forbes as the outstanding Scottish pioneer in glaciology and to restore Forbes' reputation relative to Agassiz, de Charpentier, Tyndall, and other better-known early glaciologists.

Forbes was born April 20, 1809, in Edinburgh into an aristocratic family. He had no formal schooling until age 16, when he entered Edinburgh University to study law as his father required. However, he developed an early, keen interest in physical science, especially astronomy. Forbes accompanied his family on a grand tour of the continent in 1826. This included a side trip to see the glaciers of the Chamonix valley, but the glaciers apparently made little impression on Forbes at that time. He continued at Edinburgh University and contributed a steady stream of papers on various physical science subjects to the Edinburgh Journal of Science.

Forbes was appointed Professor of Natural Philosophy at Edinburgh University in 1833. He set up a strenuous schedule of winter teaching alternating with summer research and travel. During this time he was completely indifferent to glaciers; his research focused on radiant heat and light. Although young, Forbes had built a solid position as a scientist of repute when the British Association met in Glasgow in 1840. Louis Agassiz attended this meeting to spread the message of his glacial theory and to convert influential scientists, but Forbes considered the glacial theory of Agassiz with a good deal of skepticism. Following the meeting, Agassiz and Buckland toured the Scottish Highlands, where Agassiz happened to meet Forbes again, largely by chance. Agassiz invited Forbes to visit Switzerland the next year in order to inspect glaciers firsthand together.

Forbes' career as a glaciologist began on August 9, 1841, when he and Agassiz stepped onto the Unteraar Glacier in central Switzerland. On this first day, Forbes recognized the "ice structure" (foliation) that became the basis for his understanding of glacier structure and movement. Agassiz was apparently both unaware of and not impressed by this phenomenon. Later Agassiz proclaimed that he (Agassiz) had shown the ice structure to Forbes, who had unjustly claimed priority for its discovery. Agassiz rebufed Forbes' attempts at reconciliation, and the controversy tainted the rest of Forbes' career.

Forbes' best glaciological work was done in 1842 on the Mer de Glace, where he undertook detailed mapping of the glacier and measurements of its movement. Based on these experiences, Forbes completed a book on July 1, 1843: *Travels through the Alps of Savoy and other parts of the Pennine Chain with observations on the phenomena of Glaciers.* In the book, he rejected both the dilatation and gravitation theories for glacier movement in favor of his own "viscous theory." This book was certainly equal in scientific merit to better known books by Agassiz (1840) and de Charpentier (1841).

Forbes was married a few days after completing the book, and then tragedy struck only weeks later when he became seriously ill. The illness lingered, sometimes improving, sometimes worsening. Over the next several years Forbes was able to complete some additional field observations. His last important field excursion was to Norway in 1851; this resulted in another book: *Norway and its glaciers* (1853). Forbes summarized his ideas on glacier motion gained during several years of work in the Alps and confirmed by observations in Norway.

Shortly after the trip to Norway, Forbes was again struck down by "serious pulmonary disease," which effectively ended his glaciological career. He took on administrative duty at St. Andrews College in Edinburgh in 1854, where he remained until his death in 1868. During this final phase of his life, he was unable to fully answer the growing criticisms of his work and personal character, nor could he strongly oppose the "regelation theory" for glacier movement that was supported by Tyndall and others.

A book about Forbes could have ended at this point; however, Cunningham's book is much more than a biography. The book is a thorough review of the whole status of early glaciology in the late 1700's and early 1800's. Most textbooks attribute development of the glacial theory to the "Swiss connection"—Perraudin, Venetz, de Charpentier and Agassiz—with only brief reference to preceding ideas. Most of the basic aspects

of the glacial theory were, in fact, put forth earlier in Scotland, Norway, Germany, and elsewhere. Even the distinction between a continental ice sheet in northern Europe and alpine glaciers in central Europe was published in a well-known journal by Bernhardi (1832).

The glacial theory existed at three levels during the 1840's when Forbes was active: 1) investigation of existing glaciers, 2) recognition of past, limited expansion of montane glaciers, and 3) speculation on ancient widespread glaciation of continental lowlands. Forbes was clearly a leader in the first aspect, and he eventually came to accept the second level. But he never really embraced the third level of widespread glaciation. Of the various early theories for glacier motion, only Forbes' concept of viscous flow by internal deformation remains a significant part of modern glaciology. Forbes was also first to recognize the "dirt bands," now called ogives. Cunningham suggests that it would be appropriate to refer to these features as "Forbes Bands" as Charlesworth (1957) did.

In my opinion, Cunningham has succeeded well in documenting the important contributions Forbes made to early glaciology and in further enlightening the early history of glaciology and glacial geology in general. Nonetheless, certain aspects of the book bear some criticism. Readers may be turned off by the design of the book: small print in double columns. Cunningham's writing style is also difficult to follow at times; long, complex sentences with parenthetical statements appear much too frequently for reading ease.

Cunningham was not consistent in spelling of place names nor using modern place names. This does not cause a problem in the Alps, for which good locality maps are provided. But it is troublesome in the chapter on Norway, where modern spellings are often quite different. For example "Jerkind" is now Hjerkinn and "Sneehatten" is now Snøhetta. Some Norwegian place names used by Cunningham simply do not exist on modern maps.

In spite of these minor reservations, I can strongly recommend this book for anyone with a serious interest in the early history of glaciology and glacial geology. The book will be an invaluable reference, not only for Forbes, but for all individuals who were involved in early development of the glacial theory.

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REFERENCES

AGASSIZ, L. 1840. Etudes sur les glaciers. Neuchatel, 346 p.

BERNHARDI, H. 1832. Wie Kamen die aus dem Norden stammenden Felsbruchstucke und Geschiebe, welche man in Norddeutschland und den benachbarten Landern findet, an ihre gegen- wartigen Fundorte? Jahrbuch fur Mineralogie, Geogn., Geol. und Petrefactenkunde 3:257–267.

CHARLESWORTH, J. K. 1957. The Quaternary Era with special reference to its glaciation. London.

