ANNOUNCEMENTS

Given the topic of this special issue, it is appropriate to announce that a book previously reviewed in *Earth Sciences History* (1995, 14: 124) has seen a new edition. O. Richard Norton's *Rocks from Space: Meteorites and Meteorite Hunters* is now available in paperback from Mountain Press in Missoula, Montana. Included are 50 new photographs and updated illustrations.

"Abraham Gottlob Werner (1749–1817) und seine Zeit," an International Symposium, will be held at the TU Bergakademie in Freiberg, Saxony, September 19 to 24, 1999. The conference languages are German and English. There will be field trips in the Erzgebirge and to Werner's birthplace. Contact Dr. Peter Schmidt (pschmidt@ub.tu-freiberg.de) or Prof. Dr. Helmuth Albrecht (halbrecht@vwl.tu-freiberg.de) if you are interested in attending or presenting. This Symposium is sponsored by INHIGEO and the Bergakademie.

Call for Papers: Celebrating the Age of the Earth

The Geological Society of London requests paper proposals for the William Smith Millennium Meeting, on 28–29 June 2000, at Burlington House, Piccadilly, London, with a 'time-related' field excursion to the Wealden, to be led by Professor Hugh Torrens on 30 June 2000.

With attention focused on the close of one Millennium and the dawn of another, what better time to celebrate the Age of the Earth? The meeting will review the historical development of our science, with particular emphasis on methods used to establish the Age of the Earth. Topics to be covered will range from constraints imposed on geologists by 17th century theologians and the date of Creation; through changing perceptions about geological time in the 18th and 19th centuries, to the eventual discovery of radioactivity and the very latest methods now used to date our planet and the Universe.

Talks will be of 30 minutes duration and anyone interested in presenting a paper should send a title and abstract to the convenor to arrive not later than the **20th April, 1999**. As the number of talks is inevitably limited, those papers not accepted for presentation will be invited to form a poster display.

Convenor: Dr. Cherry Lewis, HOGG, Cheese Cottage, Burton, Tarporley, Cheshire, CW6 0ER, England. Tel/fax: (44) 1829 781172. e-mail: clelewis@aol.com

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American Meteorological Society (AMS) Graduate Fellowship: The AMS is pleased to invite applications for a 1999/2000 AMS graduate fellowship for a student wishing to complete a dissertation on the history of the atmospheric, or related oceanic or hydrologic sciences. The award carries a $15,000 stipend and will support one year of dissertation research. Fellowships cannot be deferred and must be used for the year awarded, but can be used to support research at a location away from the student's institution provided the plan is approved by the student's thesis advisor. A related goal of the fellowship is to foster close working relations between historians and scientists. An effort will be made to place the student into a mentoring relationship with an AMS member at an appropriate institution. Candidates wishing to apply must be a graduate student in good standing who proposes to complete a dissertation as described above. Deadline for application: 1 June 1999.

Questions may be directed to Stephanie K. Armstrong at the AMS. Phone: 617-227-2426 ext. 235, or e-mail: armstrong@ametsoc.org

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BOOK REVIEWS

Gretchen Luepke, Book Review Editor

GEORGES CUVIER, FOSSIL BONES, AND GEOLOGICAL CATASTROPHES: NEW TRANSLATIONS AND INTEPRETATIONS OF THE PRIMARY TEXTS. *Martin J.S. Rudwick. 1994. University of Chicago Press. Hardcover, $34.95, Softcover, $19.00.*

In this book Martin Rudwick returned to his roots, both as a paleontologist and as an historian of science. In Rudwick's first book in the history of science, he devoted a chapter to Georges Cuvier.[1] Entitled "Life's Revolutions" it presented the case for Cuvier as a giant among scientists, the man who established the extinction of species as a certainty, put paleontology on a true course, and paved the way for the very theory of evolution that he himself opposed. In the present book, Rudwick aimed "to make Cuvier's main geological writings accessible to English-speaking readers" (p. 253). This he did brilliantly. In Rudwick's book one can see Cuvier developing as a scientist and appreciate how he moved with ease through comparative anatomy, paleontology, and geology. A summary of the selections best serves to introduce the prospective reader to this book.

The first selection, written in 1791 when Cuvier was twenty-two, is an extract from a letter to a friend from Stuttgart days. In it Cuvier indicated his familiarity with the ideas of Abraham Werner and analyzed the geological structure of Normandy. In the second selection, in a letter to the same friend written a year later, Cuvier discussed the outline of earth history put forward by Jean-André Deluc. The third selection is a translation of Cuvier's famous paper "Memoir on the Species of Elephants, Both Living and Fossil," read in 1796, and published in 1799. In this paper Cuvier established the differences between living and fossil elephants, documented his argument with beautifully clear plates of the comparative anatomy, and proceeded to a geological conclusion: "all these facts . . . seem to me to prove the existence of a world previous to ours, destroyed by some kind of catastrophe" (p. 24). In his fourth selection, Rudwick presented Cuvier's 1796 paper on the *Megatherium* from the Madrid museum, usefully commenting that the fossil was found in Luján, west of Buenos Aires, not in Paraguay as Cuvier's title had it. (This is a mistake still seen occasionally in print).

The fifth selection has never been published before and holds considerable interest. It is an extract of speech Cuvier gave in 1798 advocating what Rudwick termed a "research program on fossil bones" (p. 33). In this speech Cuvier used an idea that was to become one of his main themes, that "it will be necessary for physicists [*physiciens*] to do for the history of nature what antiquarians do for the history of the techniques and customs of peoples" (p. 35). As part of this selection, Rudwick also reproduced two of Cuvier's exquisite manuscript drawings of fossil bones. The sixth selection (1801) is an appeal for collectors from other countries to send their information and drawings to Cuvier in Paris. The seventh selection is from *Recherches sur les ossemens fossiles* [*Researches on Fossil Bones*] (1812) and includes a reproduction of a manuscript drawing of Cuvier's imaginative reconstruction of the soft parts, as well as the skeleton, of the *Anoplotherium medium,* one of the fossil mammals from the gypsum around Paris.[2] The eighth item, from 1804, pertains to a unique fossil marsupial from a gypsum quarry near Paris.

Text 9 is a previously unpublished set of geological lecture notes from 1804-5, which show Cuvier having been willing to leave what was for him the high road of comparative anatomy, in the sense of its reliance on observables, for the more speculative approach of geology. In these lectures Cuvier announced an interest in constructing a synthesis between ancient texts and the geological record, to the disappointment of some of his listeners of materialist conviction, as Text 10 indicates. Texts 11 and 12, both from 1806, argued for the catastrophic geological mechanism of transient marine inundations to explain the demise of fossil elephants, among other species. Texts 13 (from 1807) and 14 (from 1810) were both official reports on contemporary geological work. They show Cuvier having become more familiar with issues outside his own speciality of paleontology, though his enlarged interest was confined chiefly to the work of continental geologists, including Leopold von Buch and Jean-François d'Aubuisson de Voisin. Text 15, from 1808, is the "Essay on the Mineral Geography of the Environs of Paris" by Cuvier and his more geologically experienced co-author Alexandre Brongniart. A later version of this report was published in 1811 with a geological section map, reproduced by Rudwick in this volume. The timing of Cuvier and Brongniart's work raised the question of cross-channel comparison with the work being done by William Smith in England. Rudwick presented considerable evidence on the matter of priority of discovery in regard to the utility of fossils for stratigraphical identification. He noted that Brongiart, but not Cuvier, had visited London in 1802 and "is likely to have seen a draft of Smith's map and heard of his fossil-based methods'' (p. 129). Rudwick also noted that, "unlike William Smith, [Brongniart and Cuvier] used "characteristic fossils" not to distinguish the different formations—at least not explicitly—but only on a much more restricted scale, for recognizing specific subdivisions within this one formation [the Coarse Limestone or *calcaire grossier*]'' (p. 131).