CHARPENTIER, J. DE 1841. Essai sur les glaciers et sur le terrain erratique du bassin du Rhone. M. Ducloux, Lausanne, 363 p.

PATERSON, W. S. B. 1981. The physics of glaciers, 2nd edition. Pergamon, Oxford, 380 p.

GEOLOGY IS FUN (RECOLLECTIONS), OR THE ANATOMY AND CONFESSIONS OF A GEOLOGICAL ADDICT. *Reg Sprigg. 1989. Gilligham Printers Pty. Ltd., Adelaide, South Australia. 349 p. Hardcover, $41.00 AUST. (Price includes sea mail postage; available from Arkaroola Pty. Ltd., 50 Pirie Street, Adelaide, South Australia 5000.)*

Australian geologist Reg Sprigg, known for his discovery (among other noteworthy achievements) of the Ediacarian fauna, the world's oldest group of animal fossils at 620 Ma, has written an autobiography like no other. When a book has a bright yellow cover, a vivid green title, and a cartoon representation of an exuberant geologist cavorting with rock and hammer, one can surmise before even opening it that this is an unusual book. The author, now 72 years old, describes the book as a rather light-hearted account of his formative years, covering experiences from childhood to age 35. Although the seeds of his extraordinary career are evident in these "formative years," no unworthy conceit mars the tone. In his preface entitled (in the best Aussie slang) "On being mostly fair dinkum," Sprigg warns the reader that "[this book] exists within the limitations of dimming memory, controlled amnesia, personal bias, egotism and the stringencies of 45 years of assiduously kept diaries." One can't say fairer than that. Another passage from the preface may be among the best descriptions of what it's like to be a geologist: "For me . . . a mere second rate observer of Nature, the privilege of wandering in the field, being paid by my fellows to follow a naturalist hobby, has me still marvelling childlike at each new find, at each new discovery."

The book's foreword by Hans Mincham is a well-written introduction for anyone unfamiliar with Reg Sprigg. The book itself is organized into 26 chapters and an "epi (geo) logue" (a geological sketch of South Australia). Besides documenting his discovery of the Ediacarian fauna in the Flinders Ranges of South Australia in 1946 (chapter 18) and his discovery of the first submarine canyon to be found in the Southern Hemisphere (chapter 22), Sprigg details his family background (chapters 1–3), years in school (chapters 4 and 9), wartime experiences (chapters 15 and 16), and work with the Commonwealth Scientific and Industrial Research Organization (C.S.I.R.O.) Soils Division (chapter 17). The remaining chapters deal with his career in the South Australia Geological Survey. Chapter titles range from straightforward to pun; the best is "On the Uranium Trail or Gone Fission" (chapter 21). Puns, incidentally, are far from confined to chapter titles in this book.

The experiences of other geologists also enliven this book. Chapter 5 ("Vicarly Geologists") gives a brief but informative look at the contributions to Australian geology by religious men, particularly Reverend Professor Walter Howchin, under whom the author mapped the Flinders Ranges in the mid-1930's. Two of the most famous Australian geologists each rate separate chapters: Sir Douglas Mawson (chapter 10) and Cecil Madigan (chapter 14), both of whom also had won fame as Antarctic explorers and strongly influenced Sprigg's career.

Sprigg's writing style often leaves a reader weak from laughter. No review can quote half of the best lines. The writing is totally irreverent and blunt, often ribald but never mean. Much of the author's humor is at his own expense, with no evidence of "dimming memory" for some truly embarrassing moments. That he would choose to share some of these incidents with readers is a measure of the man's self-confidence.

While humor abounds, there are serious moments. Descriptions of bureaucratic red tape and infighting over the Radium Hill Project tell all too poignantly of the uneasy coexistence of science and politics, which apparently led Sprigg to quit government work in 1954. The dumping (by order of the technical Officer in the Mines Department) of a suite of carefully labeled rock samples is horrifying to any scientist; these were to have been reference sets for minor-element and petrographic studies. Perhaps most sobering is the fact that Sprigg nearly left geology altogether, when certain teachers didn't think he had it in him to be a good geologist.

The book contains many well-chosen photographs, those of the Ediacarian fauna being the best. Also included is the author's interpretive pen-and-ink sketch of an Ediacarian seashore. But what sets this book in a class by itself are the cartoon illustrations of humorous incidents in Sprigg's life, as depicted by the Australian cartoonist "Lafferty" (Stephen Stanley; not to be confused with Steven Stanley the American paleontologist).

I found only two errors. The most serious occurs on p. 72, where a passage reads, "The mineral is Franklinite, a zinc silicate . . ." Franklinite is an oxide, not a silicate. The zinc silicate mineral should be willemite. Because of the author's obvious mineral expertise, I'm sure this is a proofreading error. On p. 288, the names of Dutch geologists Kuenen, van Bemmelen, and Venig Meinesz are misspelled.

I recommend this book without reservation. Readers outside Australia will have to wait a while for the book after they place an order, but the wait will be worth it. The author is currently working on the sequel, covering his career after leaving the South Australia Geological Survey in 1954. The sequel is eagerly awaited by this reviewer.

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BONE HUNTERS IN PATAGONIA. NARRATIVE OF THE EXPEDITION. *Reprinted from the Reports of the Princeton University Expeditions to Patagonia, 1896–1899. John Bell Hatcher. 1985. Ox Bow Press, Woodbridge, Connecticut. 209 p. Hardcover, $26.00; Softcover, $15.95.*

This book is a gloriously authentic account of field work in vertebrate paleontology during its heroic years by one who helped make those years heroic, and a neat little package it is! It is probably familiar to those who must refer occasionally to the Reports of the Princeton University Expeditions, but most readers will find it new and exciting in spite of the nearly 90 years that have elapsed since its original publication.

The author spent 3 years in the field in Patagonia so long ago that names he gave to certain landmarks were the first to be accepted by Argentine as well as by European and North American cartographers. The area where he worked is at the same south latitude as Newfoundland is north, but Hatcher and a single companion during the first 2 years—he had 2 companions during the third year—spent almost the entire time under canvas. The country was uninviting to human habitation and to this day is underpopulated. Travel was of course by horse or foot, and what they lived on was mostly what they could trap or shoot.