Text 16, from 1809, shows Cuvier raising the question of the relative ages of various fossil bones more than he had done formerly. The final three texts (17–19) in Rudwick's book are the dedication (to Laplace), the preface, and the complete newly translated text of the *Discours préliminaire*—the "Preliminary Discourse"—to Cuvier's *Ossemens fossiles* (1812).

Rudwick's new translation of the "Preliminary Discourse" is important on two levels. First, its appearance at the end of a book composed of selections from Cuvier's earlier writings is an aid to our understanding of Cuvier's development as a scientist, or, as Rudwick called him, a *savant*. The themes that emerge in the "Preliminary Discourse" now have an easily recognizable history. Second, the new translation allows readers a fresh look at a document that played an important role in intellectual history. Among some British Protestants the "Preliminary Discourse" was used as an aid to bolster what Robert Jameson in his preface to its first English edition called the "Mosaic account of the creation of the world."[3] By separating Cuvier's text from Jameson's commentary and notes, and by offering a stylish new translation, with a new set a historically-oriented notes, and citations of the original French where useful, Rudwick brought Cuvier's work into the present. Cuvier's argument was that ancient texts ought to be consulted as one line of evidence for identifying geological change in the past. Cuvier raised the possibility of a synthesis between religion and science or, more precisely, between humanistic learning and geology.[4]

In his last chapter, Rudwick asked the hard question for the historian posed by Cuvier's use of the terms "revolution" and "catastrophe." He considered that "It is indeed possible that the idea of a geologically recent catastrophe in the natural world became much more plausible to Cuvier in the light of his own apparently traumatic experience of the social catastrophe of the Terror'' (p. 262–263). Rudwick presented some linguistic evidence in support of this position (Cuvier's use of the verb *détruire*—to demolish, to destroy—in both scientific and social contexts), but, ultimately, leaned to the view that "A more adequate understanding of Cuvier's catastrophism must . . . be sought within his scientific project itself.'' (p. 263) Rudwick concluded that the "link between Cuvier's work on fossil anatomy and his interpretation of the 'last revolution' alone seems adequate to account for his tenacious advocacy of catastrophist explanations in geology'' (pp. 264–265). A sudden physical change guaranteed Cuvier's claim "to have recovered a whole fauna of *extinct* mammals distinct from living species'' (p. 265).

The University of Chicago Press is to be congratulated on a finely produced and well-priced edition. This book does for Cuvier what Rudwick's earlier edition of Lyell did for him: to establish the sources on which he drew.[5] It also keeps difficult questions of interpretation to the fore. It is an important book.

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NOTES

1. Martin J.S. Rudwick, *The Meaning of Fossils: Episodes in the History of Palaeontology* (London: Macdonald, 1972), 101–163. For his reflections on his own work see "Martin Rudwick: Historian of Geology'' interviewed by David Oldroyd, *Metascience* 7, no. 1 (March 1998):167–180.
2. On Cuvier's drawings see also Martin J.S. Rudwick, *Scenes from Deep Time: Early Pictorial Representations of the Prehistoric World* (Chicago: University of Chicago Press, 1992), 30–38.
3. Robert Jameson "Preface," p. v, in Georges Cuvier, *Essay on the Theory of the Earth*. Translated by Robert Kerr. Edinburgh: William Blackwood, 1813. [Republished 1971 Gregg International Publishers.]
4. For two present-day examples of ancient texts being referred to by geologists, see the review by Amos Nur, *ESH* 16, no. 1 (1997): 57–58 of D. Neev and K.O. Emery's *The Destruction of Sodom, Gomorrah, and Jericho,* and Richard A. Kerr, "Black Sea Deluge May Have Helped Spread Farming," *Science* 269 (20 February 1998):1132. On Cuvier's synthesis see S. Herbert, "Between Genesis and Geology: Darwin and Some Contemporaries in the 1820s and 1830s'' in R.W. David and R.J. Helmstadter, eds., *Religion and Irreligion in Victorian Society* (London 1992), 69, 80. As might be guessed given his method of synthesis, Cuvier favored literate over non-literate societies, sometimes to harsh effect. (Rudwick, p. 246)
5. Charles Lyell, *Principles of Geology*, 3 vols. (Chicago: University of Chicago Press, 1990–1991 [reprint of 1830–1833 edition], 3:113–160 "Bibliography of Lyell's Sources'' compiled by Martin J. S. Rudwick. In a review emphasizing sources, note should also be taken of a recently published bibliography of Cuvier's writings: Jean Chandler Smith, *Georges Cuvier: An Annotated Bibliography of His Published Works* (Washington, D.C.: Smithsonian Institution Press, 1993).

DE LA GÉOLOGIE À SON HISTOIRE. OUVRAGE ÉDITÉ EN HOMMAGE À FRANÇOIS ELLENBERGER. *Gabriel Gohau, ed. 1997. Comité des Travaux Historiques et Scientifiques, Paris, 224 p. Softcover, 300 French Francs.*

The growth of interest in the history of the earth sciences during recent decades is very much a consequence of the activities of François Ellenberger. It was he who convoked the meeting in June 1976, at which the Comité française d'histoire de la géologie (COFRHIGEO) was brought into being. That organization celebrated its twenty years of achievements in June 1996 and this volume, reporting the proceedings, is fittingly dedicated to Ellenberger.

It starts with a preface by Helmut Hölder, beginning appropriately (and characteristically for Hölder) with quotations from Ellenberger's own writings. (One of these, in translation "History is not to be judged, but to be understood," should be a motto for all earth-science historians!) The themes of the other contributors to the volume are thereafter reviewed briefly by Hölder, the preface finishing with further apposite quotations from Ellenberger.

The depictions of Tertiary molluscs in the ceramics of the sixteenth-century French potter and savant Bernard Palissy are fascinatingly brought to our attention, and illustrated, by Jean-Claude Plaziat, who has even determined the probable sources of the fossils depicted. The ensuing account by Nicoletta Morello reminds us of another almost-forgotten figure, Giovanni Alfonso Borelli, who not only reported very accurately the eruption of Etna in 1669, but also made such percipient interpretations that he may be regarded as the father of modern vulcanology.

Though other aspects of the history of the study of fossil vertebrates have received considerable attention, little has been written on the history of palaeoichthyology. The paper by Jean Gaudant and Geneviève Bouillet is thus a ground-breaker, extending as it does far beyond their principal theme, the writings of Johann Jakob Scheuchzer (1708). It is enhanced by their excellent reproductions of rare illustrations. In contrast, their addendum defending Scheuchzer's blunder on *Homo diluvii testis* is kind, but unconvincing.

Kenneth L. Taylor interestingly analyzes the influence of earlier experiences upon the later work of Nicolas Desmarest, utilizing many unpublished sources. An unpublished proposal for simplifying and standardizing field observations, drafted and in part utilized by the Alpine geologist Horace-Bénédict de Saussure, is brought to light by Albert V. Carozzi, while Wolfhart Langer reviews the little-remembered French and Belgian contributions to the geological exploration of the Eifel region of northwest Germany.