Yet difficulties and physical hardships are only incidental to the straightforward account of geology, fossil collecting, general natural history, and the people of Patagonia and the conditions in which they lived. Even the prodigious physical effort required by the collection and transportation of fossils is downplayed—I suppose Hatcher felt that the account of the material in the body of the Reports would speak for itself. What comes through is the author's single-minded devotion to knowledge, especially through the study of fossils, his intelligence, skill, determination, and stamina in the gaining of such knowledge, and above all his self-effacing modesty.

Hatcher was in fact a monumental figure in the mold of the Wild West, but this book is not the place to read about the legends that have grown up around him, such as his prowess at poker or his skill and resolution in the use of firearms. The nearest thing in the book to these aspects of the author's career is a couple of offhand references to shooting a deer for the pot with his revolver.

An interesting aspect of this account is the similarity in the techniques of serious vertebrate paleontological field work between Hatcher's day and the present. There are differences, of course. We depend on the internal combustion engine rather than the hay-burner for transportation, we don't need firearms, and we probably entertain somewhat different scientific questions. However, we still operate with small parties (except when collecting dinosaurs), we still walk a lot more than we dig, and we still depend on field expedients to

deal with unexpectedly large and heavy specimens. And on the days when fossils are not making themselves evident we still spend a lot of time contemplating the local fauna and flora.

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ADVANCES IN GEOSCIENCES. SELECTED PAPERS FROM THE IAGA SYMPOSIA "GEOMAGNETISM AND AERONOMY" AND "PROBLEMS OF UNCERTAINTIES IN GEOPHYSICAL TIME SERIES." *Wilfried Schröder, ed. 1989. International Association of Geomagnetism and Aeronomy, Bremen-Roennebeck. 350 p. Softcover, 26 DM. (Available from editor, IDC History, Hechelstrasse 8, D-2820 Bremen-Roennebeck, Germany. Price includes postage.)*

Most scientists these days are preoccupied by what they face in their research day to day and have little time to reflect on where they stand in the progress of their own disciplines. An understanding of the history of these disciplines is perhaps the best way to provide them with a proper perspective in this regard. The reviewer commends the action of the Interdivisional Commission (IDC) on History of the International Association of Geomagnetism and Aeronomy (IAGA) and session chairman Dr. Wilfried Schröder for focusing on its history and devoting a session to presentation and publication of the proceedings. The 22 papers contained in this volume were presented during the 1989 IAGA Assembly in Exeter, England.

The reader will find many accounts, written by those directly involved or intimately familiar with these studies, of how the astronomic and geophysical disciplines developed. All the papers are in English, except one in French by S. Débarbat (entitles "L'astronomie, les femmes et la geophysique"). Eight papers deal with "Problems of uncertainties in geophysical time series." Three of these papers (authored by Schröder, by Legrand and Mazaudier, and by Atolini et al.) deal with the Maunder Minimum—the time between 1650 and 1710 when there appeared to be no sunspots.

The reviewer was particularly interested in the accounts of many prominent scientists, some of whom he knew personally and some only by name. For example, the solar-terrestrial research of Derek Justin Schove is discussed by Dobson. K. H. Wiederkehr and W. Schröder describe the unsuccessful efforts of German geophysicist and maritime explorer Georg von Neumayr to interest Alexander von Humboldt in the establishment of a geophysical observatory in Melbourne, Australia. Two papers, one by Baer and one by Liebowitz, discuss the career of climatologist Helmut Erich Landsberg.

The reviewer enjoyed most the paper entitled "Early history of the equatorial electrojet" by N. J. Skinner, partly because of his own interest in the electrojet—a concentration of electric current in the atmosphere found in the magnetic equator. The reviewer also believes the paper "One and a half centuries of geophysics in Canada" by Franz Heider is an important document.

Much of the information in this volume would not be given in a standard textbook, which is often written simply by "compilers" uninterested in how a scientific discipline develops. Dr. Wilfried Schröder, who chaired the session and edited this volume, is to be commended for this accomplishment.

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MY CALIFORNIA: AUTOBIOGRAPHY OF A GEOLOGIST, WITH A TRIBUTE TO DON TOCHER. *Gordon B. Oakeshott. 1989. GRT Book Printing Co., Oakland, California. 194 p. Softcover, $18.00. (Price includes postage; available from the author, 3040 Totterdell Street, Oakland, CA 94611.)*

Gordon B. Oakeshott, former State Geologist with the California Division of Mines and Geology, continues a welcome trend of retired geological professionals penning their memoirs. He clearly intends this publication primarily for family and friends (his brother Peter coauthored the chapter on their family), but historians also will find it useful for references to the early days of San Francisco's East Bay region. He includes a selected list of references used in the writing of this memoir.

To give some perspective on the time period covered, Gordon Oakeshott saw Halley's comet in both 1910 and 1986, and he remembers the aftershocks of the 1906 San Francisco earthquake! He recounts a great many details (found with difficulty elsewhere, if at all) of his boyhood in the village of Niles (now incorporated into the city of Fremont, California). He writes of his regrets in not talking to an elderly lady who lived near him in Niles for details about her experiences in the 1868 Hayward earthquake.

His first job with the Shell Oil Co. ended after only a year, when many younger geologists were laid off during the Great Depression. He then taught at Compton Junior College near Los Angeles before moving to the California Division of Mines (as it was known at that time), where he eventually rose to the top post.

Political as well as geologic details fill the chapter on the California Division of Mines and Geology. Oakeshott contrasts with fairness the diverse management styles of former State Geologists Ian Campbell and Olaf P. Jenkins. Earthquake studies are the subject of a separate chapter; he includes a copy of a letter he once wrote on the seismic safety of the proposed Auburn Dam. In addition to his autobiography and bib-

liography, Oakeshott includes a biographic sketch and bibliography of seismologist Don Tocher, one of the early pioneers in surface-fault studies and the director of the Earthquake Mechanism Laboratory from 1964 to 1974.