A somewhat less favourable sidelight on the activities of our geological predecessors is to be found in Hugh Torrens's meticulous account of the proposal for a deep coal mine at Brewham in Somerset. The great stratigraphical pioneer William Smith did not initiate this, but his implicit endorsement of it was not to his credit. However, in the decade of Bre-X, we geologists can scarcely presume to be scornful!

Martin Rudwick concerns himself with the influence of theoretical concepts upon the development of stratigraphy and "geohistory", as exemplified by the work of William Smith in England and of Cuvier and Alexandre Brongniart in the Paris Basin. Kennard B. Bork demonstrates the influence of the work of Brongniart and other French scientists on the first U.S. mineralogical treatise, written by Parker Cleaveland in 1816. Gabriel Gohau, in contrast, reverts to geophilosophical themes, striving to demonstrate the problems encountered in formulating a division between actualism and catastrophism when categorizing early nineteenth-century geological writings.

A long-standing palaeobotanical/stratigraphical controversy concerning discoveries at Petit-Coeur, in the Tarentaise region of French Savoy, is recounted by Philippe Grandchamp. He shows how an initial misconception—that floras of Late Carboniferous type had survived into the Jurassic period in this region—was a consequence of equivocations by Élie de Beaumont, whose authority in the mid-19th century was such that he has been called the "Pope" of French geology.

René Tintant's analysis of Alcide d'Orbigny's work on the progression of faunas is undoubtedly useful. However, it disappointed me because it ignored the studies of Michel Rioult (1969), who showed that d'Orbigny *was* well aware of environmental factors controlling the character and distribution of faunas—factors that could not be properly characterized as global "catastrophes."

In contrast, I was very much intrigued by Goulven Laurent's analysis of the contribution of Heinrich Georg Bronn (1856) to the demise of catastrophism. His inadvertent anticipation of the findings of Charles Darwin three years later, by demonstrating the progression of life, is especially intriguing. It is curious, in consequence, that Bronn's reaction (1861) to Darwin's concepts proved so equivocal.

In the same year as Darwin's theory of evolution appeared, the ever-controversial and abrasive James Hall utilized Dana's concept of geosynclines as basis for a dynamical theory of Earth evolution. Cecil J. Schneer, who reminds us of this, may well be correct in styling it "the last theory of the earth"—though the followers of such wild theorists as Immanuel Velikovsky might contest his judgment!

The theme of the development of geological maps of the whole World, from the earliest endeavors by Ami Boué (1843) and Jules Marcou (1861) to today, is lucidly treated by Michel Durand-Delga, excellent colour illustrations of those two earliest maps being presented. From such broad generalities, it is somewhat of a shock to descend, in the last paper, to the very much more circumscribed theme of the exploitation of lime phosphates in the French Midi during the late nineteenth century!

This admirable and thought-provoking volume concludes fittingly with a reminiscence of the growth of his historical interests by Ellenberger himself, culminating in a touchingly emotional expression of appreciation to the persons who conceived this honoring of him.

REFERENCE

Rioult, M., 1969. "Alcide d'Orbigny and the stages of the Jurassic." Transl. by W. A. S. Sarjeant and A. M. Sarjeant. *The Mercian Geologist,* vol. 3, no. 1, p. 1–30. [Original French version published: 1973. "Alcide d'Orbigny et les étages du Jurassique." *In: Colloque du Jurassique à Luxembourg* 1967. Memoires du Bureau de Recherches Géologiques et Minières, Paris, vol. 75, p. 17–33.]

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SCIENTISTS AND THE SEA, 1650–1900: A STUDY OF MARINE SCIENCE. *Margaret Deacon. 1997. Ashgate. 459 pp. Hardcover, $85.95.*

Over a quarter of a century after its original publication in 1971, Deacon's book remains the primary reference source for history of marine science. This new edition of the long-out-of-print *Scientists and the Sea* arrives at an important juncture. Although oceanographers have for decades exercised an interest in the history of their field, a growing number of historians have turned their attention to oceanography. These include scholars interested in seismology, terrestrial physics, geology and other earth sciences. In fact, about one third of the participants in a recent workshop on the history of oceanography, held in Woods Hole, MA, in summer 1997, study earth science history. A wide range of historians and scientists will, therefore, seek out this re-issue of Deacon's comprehensive volume. They will be pleased to find some valuable additions, including a historiographic introduction and updated bibliography, along with the original text.

Deacon's decision to reprint, not substantially revise, strikes me as quite appropriate. As she herself points out in the introduction to the second edition, adding material would have necessitated cutting, most likely material covering earlier periods which are not well chronicled elsewhere. As such, then, the book covers the same territory as the original: the history of scientific interest in and investigation of marine phenomena ranging from tides to currents and temperature to the question of existence of life at great depths. Deacon, who embarked on the original book with encouragement and support from oceanographers, decided to investigate what is essentially the pre-history of oceanography, a field that emerged only at the end of the nineteenth century. Aware of seventeenth-century interest in the sea, Deacon looked both backward and forward to search for connections between what she identified as periods of intense interest in oceanic phenomena. Instead of continuity she found disjointed episodes of scientific attention to the sea which did not, in general, relate closely to or build upon previous work.

Deacon devotes most of the book to identifying and elaborating three main periods of scientific activity associated with the oceans. Before this, a long introductory section discusses the origins of marine science in antiquity, the middle ages and the Renaissance, presenting the scientific ideas about the sea that preceded the Scientific Revolution. During the second half of the seventeenth century, members of the Royal Society turned seaward with Baconian curiosity and confidence to study the natural world. They investigated tides, salinity, temperature and currents with the understanding that their work would yield economic and humanitarian benefits. Robert Hooke devised some of the earliest oceanographic equipment only to suffer the acute frustration of discovering that enthusiasm for marine science had dwindled to almost nothing. A reawakening of interest in oceanic phenomena accompanied eighteenth-century exploration and navigation, although it did not build on the base constructed by seventeenth-century natural philosophers. James Cook instilled a tradition of making scientific observations that became a routine part of voyages of discovery. Especially on arctic exploring expeditions, observations and measurements of oceanic phenomena promised important contributions within the fields of terrestrial physics, astronomy, meteorology, and geology. Interest in the sea attenuated once again in the early nineteenth century, reviving in mid to late century when naturalists identified the ocean's depths as a potential source for answers to questions about origins of species and origins of life. In this period scientists studied tides and currents as well as marine chemistry, geology and biology, establishing the breadth of the modern science of oceanography.

Many important aspects of Deacon's work have withstood the test of time. Although she initially planned a book on the history of British marine science she immediately realized the folly of writing without reference to people and investigations in other nations. Historians of oceanography, fisheries and marine biology remain aware of the simple but powerful fact that oceans and their inhabitants do not recognize national political boundaries. Perhaps Deacon's most significant contribution at the time of publication was her insistence that the history of oceanography not be considered synonymous with the history of expeditions. Her reappraisal of the famous voyage of HMS *Challenger,* long cited as the founding moment of modern oceanography, allowed her to pay serious attention to its more mundane precursor cruises. She also recognized the breadth of *Challenger's* importance to allied fields including marine geology, biology and oceanic circulation. One example of an important area of inquiry liberated by Deacon's new approach to history of marine science has been the study of women in oceanography. Without the imperative to consider only grand voyages, historians have expanded their study to include the work of women scientists and technicians who rarely or never went to sea. In addition, the rising number of historians of earth sciences contributing to history of oceanography derives in large measure from this simple yet powerful assertion that not all oceanography takes place on ships at sea.