Although there are no problems with its overall printing legibility, the reproduction of the volume leaves something to be desired, in that large parts of at least 24 pages scattered throughout the book are blank for no particular reason. Most of the photographs included are of people, and the photograph on p. 52 is unidentified. Unfortunately, the reproduction quality of all of them is generally poor.

The one factual (and entirely nongeologic) detail I question is on p. 71, where he speaks of taking the Compton Junior College tennis team to Arizona in the late 1930's to play "... Arizona College and State Teacher's College (much later University of Arizona and Arizona State)." He names no specific cities, but the University of Arizona (in Tucson) has always been a university. "Arizona College" is probably the present Arizona State University (in Tempe), whereas Arizona State Teacher's College (in Flagstaff) is now Northern Arizona University.

Oakeshott, like so many geologists who write their memoirs, almost seems to apologize for doing so—"Why am I writing about my life? It has not been remarkable, for a geologist of my time," he begins his preface. No apology is necessary. Sadly, there are still too few geologists who take the time to write down their experiences to give peers and nonpeers alike a look at what it's like to be a geologist. In particular, this pleasant, rambling memoir will interest geologists who have lived and (or) worked in California for a long time.

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TO THE WATERS AND THE WILD-PETROLEUM GEOLOGY 1918 TO 1941. *Ellen Sue Blakey. 1991. American Association of Petroleum Geologists, Tulsa, Oklahoma. 207 p. Hardcover, $38.00.*

Alternately this book may be titled *The Tall Tales of Field Geologists Lavishly Illustrated.* While most modern petroleum geologists and geophysicists sit in offices and depend on logs, seismic sections, and computers, fifty years ago geophysicists were a minuscule population in the geoscience community and geologists operated in the great outdoors. This book captures the excitement of petroleum geologists in the wild jungle and remote desert between 1918 and 1941. Since I burst on the scene in 1949 I recall nostalgically many of the views shown on the photographs. In fact, geologists seen on these pages include colleagues whom I know well or knew when they were still alive, and with some of whom I worked quite closely: Theodore Link, Lewis G. Weeks, J. E. Hawley, Daniel A. Bush, Harold Fisk, Robert Dott, Paris Stockdale, E. M. Spieker, John L. Rich and Philip B. King.

The chapter headings explain some of the excitement: The Big War; Bicycles Not Acceptable; Fossils in the Earth; A Golden Land; Escape from the Firing Squad; Dangers of the Territory; A Fiery Furnace; Proper Tea and Water-buffalo Milk; Jungle Trails; Escape From Montana; Too Much Ransom; One Dead Horse; Far Ends of the Earth; Shooting the Rapids; Trouble With Allah; Riding Through an Oven; Barbed Arrows; Comic Opera War; Midst of a Revolution; Hospitality in the Andes; Flour for the Camels; Lost in a Sea of Sand; and Wild Men of the Jungle. These headings, illustrated with photos from the geologists themselves, explain the stories of high adventure and hardship in the field. They are fascinating and inspiring. From my own experience I can recount similar stories from my worldwide geologic travels: near-drowning off Atlantic reefs; averted helicopter tragedy in a canyon of Alaska; Canadian drillers leave rig on payday and must be recaptured with booze; encounter with machete-armed youth in the jungle of Hispañola four days before President Johnson sent the marines; leopard storms across field party in jungle of India; and meeting black mamba on southeastern Asian jungle trail, to name but a few.

As a historian of geology, I would have liked to see in print the vital dates of birth and death of geologists whose tales and photos are included in this book. Furthermore, how was this sample of geologists, tales, and photographs obtained? Why were they selected and others omitted? I recall the wild tales of J. Harlen Bretz (1882–1982) and John L. Rich (1884–1956). M. Gordon Frey once told me of his experience in Saudi Arabia where local bedouins removed some of the markers for geophysical surveys. The police apprehended the bedouins and Gordon had to witness how the policemen cut off their hands and plunged the stumps into boiling oil. Field geologists certainly see a lot that the average citizen barely can fathom, still today.

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THE FIVE OF HEARTS. *Patricia O'Toole. 1990. Clarkson Potter, New York. 459 p. Hardcover, $25.00.*

Some years ago I stumbled onto *The Education of Henry Adams* and became interested, because of the references to Clarence King, first Director of the U.S. Geological Survey. Having read *The Five of Hearts,* subtitled as "An intimate portrait of Henry Adams and his friends 1880–1918," I have learned an important lesson in caution concerning all autobiogra-

phies. There is a great deal that was not written by Mr. Adams, and no doubt others who write of themselves also have selective memories.

This is not a work by an historian of science, but it was for me a most illuminating volume. Book jacket comments are a special form of literature, and in one the author is credited with having "written a wonderful new kind of book that advances the art of biography." I judge this to be an accurate statement, not the usual puffery, for the intertwining of five lives and a host of accompanying folk is done in a marvelous manner, easy to read and easy to absorb. The rich do live a different life from the average field geologist today and did even more so a century ago.

The five of hearts were five people who enjoyed one another's conversation. On a trip to the West, Henry Adams happened to cross paths with Clarence King and became mesmerized by him; no other word will do to describe their relationship. Adams and John Hay had worked in the White House as secretaries to Abraham Lincoln. So years later, Adams and his wife Clover set up housekeeping in Washington, D.C. and ran one of the most exclusive salons in the city. Although John Hay and his wife Clara were then living in Cleveland, they came often enough to the Capital that the group coalesced. In choosing their symbol from a deck of playing cards Clarence King was designated as the central pit; the Hays styled themselves as the nether hearts, perhaps because Clara Hay was the only listener while the other four entertained themselves with witty remarks. She was a normal wife and mother and, unlike the three men involved, stayed on the straight and narrow path during her marriage.