Deacon herself acknowledges the criticism that her work lacks consideration of external influences on development of marine science (p. xxix). Although elaboration of these had never been a goal in this particular work, the book is hardly without cogent observations suggesting important social, political and economic influences. The short foreword by Eric Mills, who has published the most important work in history of oceanography since 1971, asserts the importance of *Scientists and the Sea* at the time of its original publication as "the vanguard of a new historiography of science" (p. viii). One topic which I have investigated is the complicated relationship between development of submarine telegraphy and investigation of the ocean floor. Although reviewer Harold Burstyn criticized Deacon in 1974 for denying a connection between them, my findings vindicate Deacon's assertions that scientific interest in deep sea soundings preceded telegraph surveys. Interest in the nature of the ocean bottom was first inspired by cultural imperialism and intellectual curiosity about marine biology and geography, not by the economic promise of submarine telegraphy. Anita McConnell's investigation of the importance of submarine telegraphy to the development of oceanographic instrumentation has refined our understanding by showing how the industry significantly improved deep sea sounding technology.[1] Nevertheless, Deacon's warning proved true that the apparent simultaneity of trans-atlantic telegraphy and ocean science does not, by itself, represent a causal relationship.

Several additions to the text in the second edition make it much more valuable than the original. In his foreword, Mills quite correctly points out that this book asks the questions that are still fueling research as this new edition appears (p. viii). Scholars attacking these research questions today will benefit from Deacon's introduction to the second edition which provides an excellent historiographic orientation to the field. Deacon characterizes history of oceanography before *Scientists and the Sea* as mostly penned by scientists. She judges fairly the strong and weak points of scientists' contributions and states frankly that her book should be understood as part of oceanographers' agenda to identify and advertise a long and distinguished history for their field. Next she turns to oceanography's place within the history of science, pointing out that until recently oceanography's history, and the work of its mostly scientific writers, often suffered neglect. She associates the recent improvement with growth of interest in history of earth sciences (especially geology), environmental sciences and ecology. I would elaborate a bit further. Starting, perhaps, with a blossoming of interest in history of geology, historians of science have generally become aware of the lack of attention to field sciences. To counterbalance what many see as an overemphasis on history of physics and chemistry focused on theory or in laboratory settings, a large number of historians have turned to investigate the fieldwork of gentleman naturalists, botanists, zoologists, anthropologists, astronomers, glaciologists, meteorologists and even social scientists.[2] The rapprochement between historians of oceanography and historians of science came about, I argue, in the context of this general turn to history of field sciences which includes but is hardly limited to earth sciences and ecology. A final section of Deacon's introduction discusses work in history of oceanography published since 1971. This section, in conjunction with the bibliography to the second edition, provides an invaluable guide that will bring even newcomers up to date on the current shape and future prospects of the field. The bibliography includes locations of proceedings from international meetings, catalogues, lists of expeditions and bibliographies in addition to published works. Excellent subject and person indexes facilitate use of the volume as a reference source.

Most, though not all, shortcomings are unavoidable given the decision (appropriate, in my opinion) not to undertake substantial revision. First, leaving quoted material in the original French, Italian and Latin makes, according to current professional standards in history, unrealistic assumptions about readers' linguistic abilities. Unfortunately the time has passed when readers for whom this book is intended, namely scientists and historians of science, can be presumed to read several other languages. (See *The Chicago Manual of Style*.) Second, asterisks are employed to mark the location of additions and corrections, which are enumerated at the end of each chapter following the footnotes. These marks are quite distracting and it is too bad that additions and corrections could not be incorporated into the text. Finally, and not necessarily related to the decision to reprint without substantial revision, the physical production of the book leaves much to be desired. In my copy, thirty-two pages (pp. xxix–20) were bound so low that these are a quarter of an inch below the rest, with ragged edges because the excess was not trimmed. Given the extremely high cost of the book, I would expect higher quality production. In balance, however, Deacon's book is too valuable to quibble over such complaints. Many historians and scientists will welcome it back or greet it for the first time with the enthusiasm it deserves.

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NOTES

1. Harold L. Burstyn, "Seers of the sea," *Isis* 65(1974): 92–95. Helen Rozwadowski, "Fathoming the Ocean: Discovery and Exploration of the Deep Sea, 1840–1880," (Ph.D., University of Pennsylvania, 1996). See Deacon, p. 298, for her comments on submarine telegraphy. Anita McConnell, *No Sea too Deep: The History of Oceanographic Instruments* (Bristol: Adam Hilgar Ltd., 1982), pp. 49–79.
2. Henrika Kuklick and Robert E. Kohler, eds., *Science in the Field*, vol. 11, *Osiris* (1996).

CHARLES DARWIN'S LETTERS, A SELECTION, 1825–1859. *Frederick Burkhardt, editor. 1996. Cambridge University Press. Cambridge. 249 p. Hardcover, $21.95.*

We know Darwin as a scientist through his books, but we know Darwin as a person through his letters. To produce a book, Darwin worked to the point of sickness: he wrote, revised, rewrote, and corrected;

sometimes decades elapsed before publishing. To produce a letter, Darwin usually wrote in a hurry: he abbreviated, omitted words, and changed spelling: hours and not decades were the time scales for his letters. He wrote books to present his mature consideration of a scientific topic, based on observations and reading. He wrote letters usually to seek information, sometimes to relax ("mental rioting," he told J. D. Hooker), and occasionally to communicate personal or family events.

Darwin's many books have been in evidence since their publication, the first in 1839, the last in 1881. His letters, in scholarly form, have been appearing only since 1985, the date of Volume 1 of *Complete Correspondence*. The priority of his books is shown in Bartlett's *Familiar Quotations* (16th ed., 1991), which has fourteen entries under Charles Darwin's name, including twelve from his books, and two attributed to Francis Darwin's *Life and Letters*. On the evidence of Bartlett, Darwin's best sentences are more notable for the concepts that they convey than for the style of their conveyance.

The book under review contains 169 letters written from 1825, when Darwin was 16 years old, through 1859, when he had reached his 50th birthday and *Origin of Species* was published. The editor, Frederick Burkhardt, selected these letters by Darwin from the first seven volumes of *Complete Correspondence* as "a trustworthy portrayal of Darwin's mind, personality, and method of work as well as an account of the important stages of his development from a student to the author of the work that has transformed our understanding of nature and mankind." The frequency of letters increased with time, so that 46 per cent of those selected come from the last five years of the 35-year period.

Darwin wrote most of the selected letters to his scientific colleagues. The botanist and Darwin's closest friend, J. D. Hooker, received 42, which is only one less than the combined totals received by the next three ranking correspondents. These next three were his second cousin and good friend, William Darwin Fox; his intellectual guide, Charles Lyell; and his university teacher and friend, John Henslow. Other letters went to T. H. Huxley (7), Asa Gray (6), A. R. Wallace (5), and J. D. Dana (3). Only one correspondent (Tegetmeier, two letters) was primarily concerned with pigeon raising, although Darwin elsewhere emphasized how much he benefitted from information on domestic pigeons.

There are 37 letters to his family, primarily to his sisters, his wife, and his oldest child. The sisters were his main correspondents during the voyage of the Beagle, and even a letter written to his father at that time closes with the acknowledgement that it seems to be written with his sisters in mind. To his wife, Emma, he writes mainly about their children, except for the often-cited letter of 5 July 1844 in which he requests that Emma publish the sketch of his species theory that he had just finished, "in case of my sudden death."

Considered as an object, the book is attractive. The dust jacket shows a pair of vermillion flycatchers from the Galapagos, superimposed on a letter from Darwin to Henslow, written as Darwin was about to leave Lima for the Galapagos. Darwin signed this letter in a bold scrawl, and his dust jacket signature is embossed on the hard cover underneath. The book is small in size, sturdily bound, well printed, and uncluttered. The end papers include the Darwin and Wedgewood family trees and the track of the Beagle. The only other illustration is the frontispiece, a watercolor portrait in grey tones that appears in color on the back of the dust jacket.

The book begins with a Foreword by Stephen Jay Gould and an Introduction by Frederick Burkhardt. Gould holds a monopoly on the writing of Forewords for books by or about important figures in the history of science, especially biology. He points out that Darwin was radical in science, liberal in politics, and conservative in lifestyle. According to Gould, Darwin's experience with a freed slave while a teenager in Edinburgh helped to set his liberal views on race. Gould approves of the chronologic order of the selected letters because this order illustrates contingent histories "where key items do not occur as predictable consequences of nature's laws, but as largely fortuitous outcomes of undetermined antecedent strings of events."

Gould provides such a contingent history in describing Darwin's barnacle work as it relates to the *Origin*. First he points out the intimate connection between Darwin's evolutionary expectations and his making out key aspects of barnacle morphology. On the next page, he dismisses the barnacle work as "sui generis." In his discussion of Darwin's letter to Lyell dated 3 May 1856, Gould makes Darwin a prophet for worrying about being anticipated in print, but Lyell had just urged this possibility on Darwin, as suggested a few pages later in Burkhardt's Introduction. See also the 3 May 1856 letter itself, *Complete Correspondence,* volume 6, page 100, particularly note 7.

Notes keyed to the separate chapters follow the letters. These notes emphasize points that the general reader will appreciate. A useful Biographical Register identifies all correspondents and most persons named in the selected letters. The book closes with an Index that consists overwhelmingly of proper nouns; common nouns are uncommon. Let us examine the Index for three common nouns that, in context, might interest general and specialized readers: 'cats,' 'chloroform,' and 'experiment.'

Darwin did not care for cats, which is consistent with the way that he mentions cats in the selected letters. In separate letters, he had his eye on Lyell's Persian cat and on Fox's African cat as potential skeletons for study, and he puts emphasis on **cats** in a letter to Wallace, as well as mentioning them elsewhere. There is only one 'cat' in the index.

The introduction of chloroform into medical practice interested Darwin both as an example of unanticipated benefits from research, and as a way to reduce pain, particularly in childbirth. 'Blessed Chloroform,' he says, but he spells it 'Chloriform,' as well. He administered chloroform to Emma during labor, writing about this experience in at least three of the selected letters, and in another he used chloroform as an example of what research for its own sake could produce. 'Chloroform' does not appear in the index.

Darwin said, "I love fools' experiments. I am always making them." (referenced in Bartlett's, attributed to *Life and Letters*). More than a dozen selected letters deal with Darwin's experiments, but 'experiments' is not in the index. If you look under 'seeds,' you will get direction to many of the experiments.

In textbooks now in use, historical reviews of plate tectonics identify temporary landbridges as the outmoded nineteenth-century way of explaining similar plants and animals on different continents. This book may surprise readers of those plate tectonic discussions. At least fourteen of the selected letters mention such landbridges, usually with Darwin protesting that they are not necessary. His letter of 5 June 1855 to Hooker probably best expresses his opinion: "For my own pet theoretical notions, it is quite indifferent whether they are transmitted by sea or land, as long as some, tolerably probable way is shown. But it shocks my philosophy to create land without some other independent evidence."

A few days later (16 June 1855) he complains to Lyell, after naming landbridges created by four of Lyell's followers: "If you do not stop this, if there be a lower region for the punishment of geologists, I believe, my great master, you will go there. Why your disciples in a slow & creeping manner beat all the old catastrophists who ever lived.—You will live to be the great chief of the catastrophists!"

Darwin's preferred solution to this problem was to find some natural process that might, under favorable conditions, do the transport. He seems to have felt, as did George Gaylord Simpson long afterwards, that a transport process with a low probability of success at any given time could have a high probability of success when operating over a long period of time. To test the transport of seeds by marine currents, he performed many experiments on the viability of seeds immersed in sea water. These are summarized in this book in a letter to *Gardeners' Chronicle* dated 21 November 1855. He found that seeds of some plants were able to germinate after months of immersion, but he could not find an easy way to keep them afloat that long.

If one wanted to balance Bartlett's reliance on Darwin's books with quotations from Darwin's letters, there are many candidates in the selected letters under review, some already mentioned. They would never pass as models of literature, but here are additional samples that might appeal to geologists and naturalists.

- "Farewell my dear Hooker & be a good boy & make Sigillaria a submarine sea–weed" (To J. D. Hooker, 1 May 1847, in a letter that continued CD's erroneous argument for the marine origin of coal. Hooker exploded in exasperation.)
- "I believe there exists, & feel within me, an instinct for truth, or knowledge or discovery, of something same nature as the instinct of virtue, & that our having such an instinct is reason enough for scientific researches without any practical results *ever* ensuing from them." (To J. S. Henslow, 1 April 1848)
- "I daresay not a word of this is really mine; it is all hereditary, except my love for you, which I sh[d] think could not be so, but who knows? Yours/CD. You were quite right to send the Barnacles; but mind that in all ordinary cases, they must instantly be put in **spirits**." (Close of a family letter to Emma, 20–21 May 1848, just after mentioning that her brother (his first cousin) had settled the Free Will question. The barnacles, which must have smelled badly, appear in a postscript after his signature.)
- "It is a melancholy, & I hope not quite true view of your's that facts will prove anything, & are therefore superfluous!" (To J. D. Hooker, 11 May 1856)
- "I have long thought that geologists not having found this or that form in this or that formation was *very poor* evidence of such forms not having then existed." (To J. D. Dana, 29 September 1856)

I recommend these selected letters to anyone with an interest in Charles Darwin. They are a valuable distillation of the first seven volumes of the *Complete Correspondence*. The *Complete Correspondence* reached Volume 10 in 1997, but Volume 10 contains the correspondence from 1862 only, which was age 53 for Darwin. The correspondence yet to be published exceeds by a significant margin the correspondence already published. May the editor, his successor, and their staff see through to completion this remarkable publishing project.

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HISTORICAL ECLIPSES AND EARTH'S ROTATION. *F. Richard Stephenson. 1997. Cambridge University Press. 557 p. Hardcover, $160.00.*

This book is impressive, both at a first glance and under more detailed examination, for it represents a masterly synthesis of scientific and historical research. There is an immense amount of work represented in its pages—both that by many scholars dating back thousands of years to Hipparchus and Ptolemy and that by author F. Richard Stephenson himself; the searching for records of observations, translation, interpretation, organization, and analyses represent many, many years of work synthesized into a single volume. This is a book that every serious library should have and that eclipse and earth-rotation experts will want to consult.

As its title suggests, *Historical Eclipses and Earth's*

Rotation centers both on eclipses and on issues surrounding the earth's slowing rotation rate (due to the sloshing of ocean waters caused by lunar and solar gravitational tides), which has the effects of lengthening the terrestrial day and—by transfer of angular momentum—of accelerating the moon in its orbit (thereby causing a very slow movement of the moon away from the earth). The decrease in the earth's rotation rate is not large: the day's length has increased by only about 0.05 second since 700 BC (and perhaps 1 hour in 200 million years) But this small change is detectable by analyzing thousands of years' worth of eclipse data as Stephenson has done, and long-term trends in the length of the day are not discernible from modern measurements alone. His book begins with a detailed history of the problems that were gradually realized from astronomical observations over the last three centuries, in which theories of the moon's acceleration had discrepancies that were finally solved in the twentieth century by astronomers, who then showed that a new time system had to be installed that was not dependent on the earth's variable rotation rate.