In spite of his central location, King was in many respects the weakest member of the group. He left the Geological Survey in 1881 to seek his fortune in Mexican silver. Having gotten several mines into operation, he then moved to London to convince the moneyed aristocracy to invest in his mines. In his green suede suit with buckled knee britches, he cut quite a figure in society, but at night King prowled the slums where he met with what at the time were called ladies of the evening. The money magnates evaded his hook and King began his downward spiral.

Bits of information on King scattered through the book help illuminate the times. For example, the Allison Commission hearing in Congress was an important event, and in a sense John Wesley Powell's finest hour, for the question of whether the government should be involved in science was in the balance. The prime opponent was Alexander Agassiz, who had the grandest of reasons why science should be left entirely to the academics. Until reading this book I did not know that Agassiz was heavily involved financially in King's failed Mexican silver mines. Thus, there is a hint of a personal vendetta as to why government scientists were attacked so viciously.

The "five" became four in 1885, when Clover Adams committed suicide because of hereditary depression combined with her father's death. Much of the rest of the tale concerns Adams and Hay, with occasional and irregular appearances by King. His brief stay in a mental hospital is explained; it was shortly after King's marriage—without a license—and he hid away to keep his secret scandal from being exposed.

Clarence King must have been an incredibly charming man. If one reads *Angle of Repose* by Wallace Stegner, that novelist brings out all of King's finest features in a vignette. Whatever the attraction, Hay kept lending him money, and Adams and Hay schemed to make sure that King's feeling were not hurt. Thus King pledged a painting to Hay for a "loan," and later Adams paid King $2500 for the same painting in such a way that all three agreed that the debt to Hay was cancelled. How nice it would be to have such generous friends; how nice to have the money to throw around as Hay did. Compared to Hay, Adams was a poor relation, but he did have enough to pay the expenses of John La Farge when they went off on several trips, whose main purpose seems to have been to see naked-breasted native maidens. Trips to Europe were so common that they did not count as foreign travel.

King died December 24, 1901, in the early part of the fourth and final segment of this book. Poor though he might be from supporting his mother and her household, plus his secret family, he began the 40th Parallel Survey of the West with a valet as part of the camp outfit, and the man was still at his side at the end. According to his reckoning, he had spent $275,000 to help support his mother and various other dependents. Of course more than $100,000 of that had come from Hay; this sum owed Hay was about what King would have made had he remained as Director of the USGS. Even at the end King believed his financial failure was because he had devoted too much time to pure science. Hay and Adams were sure it was the fault of American society for not recognizing and automatically rewarding their pet genius.

John Hay died and then Clara; Henry Adams, the last "heart" lived until 1918. To be honest, I do not think I would have cared to have been invited to Mr. Adams' breakfasts, for he was too cynical for my tastes, and it is certain that he would never have invited me. Because I am a Washington, D.C. native and know how the Hay-Adams Hotel got its name, my judgement in favor of this history has been colored. However, one way to learn to be a good writer in history is to read well written history. The story of *The Five of Hearts* surely qualifies.

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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 Editor.

Ala, M. (Chairman), Hatamian, H., Hobson, G. D., King, M. S., Williamson, I., eds., 1990, Seventy Five Years of Progress in Oil Field Science and Technology: A symposium to mark the 75th anniversary of the foundation of the Oil Technology Course at the Royal School of Mines, Imperial College of Science, Technology and Medicine, University of London, 12 July 1988, A. A. Balkema, P.O. Box 1675 Rotterdam, Holland, 207 p. $60.00.

Allen, John E., 1990, Mapping the Geology of the Columbia Gorge and Mt. Hood in 1931: *Jour. Geol. Educ.*, v. 38, p. 50–54.

Angel, M., 1990, Présentation d'ouvrage: Mines et fonderie au XVIéme siècle d'après le "De re metallica" d'Agricola: *Troisieme Serie,* t.IV, 1990, p. 37–38.

Averill, David, 1991, Founders' diverse backgrounds blended in Tulsa to forge AAPG: *Explorer,* v. 12, No. 3, p. 34–36.

Baldwin, Stuart, 1991, John Ray (1627–1705)—His life, work and 17th century geology: *Geologists' Association Circular,* No. 884, p. 5.

Bouillet, G., 1990, Sur des faits géologiques mentionnés par quelques Pères de l'Eglise et leur utilisation apologétique: *Troisieme serie,* t.IV, 1990, p. 29–35.

Boulaine, J., 1990, Analyse d'ouvrage: Ernest Kahane: "Boussingault entre Lavoisier et Pasteur": *Troisieme Serie,* t.IV, 1990, p. 223–224.

Brown, David, 1991, Wafra targeted from air in 1948 by AAPG member: *Explorer,* v. 12, No. 3, p. 42–43.

Burchfield, Joe D., 1990, Lord Kelvin and the Age of the Earth: Univ. Chicago Press, 260 p. $15.95.

Carozzi, Albert V., 1990, A manuscript of Horace-Bénédict de Saussure on avalanches in the Swiss Alps (1795) and a comparison between 18th century and modern ideas on snow and avalanches: *Archs. Sci. Geneve,* v. 43 p. 371–399.

Devillers, Ch., 1990, Interrogations sur un vieux problème: l'homme de Piltdown: *Troisième serie,* t.IV, 1990, p. 23–28.

Dickey, P. A., 1991, Pennsylvania's contribution to petroleum geology: *American Association of Petroleum Geologists Bulletin,* v. 75, p. 562.

Dix, F. A., 1991, AAPG—The formative years (1915–1926): *American Association of Petroleum Geologists Bulletin,* v. 75, p. 563.

Durand-Delga, M., 1990, L'Affaire Deprat: *Troisième Serie,* t.IV, p. 117–212.

Ellenberger, F., 1990, Johann Scheuchzer, pionnier de la tectonique alpine: *Troisième Serie,* t.IV, 1990, p. 85–115.

Gaudant, J., 1990, Analyse d'ouvrage: G. Gohau: "Les Sciences de la Terre aux XVIIè et XVIIIè siècles. Naissance de la Géologie": *Troisième Serie,* t.IV, 1990, p. 219–221.

Gaudant, J., 1990, L'exploration géologique du Bassin Parisien. Quelques pionniers, le plus souvent méconnus: *Troisième Serie,* t.IV, 1990, p. 59–78.

Gohau, G., 1990, Mantovani et sa théorie de la dilatation planétaire: *Troisieme Serie,* t.IV, 1990, p. 53–58.

Goldsmith, Naomi F. and Gould, Edwin, 1990, Sumerian Bats, Lion-Headed Eagles, and Iconographic Evidence for the Overthrow of a Female-priest Hegemony: *Biblical Archaeologist,* September p. 142–156.

Gould, Stephen Jay, 1991, Bully for Brontosaurus. Reflections in Natural History: New York: W.W. Norton & Company, 540 p. $22.95.

Gould, Stephen Jay, 1991, What the immaculate pigeon teaches the burdened mind: *Natural History,* April, p. 12–21.

Greenburg, Jonathan D., 1990, Staking A Claim: Jake Simmons, Jr., and the Making of an African-American Oil Dynasty: Atheneum New York, 311 p. $19.95.

Laporte, Léo, ed., 1990, Establishment of a Geologic Framework for Paleoanthropology: Geol. Soc. Am., Special Papers publication #242, 82 p. $22.50 (paper).

Lys, M., Bref rapport sur l'oeuvre micropaléontologique de Jacques Deprat: *Troisieme Serie,* t.IV, 1990, p. 213–215.

Miller, Daniel N., Commercial and industrial use of archives: *The Professional Geologist,* 1989, 26 (12): p. 10–11.

Mobil Corporation, 1991, A brief history of Mobil: Mobil Corporation, 3225 Gallows Road, Fairfax, Virginia.

Nelson, C. M. and Rabbitt, M. C., 1991, Why President Hayes chose Clarence King: *Geol. Soc. Am.,* Abstracts with programs, v. 23, No. 1, p. 108.

Plaziat, J. C., 1990, Les fossiles du Tertiaire parisien dans l'oeuvre de Bernard Palissy (1510?–1590), en commémoration du quatrième centenaire de sa more: *Troisieme Serie,* t.IV, 1990, p. 79–84.

Renault, Ph., 1990, Analyse d'ouvrage: Trevor R. Shaw: History of cave science. The scientific investigation of limestone caves, to 1900: *Troisieme Serie,* t.IV, 1990, p. 217–218.

Renault, Ph., 1990, Les grandes étapes de la Karstologie française: *Troisieme Serie,* t.IV, 1990 p. 1–21.

Schröder, W., ed., 1991, Geophysical Hydrodynamics and Ertel's Potential Vorticity: (Selected papers of Prof. Dr. Hans Ertel): W. Schröder, IDC History, Hechelstrasse 8, D-2820 Bremen Ronnebeck, Germany, 232 p. $16.00.

Shaver, Robert H., 1991, A history of study of Silurian reefs in the Michigan Basin environs: p. 101–138 in Catacosinos, P.A., Jr., ed., *Geol. Soc. Am.* Special Publication Papers #256, 248 p.

Starr, E. M., 1991, The history of the development of earth-science programs in higher-education: *Journal of Geological Education,* v. 39, p. 48–51.

Stewart, John A., 1990, Drifting Continents and Colliding Paradigms: Indiana University Press, 272 p. $35.00.

Tex, E. Den, 1989, Helicoidal and Punctuated Cyclicity in Terrestrial Processes and in Geological Thinking: Pathways in Geology, Essays in Honour of Edwin Sherbourne Hills. *Melbourne, Blackwell Sci. Pub.* p. 408–417.

Tex, E. Den, 1990, Punctuated equilibria between rival concepts of granite genesis in the late 18th, 19th, and early 20th centuries: *Geological Journal,* v. 25, p. 215–219.

Van Houten, F. B., 1991, Interpreting Silurian Clinton oolitic ironstones—1850–1975: *Journal of Geological Education,* v. 39, p. 19–22.

Wickman, Franse, 1986, Brögger in Stockholm 1881–1890, a sem-

inal period of Nordic geology: *Geological Society of Finland,* v. 58, Part 1, p. 29–44.
Wilson, D. B., ed., 1990, The Correspondence Between Sir George Gabriel Stokes and Sir William Thompson, Baron Kelvin of Largs: New York Cambridge University Press, 2 volumes, boxed, 783 p. $195.
Wimbledon, Bill, 1991, Historical sites for the Geological Conservation Review: *Geoscientist,* v. 1, No. 2, p. 23–24.

ANNOUNCEMENTS

The Northeastern Science Foundation, a not for-profit corporation affiliated with Brooklyn College of the City University of New York, jointly with the History of the Earth Sciences Society (HESS) will hold a meeting on the History of Geology in its Rensselaer Center of Applied Geology in Troy, New York.

This meeting is scheduled to combine field trips with sessions of theme-oriented papers and posters. The meeting is scheduled for July 29 through August 1, 1992 following the meeting of the British Society for the History of Science, which, jointly with its Canadian and U.S. counterparts, will meet in Toronto, Ontario, Canada, July 25–28, 1992. Toronto and Troy are within less than a day's driving range or about one hour's flight time. The field trips return to the hallowed ground of geologic pioneers: Amos Eaton (1776–1842), James Hall (1811–1898), William W. Mather (1804–1859), Lardner Vanuxem (1792–1848), Sir Charles Lyell (1797–1875), Louis Agassiz (1807–1873), and Sir William Logan (1798–1875). The trips include visiting their field locations, and even visiting some of their work stations and graves.

The program consists of three parts: (1) a program on the history of Canadian geology, (2) the U.S.-Canada connection, and (3) the trans-Atlantic link. The program committee, which is currently being enlarged, consists of Charles H. Smith (Geological Survey of Canada), Hugh S. Torrens (Crewe, England), and Gerald M. Friedman (Brooklyn College and Northeasten Science Foundation). The program on the history of Canadian geology will focus on the 150th Anniversary of the Geological Survey of Canada.