Stephenson's third chapter outlines the problems associated with pre-telescopic eclipse observations and how one proceeds to analyze the historical records. It also gives some basic background into the aspects and statistics of lunar and solar eclipses. While the book does contain a couple of photographs of partial solar eclipses (including an annular one), there are no photographs or even drawings depicting a total solar eclipse, and the text lacks an adequate description of how awesome and spellbinding a total solar eclipse appears to those viewing it—such events are among the most remarkable sights that nature offers us, and they are not soon forgotten by witnesses.

Chapters 4–7 delve deeply into ancient Babylonian and Assyrian observations of eclipses (both solar and lunar) and lunar phenomena, detailing the events chronologically with translations (by Peter J. Huber and Hermann Hunger) from original texts and accompanied by specific comments by Stephenson. Chapters 8 and 9 similarly present the corresponding observations from eastern Asia, including China. Chapters 10 and 11 contain eclipse information from ancient and medieval Europe, respectively, and Chapters 12 and 13 give the eclipse data from medieval Arab chronicles. Amongst the 400-plus events detailed in Chapters 4–13, Stephenson presents representative photographs of the original documents and useful maps of the observers' locales, along with graphs and tables that show well the agreement or discordance amongst various sets of observations. Much useful historical background is also provided in the text that makes the text quite interesting to read but also provides some useful context for evaluating the recorded observations themselves (including, for example, how seriously the observers kept track of the time and/or place of observation).

Careful analysis of the data involves much thought regarding the calendar system employed for each record; for ancient and even medieval observations, this can involve a very complex unraveling of the written date. Also included in Chapters 4–13 are helpful discussions and some history regarding problems in translating the original materials; words describing what was observed are often far from unambiguous. The eclipse data utilized in this book span Babylonian and Chinese observations of the eighth century BC to European observations in 1605 (just before the invention of the astronomical telescope).

A deep assessment of the quality of observations is needed, and Stephenson inspires confidence in his careful thinking of each case—for example, whether or not a total lunar eclipse would really be visible at moonrise (as stated), or if some other interpretation (and perhaps rejection) is appropriate. A good example is given in Chapter 5, where Stephenson systematically outlines reasons for rejecting a conclusion reached by P. H. Cowell, J. K. Fotheringham, and M. B. Rowton in the first half of the twentieth century that an 11th-century-BC Babylonian reference was definitely a total solar eclipse. I was a bit surprised, however, to find no mention in *Historical Eclipses and Earth's Rotation* of the possible total solar eclipse of 1375 May 3 BC—which was reported by Stephenson and his colleagues in several 1970s publications as being "reliable," and which has subsequently been cited prominently by other authors. And I disagree with Stephenson's remark that "when the totally eclipsed Moon is on the horizon, it is probably always invisible to the unaided eye" (page 87), as some bright total eclipses have been measured as being as bright as the brightest stars, and surely a clear, dark sky would allow observers looking for the moon to see it, at times of the year when twilight is not a big factor (particularly in winter).

Stephenson spends a couple of pages discussing ancient Babylonian eclipse predicting, and only a brief mention of east-Asian eclipse predictions. A larger discussion of eclipse predicting in history may be viewed by the reader as pertinent to the whole problem surrounding historical eclipse observations (available predictions would encourage more attempts at observing eclipses, as Stephenson infers on page 73), and I might have advised a few more pages of explanation in this regard (particularly for predictions by medieval and early-modern astronomers). For instance, it is implied (page 62) that Edmond Halley predicted exactly where the edges of totality would be in England for interested observers of the 1715 solar eclipse, but there is no introduction to the history leading up to such a prediction, nor is there any discussion of the ramifications of this prediction. Following Ptolemy's *Almagest*, it was possible for astronomers to make fairly accurate predictions of eclipses, in which a percentage of the maximum possible eclipse was estimated in twelfths of a solar/lunar diameter (this point system arising from the 'finger' or 'digit' system employed for many centuries by Babylonian, Greek, and Arab astronomers). Though such predictions were perhaps not widely available in the average medieval European or Arab community, their partial availability did encourage some observers to await eagerly for forthcoming eclipses (but people would have to await the work of Halley and others in the eighteenth century before it was reasonable to hope to travel to the path of a total solar eclipse). Stephenson does mention fourteenth-century eclipse observations in northern France by Johannes de Muris, who was interested in comparing his timings of eclipses to the Alfonsine tables' predictions (which in turn were computed from the millennium-old *Almagest*)—revealing that Ptolemy's ancient system still produced times to an accuracy of a quarter of an hour!

The difference in "steady", unchanging time (now known as Terrestrial Dynamical Time) invoked by astronomers in the present century and the "clock" time used in observations and tied to the earth's rotation (Universal Time), denoted ΔT, is currently around +64 seconds, but Stephenson shows in his concluding chapter that the ancient eclipse observations yield a value of $\Delta T \approx +20000$ s (or a difference of about 5.5 hours) for 700 BC, and even the casual reader can readily understand how such a difference is readily apparent in even rather crudely recorded eclipse observations from so many centuries ago. This "clock error" accumulates from the length of the day being some milliseconds longer than the standard SI value of 86400 seconds, translated over many centuries; the day was thus about 50 ms shorter in 700 BC than it is today. A small change in the earth's rotation rate causes the apparent position of the moon (with respect to the sun) to change, as seen from the surface of the earth, and the narrow path of visibility of total solar eclipses to move appreciably. Stephenson depicts this beautifully for his readers with diagrams showing that the path of totality for the eclipse of 136 BC must be shifted 49 degrees eastward (corresponding to $\Delta T \approx +11700$ s) from an unadjusted computation to agree with the observation at Babylon of a total solar eclipse. Both timed and untimed total eclipses can be used, if one can be certain that a total eclipse was observed at all at a specific location (as opposed to a partial solar eclipse), because, in Stephenson's words, such visibility "at any particular site depends very much on the value of the accumulated clock error ΔT at that date" (page 48). Partial eclipses and other observed phenomena involving the moon can help by setting limits to ΔT.

It is difficult to find major problems with *Historical Eclipses and Earth's Rotation*, but there are times when the author gets a bit ahead of his reader, as with the discussion of some esoteric aspects of the lunar "secular acceleration" (never fully defined for the uninitiated reader), traditionally given in seconds of arc per century², on pages 8–14. Some readers may require a definition of the "advance of the Earth's perihelion" (page 4), and sometimes it is not at all clear what Stephenson is talking about (as with "the latter" at the top of page 24). Why the moon should lag behind the earth's tidal bulges (page 14) is perhaps not intuitively obvious to many readers; it occurs due to a combination of the earth's rotation and the friction caused upon the oceans and seas by the land masses.

A more lucid, reader-friendly examination of the differences in apparent versus real components of the earth's rotation, the moon's changing velocity, and the "solar secular acceleration" might be wished for by many readers. The author's train of thought in his discussion of the solar acceleration, in terms of why and how this concept came to be realized and confirmed, is also deficient in explanation (pages 15–17). Lacking here, for instance, is a clear picture of why lunar acceleration did not account for all of the observed effects from historical eclipse data, necessitating the need to invoke a solar component (which seems almost arbitrarily invoked, from the murkey outline presented by Stephenson); it seems odd that Stephenson would give as many details as he does (about lunar and solar acceleration) without helping the reader through this extra important step. The confusion is perhaps greatest regarding the "coefficients" of the accelerations, which are thrown about the text very liberally without benefit of coherent connections to their corresponding physical meaning.