* * *

150 Years Old and Bursting with ENERGY! In 1835 a young geologist, Henry De La Beche, set up the British Geological Survey. Geologists from around the world convened at the Royal School of Mines in London (England) in September to celebrate the 150th birthday of the Geology Department. Saturday, September 21, 1991 was the day selected to celebrate the founding of the Department of Geology and vision of De Le Beche. Interesting topics and speakers of the day included Sir Henry De La Beche, by Richard Scrivener, British Geological Survey; The structure of the earth (1841), by John Thackray, Natural History Museum; The structure of the earth (1991), by Joe Cartwright, Royal School of Mines; The origin of mineral deposits (1841), by Jim Secord, Imperial College; The origin of mineral deposits (1991), by Dennis Buchanan, Royal School of Mines; The origin and extinction of species (1841), by Jake Hancock, Royal School of Mines; The origin and extinction of species (1991), by Collin Patterson, Natural History Museum; The role of the Geological Survey (1991), by Peter Cook, Director, British Geological Survey.

* * *

The XIXth International Congress of History of Science is scheduled to take place at the Science Faculty in Zaragoza from August 22 to 29, 1993. The Congress will consist of Symposia which will address themes of special interest, Scientific Sections devoted to the various branches and periods of the history of science and technology as well as Poster Sessions. Official languages of the Congress will be English, French and Spanish. Director of the Program Committee if Prof. Jean Dhombres (Centre National de la Recherche Scientifique, Unité nÕ 21, 49 rue Mirabeau, F-75016 PARIS, France). President of the Organizing Committee is Prof. Mariano Hormigón (Facultad de Ciencias Matemáticas), Ciudad Universitaria, E-50009 ZARAGOZA, Spain). Chairpersons of the various Commissions and Committees of the Division of History of Science of the International Union of History and Philosophy of Science who are interested in organizing special symposia are invited to contact either Prof. Dhombres of Prof. Hormigón in the near future. The first circular should be ready for distribution in late summer 1991. The second circular will be mailed to all colleagues who by returning the entry form express interest in further information.

* * *

A new volume of historical papers in all areas of geophysics is being planned for publication by Garland Publishing. The volume, titled "History of the Geosciences: An Encyclopedia", is scheduled for release in 1993. Contributions in all areas of geophysics are needed. Requests for an authors' guide and article list should be addressed to the editor, Gregory A. Good, Encyclopedia Project, History Department, Woodburn Hall, West Virginia University, Morgantown, WV 26506, U.S.A.

History Of The School Of Geology And Geophysics University of Oklahoma (OU): compiled and written by Professor Emeritus George G. Huffman and published in the University of Oklahoma's Centennial year, this 312-page volume traces the history of the School of Geology and Geophysics from 1900 to 1990. With OU noted worldwide as having the "first and best school of petroleum geology", this comprehensive history covers the golden period of the beginning of the concentrated use of geology and geophysics in the search for oil and gas, as well as paying tribute to pioneer geologists, faculty, staff, and alumni. Also chronicled are the many contributions of the school to science, industry, and technology.

Order from: University of Oklahoma Foundation, School of Geology and Geophysics, 100 E. Boyd, Room S-114, Norman, OK 73019; phone (405) 325-3253. The price is $25 paperbound and $30 hardbound; add $3 shipping and handling per book. Oklahoma residents must add 7% sales tax.

KUDOS

The 1991 Sue Tyler Friedman Medal for distinction in the History of Geology of the Geological Society (of London) was awarded to *Earth Sciences History* editorial board member Hugh S. Torrens.

Torrens currently serves as President of the British History of Science Society and in the past was Assistant Treasurer of HESS.

* * *

William A. S. Sarjeant (Department of Geological Sciences, University of Saskatchewan) has gained two further major distinctions. In May 1991, he received, in the Linnean Society chambers of Burlington House, Piccadilly, London, England, the Founders' Medal of the Society for the History of Natural History. In October he will receive the History of Geology Award of the Geological Society of America, during its meeting in San Diego, California.

Using as his pen-name his middle names Antony Swithin, Dr. Sarjeant has published two historical science fantasy novels, *Princes of Sandastre* (Fontana Books, London, 1990) and *The Lords of the Stoney Mountains* (Fontana Books, London, 1991). Two others are in press. In 1989, writing under his full name, he was co-author with C. Alan Bradley of *Ms. Holmes of Baker Street: The Truth About Sherlock* (Gasogene Press, Dubuque, Iowa).

CALENDAR

1992

January 14-16—The World at Risk: Natural Hazards and Climate Change, Cambridge, MA. Sponsors: Massachusetts Institute of Technology Center for Global Change Science; NSF. (Anne Slinn, Center for Global Change Science, MIT, Bldg. 54-1312, Cambridge, MA 02139. Phone 617/253-4902. Fax: 617/253-0354.)

February 3-5—International Conference on Protection and Development of the Nile and Other Major Rivers, Cairo, Egypt, Sponsor: Canadian International Development Agency. (Mohamed El Moattassem, Director, High Aswan Dam Side Effects Research Institute, Water Research Center Building, Qanater, Egypt. Phone 202/954163. Fax: 202/778298.)

February 6-11—American Association for the Advancement of Science, annual meeting, Chicago. (AAAS, 1333 H St. N.W., Washington, DC. 20005. Phone: 202/326-6400.)

March 9-12—Circum-Pacific Council for Energy and Mineral Resources, meeting, Bangkok, Thailand. (Mary Stewart, Circum-Pacific Council, Suite 500, 5100 Westheimer, Houston, TX 77056. Phone 713/622-1130. Fax 713/622-5360.)

March 25-28—Earthquake hazards in the eastern San Francisco Bay area, meeting, Hayward, CA. (S.E. Hirschfold, Dept. of Geological Sciences, California State University, Hayward, CA 94542. Phone: 415/881-3486.)

March 26-28—Northeastern Section, Geological Society of America, meeting, Harrisburg, PA (Vanessa George, Geological Society of America, Box 9140, 3300 Penrose Place, Boulder, CO 80301. Phone: 303/447-2020. Fax: 303/447-1133.)

April 12-16—1992 International High-Level Radioactive Waste Management Conference, Las Vegas, Nev. Sponsors: American Nuclear Society; American Society of Civil Engineers. (James Tulenko, University of Florida, Nuclear Engineering Science Dept., 202 Nuclear Science Center, Gainesville, FL 32611. Phone 904/393-1401. Fax 904/392-3380.)

April 16-17—North Central Section, Geological Society of America, meeting, Iowa City, IA. (Vanessa George, GSA, Box 9140, 3300 Penrose Place, Boulder, CO 80301. Phone: 303/447-2020. Fax: 303/447-1133.)

April 29-May 1—Pacific Section, American Association of Petroleum Geologists, meeting, Sacramento, CA. (American Association of Petroleum Geologists, Box 9791, Tulsa, OK 74101-0979. Phone: 918/584-2555. Fax: 918/584-0469.)

May 8-10—Goldschmidt Conference, Reston, VA by Geochemical Society and others. (Bruce R. Doe, USGS, 923 National Center, Reston, VA 22092. Phone: 703/648-6205. Fax: 703/648-6191.)

May 25-27—Geological Association of Canada/Mineralogical Association of Canada, Joint Annual Meeting, Wolfville, Nova Scotia, Canada. Sponsor: Atlantic Geoscience Society. (Aubrey Fricker, General Secretary, Atlantic Geoscience Centre, Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, Nova Scotia, Canada, B2Y 4A2. Phone: 902/426-6759. Fax: 902/426-4465.)

May 25-27—Geological Society of Greece, symposium, Athens. (D. Papanikolaou, Department of Geology, University of Athens, Panepistimoupoli, Zografou, 157 84 Athens, Greece. Phone: (01) 72 42 743) Fee: $100. Meeting topic: geology of the Aegean.)

June 1-5—Fifth Pacific Congress on Marine Science and Technology (PACON 92), Kona, HI. Sponsors: AGU; Pacific Congress on Marine Science & Technology. (PACON International, % Dept. of Civil Engineering, University of Hawaii, 2540 Dole St., Holmes 383, Honolulu, HI 96822. Phone 808/948-6163. Fax: 808/942-5624.)

June 21-24—American Association of Petroleum Geologists, annual meeting, Calgary, Alberta. (AAPG, Box 979, Tulsa, OK 74101-0979. Phone: 918/584-0469.)

July 25-29—British History of Science Society, Canadian History of Science Society, and U.S. History of Science Society, joint meeting, will be held in Toronto, Ontario, Canada.

July 29-August 1—History of Geology Meeting, Troy, NY. Sponsors: Northeastern Science Foundation; History of Earth Sciences Society. (Gerald M. Friedman, Northeastern Science Foundation, P.O. Box 746, Troy, NY 12181-0746 USA. Phone: 518/273-3247. Fax: 518/273-3249.)

August 2-5—American Association of Petroleum Geologists, international meeting, Sydney, Australia. (AAPG, Box 979, Tulsa, OK 74101-0979. Phone: 918/584-2555. Fax: 918/584-0469.)

August 24-September 3—International Geological Congress, Kyoto, Japan. (Secretary General, ICC-92 Office, Box 65, Tsukuba, Ibaraki 305, Japan. Phone: 81/298/54-3627. Fax: 81/298/54-3629.)

August 25-28—Second International Research Symposium on Modern and Ancient Clastic Tidal Deposits. Wilhemshaven, West Germany. Contact: Burg Flemming, Senkenbert Institute, Schlevsenstr. 39a, 2940 Wilhelmshaven, West Germany.

August 28-September 9—World Space Congress, Washington, DC. Hosts: National Academy of Sciences; National Aeronautics and Space Administration; American Institute of Aeronautics and Astronautics. (World Space Congress, % American Institute of Aeronautics and Astronautics, 370 L'Enfant Promenade, S.W., Washington, DC 20024-2518. Phone 202/646-7451. Fax: 202/646-7508.)

August 31-September 2—International Conference on Large Meteorite Impacts and Planetary Evolution, Sudbury, Ontario, Canada. Sponsors: Ontario Geological Survey; Lunar and Planetary Institute; IUGS Commission on Comparative Planetology. (Sudbury 1992, % B. Dressler, Ontario Geological Survey, 77 Grenville St., Toronto, Ontario, M7A 1W4, Canada. Phone: 416/965-4817. Fax: 416/324-4933.)

September 1992—Research Conference, Carbonate Stratigraphic Sequences: Sequence Boundaries and Associated Facies. La Scu, Spain. Contact: Susan Green, SEPM, P.O. Box 4756, Tulsa, OK 74159-0756 U.S.A.

September 7-11—Geology of the Black Sea Region. Intl. symposium, Ankara, Turkey, by Mineral Research and Exploration. (MTA Genel Müdürlügü, 06520 Ankara, Turkey. Phone: 90-4-223-6927. Fax: 90-4-222-8278.)

September 13-18—Fourth International Geostatistics Congress, meeting, Troia, Portugal. Sponsor: Instituto Superior Tecnico of Lisbon University. (Amilcar Soares, Congress Secretary, Centro de Valorizacao de Recursos Minerals, 1ST Av. Rovisco Pais, 1096 Lisbon, Portugal. Fax: 351/1-8486935.)

September 21-25—Short and Long-Term Global Changes—Records and Modeling: 4th International Conference on Paleoceanography, Kiel, Germany. (ICP IV Organizing Committee, % GEOMAR Research Center for Marine Geosciences, Wischhofstrasse 1-3/Bldg. 4, D-2300 Kiel 14, Germany. Phone +49-431-725391 or 725650.)

October 26-29—Annual Meeting, Geological Society of America, Cincinnati, Ohio. Contact: Vanessa George, G.S.A., Box 9140, 3300 Penrose Place, Boulder, CO 80301 U.S.A. Phone 303/447-2020.

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