Occasionally an unsupported sentence seems to come out of nowhere, leaving the reader hanging—as with the remark that "for a solar observation, mid-eclipse cannot be identified directly; this moment can often be several minutes earlier or later than that of greatest phase owing to the uneven speed of the shadow across the ground" (and also the immediately-following sentence on page 74). Had I been asked to read the manuscript prior to publication, I'd have urged the author to make the text much more readable and consistent, avoiding many of the present leaps over user-friendly steps. Why, for instance, should the reader understand that (P-U) is a constant value (page 52)? Also, the "fundamental plane" scheme on pages 69–70 really needs some more elucidation. And the reason why moonset calculations should vary by 0.16 hour, as stated on page 88, is not obvious to the reader.

At times, consequently, I found myself wondering for whom the book was written, as there are sections obviously understandable only by those well versed in celestial mechanics (for example), while in other places we find the most basic types of explanations (as with what are the causes of eclipses, historical sources of astronomical data, and history of the calendar). It is obvious that Stephenson actually was aiming to write for a broad group of readers, from geophysicists to astronomers to historians, and he probably chose to write at different levels in different sections of his book, depending on whom he thought was most likely to spend time reading each section. Thus, for example, the several dozen algebraic and differential equations are mostly clustered in the first two chapters that outline the problems concerned with tidal acceleration and how this can be measured. But the text certainly could be polished a bit more, and given the importance of this book, I hope that this might happen if a revised edition is forthcoming. I also found Stephenson's use of units to be inconsistent (for example, using "h" for hours and "sec" for seconds, and using the letters "deg" for degrees but the symbol """ (douple prime) for seconds of arc). The abbreviation "RA" appears on page 84, but it is not defined until page 231 (it stands for right ascension). Another indication of poor proofreading of the text prior to publication are numerous prominent typos, including a couple on page 84 (the reference to Chapter 6 at the top of the page, and the date of the 854 eclipse toward the bottom). Near the end of the book is a 12-page reference list in standard research-journal format, with citations given in the main text as (author, year). I was surprised to see Stephenson tell his readers to "see Britton (1985), . . . for a valuable historical discussion" (page 99), the reference being to an "unpublished manuscript"; where is the reader supposed to find Britton's paper? And the reference to "Dio, LXVII" on page 106 makes no sense (a reference to an AD 116 event that is apparently by an author writing around 10 BC!).

Nonetheless, if you are interested in the earth's rotation, in solar and lunar eclipses, in the calendar and/or systems of reckoning time, in the history of astronomy and the development and recording of astronomical observations, or in general ancient and medieval history, you are likely to find at least some parts of this book very interesting. *Historical Eclipses and Earth's Rotation* is a landmark volume that will be heavily referenced and that will spawn future researches in various areas.

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COSMOS: A SKETCH OF THE PHYSICAL DESCRIPTION OF THE UNIVERSE, VOLUMES 1 AND 2. *Alexander von Humboldt. Translated by E.C. Otte. 1997. Johns Hopkins University Press. Volume 1, 375 p. Volume 2, 367 p. Softcover, $15.95 per volume.*

Thanks to the efforts of Johns Hopkins University Press to re-publish classic works in natural history, we now have the first two volumes of Humboldt's *Cosmos* readily available. Humboldt's third and fourth volumes, as well as a posthumously published fifth volume, are not part of this republication. Originally published in 1845 and 1847, these two volumes were among the best-selling books of the nineteenth century, and for that reason alone they merit republication. The question of how widely read *Cosmos* actually was represents the tip of the iceberg for a set of questions that have yet to be addressed by historians. The problems of distinguishing among Humboldt's exalted reputation, his self-promotion, and the reception of his writings remain largely untackled in the history of science. This re-publication of his last grand synthesis before his death in 1859 provides a useful text not only for historians in the English-speaking world interested in Humboldt and things Humboldtian, but it will likely attract scientists and students of nature of various stripes, especially geographers and earth scientists.

The introductory essays by Rupke (volume one) and Dettelbach (volume two) provide those who are not fluent readers of German with a valuable distillation of primary and secondary literature surrounding Humboldt. That *Cosmos* had been translated into eleven languages by 1858 when the fourth volume was published is one of many contextual facts that Rupke's introduction brings to light. His essay contextualizes *Cosmos* among his other major writings, including a discussion of several separately published atlases that were to accompany the multivolume text. Rupke provides a provocative survey of contemporary reactions in England, France, Germany, and the United States, much like a tasty appetizer to a fuller treatment of the reception of Humboldt's last work. Rupke also assesses Humboldt's place in the sociopolitical map of the day, indirectly suggesting that in spite of the seemingly liberal science he sought to promote, Humboldt was a spokesman for science comfortably ensconced in the court of Prussian King Wilhelm IV.

Dettelbach's essay for the second volume must have been difficult to write, as Rupke had already covered so much, and the volume itself offers a breathlessly wide-ranging history of the study of nature, including Greek, Roman, and Arab cultures, and covering such topics as Hebrew poetry, landscape painting, the amber trade, and the geographic and astronomic explorations of the early modern period. He succeeds precisely where Rupke leaves off, providing a more detailed account of the political atmosphere surrounding the publication of the second volume and some particulars of Humboldt's role in King Wilhelm's court. He elucidates the kind of science that *Cosmos* constructed and promoted, an Enlightenment project that sought to foster neither encyclopedism nor popularization but a "meaningful ordering of empirical data (xvii)." Dettelbach characterizes Humboldt's philosophical account as a "history of the intuition of nature as subject to physical law," or more pointedly as an all-encompassing history of Humboldtian science by the man himself.

For all its promise, *Cosmos* will prove a rather difficult and perhaps boring work for many readers. Worse, as Rupke reminds us, it "made no original contribution to any branch of modern science, not even to geography; and its holistic-aesthetic philosophy had no impact on any scientific discipline during the mid- and late-nineteenth century (vol 1, xxxii)." And yet, Humboldt captured the imagination of an enormous audience because he combined the compelling and promising virtues of his day—the ability to use the experience of the sublime in nature to gain a deeper understanding of the human condition—into a heady but goal-driven scientific direction. Humboldt's emphasis on the connections among physical phenomena, on the notion of unity in diversity, is the single most prevalent principle to which he returns again and again. Equally dominant in the writings of the contemporary geographer Carl Ritter, the idea of unity in diversity echoes loud and clear the teachings of Herder and of cameralism (a philosophical administrative science prominent in 17th and 18th century German political thought). Another theme in *Cosmos* that might be disconcerting to present day readers is the attention to the effect of nature upon the observer, such that the harmonious and orderly whole reveals its laws to certain minds prepared to receive them, and various levels of communion with nature are possible depending upon the level of preparation. This sort of introjection of the observer's mind into the object of study, along with a belief in the invariability and truthfulness of natural laws, places *Cosmos* firmly in its day, a mid-nineteenth century blend of romanticism and positivism, flavored with a liberal conservatism that has yet to be fully explored. Like other great intellects, Humboldt not only reflected the themes of his day, he also reached beyond, towards a humanistic and synthetic approach to science that was, and in many ways still is, inspiring.

I have been pondering the reasons for the republication of *Cosmos,* and the omission of any discussion of the reasons in the introductory essays. Readers, or potential readers, of this new edition of *Cosmos* might wish to understand why there is now a resurgence of interest in the great Euro-scientist. As it is not an anniversary of his birth or death, nor are there any major exhibits to justify, one might well ask, why now? And why *Cosmos,* and not the more difficult to find and arguably more significant *Views of Nature,* or Humboldt's famous but never translated *Essai sur la geographie des plantes*? Some of the answers to these questions are practical publishing issues, such as the low cost of reproducing an existing translation with an appealing title. These factors coincide with a rise in current scholarly interest in Humboldt, and this too has reasons. I venture to suggest that the interest in Humboldt reflects a collective wish to see highly synthetic environmental sciences prosper, achieving a status and a broad audience comparable to that claimed 150 years ago. In addition, Humboldt was a great man, admired and loved for a vision of global scientific cooperation that would unify the human world in the liberal cause of the search for scientific laws. The appeal of "great scientists" to historians and to a wider public never seems to fade, and the growing interest in Humboldt (stimulated in part by the now classic *Science in Culture* by Susan Cannon, 1978) suggests that we are witnessing only the beginning of wave of "humboldtian" publications. This should help to break down the relative isolation of the vast German literature on Humboldt, continuing the work begun in these introductory essays.

A few final notes on the books themselves. I wish they had been printed to accommodate a larger, more readable type size, and it was not clear at the outset that these two volumes are in fact volumes one and two of *Cosmos,* and not the whole of that work reproduced in two volumes. In spite of its shortcomings, the new *Cosmos* provides readers of *Earth Sciences History* a worthwhile reading adventure, not least for the exalted context in which the chapters on rocks, volcanoes, and physical geography are found.

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PERILS OF A RESTLESS PLANET: **Scientific Perspectives on Natural Disasters.** *Ernest Zebrowski, Jr. 1997. Cambridge University Press, Cambridge. 306 p. Hardcover, $24.95.*

I opened this book after an exhausting week, waiting for the plane to take off across the country. Six hours later, as we landed, I finished reading it, much enriched by the experience. Zebrowski, in a clear and breezy style, weaves the history and basis for scientific thought and process with gripping accounts of major disasters during the history of humans on Earth. He explains how disasters have influenced man's quest for understanding and how science and engineering are helping man cope with the perils of a restless planet.

"A natural disaster is an event in which the forces of nature claim human lives or destroy the fruits of human labor on a large scale" (p. 19). Zebrowski describes how disasters have shaped human history with the destruction of Santorini and the Minoan culture (1650 B.C.); the Lisbon (1755), San Francisco (1906), Messina (1908), Alaskan (1964), and Mexico City (1985) earthquakes; the Johnstown flood (1889); the killer lakes of Cameroun (1984 and 1986); the floods of Bangladesh; the overpopulation and demise of Easter Island in the 1700s; the plagues of 430 B.C., 300 A.D. and 540 A.D.; a tsunami in Chili (1868); hurricane-driven storm waves in Galveston (1900); the eruptions of Mt. Pelee (1902), Tambora (1815), and Krakatau (1883); the asteroid impact in Siberia in 1908; and hurricane Andrew (1992).

Disasters and the need to understand nature have shaped science from astronomy, through physics, chemistry, biology, to psychology and sociology. This spectrum of science ranges from the broad generality of astronomy with few variables required to explain observed phenomena, to the decreased generality of sociology where large numbers of variables must be dealt with to explain even simple observations (p. 43–45). The word disaster is rooted in the words "unfavorable stars", meaning star-crossed (p. 28). "Science grew out of the social imperatives of prehistoric and ancient civilizations to predict, and plan for, the future" (p. 42). "Scientific predictability became the foundation of modern engineering" (p. 39). While science students study history and make observations, uncertainties are inherent characteristics of all scientific data. So science is not about facts, it is about process. Science begins with the particular and moves to the more general. Logic is imperative but instinct plays a key role. Disasters present particularly difficult problems to scientists who must "identify patterns in classes of events that are not only geographically dispersed, but whose time lines also transcend the life span of the individual observer" (p. 21).

This book has much to recommend it to a broad audience. It provides an excellent portrayal for the non-scientist of both the challenges and intrigue of science to the scientist. It can help scientists better understand their link and responsibility to society. The book also helps explain to society's leaders why disasters can have profound influence on culture and history, thus building support for the science necessary to understand the processes controlling the occurrence of these disasters and their effects. Finally, Zebrowski's book helps everyone understand how "the natural law of growth" (p. 101) makes overpopulation and dwindling resources inevitable, global warming a serious problem, and why, if we do not find rational approaches to such problems, humans will just become one more extinct species.

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HOW THE CANYON BECAME GRAND: A SHORT HISTORY. *Stephen J. Pyne. 1998. Viking Press, the Penguin Group, New York. 189 pages, plus 10-page index. Hardcover, US $24.95; Canada $34.99.*

Just go out and buy this book, without wasting time by reading further.

S. J. Pyne is both a prolific and a remarkably good scholar. Any of the many books he has written is worth reading. However, in this slim volume, 5¼″ × 8½″, he has returned to his first love, the Grand Canyon. Fourteen summers on the north rim gave him a long time to contemplate that geographic feature and its significance.

His story is in three chapters with an opening "Overlook" and a short "Afterward." The nine pages of graphs in the appendix and eight pages of pictures repeat and reinforce his text. Pyne is a real word mechanic and while a few sentences approach purple prose, he never reaches that point. One example is a discussion of a painting by Thomas Moran. "Even here, however, there are countervailing horizontal planes with which to balance the vertiginous gorge. One is the horizon; the other is the Esplanade, an erosional terrace between the rim and the gorge." He can also be pithy, as in comparing the artistry of Moran and William Henry Holmes. "A Moran landscape is a study in grandiloquence; every Moran painting has every Canyon element in it. Holmes, however, evolves the great from the tiny."

Pyne's first chapter, "Two new worlds," begins with discussion of Spanish exploration of the Southwest in the context of the first great age of exploration and ends at about the time of the Civil War. His second and longest chapter, "Rim and river," carries through to about the first decade of this century, and documents what was essentially rediscovery of this remarkable feature of western America. In this, geological exploration is important and it is cast within the context of a second age of discovery. From what perspective one views the Canyon is important, as indicated by the chapter heading.

Pyne may be an historian, but he knows the science of geology and geologists well indeed. Science for science's sake was important in the developing recognition of the significance of the Grand Canyon, but equal space and thought is given to artistic and intellectual developments of the time. He especially explores interaction between the Canyon as a geographic feature and the national "psyche," if you will allow that term. The book has a felicitous title and this chapter explains just how appropriate is that title.

The third chapter, "Canyon and cosmos," touches on dam building, river rafting, and environmental concerns. Pyne postulates these items are part of a third age of exploration. That particular idea may not be entirely original with him, but he surely has developed it and deserves a great deal of credit for his efforts.

Although this publication is centered on the Grand Canyon, reading it will illuminate other areas and other historic personalities. Pyne leads one to reexamine some aspects of the history of science and history of ideas. His subject may be geographically limited, but his concepts overlook a remarkably wide vista. Now stop reading this screed and go buy the book.

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DEAD AS A DODO. *Jane Langton. 1996. Viking, New York. 339 pp. Hardcover, $21.95 U.S.*

It is not usual to review works of fiction for *Earth Sciences History*; but then, *Dead as a Dodo* is an unusual book. Jane Langton's earlier crime novels have almost always had a significant literary content—and indeed, her principal protagonists are Homer and Mary Kelly, a husband and wife who are both professors of English; Homer lectures at Harvard University. Moreover, some of those novels have focussed on ecological and environmental concerns; for example, *Natural Enemy* (1982), which has a young arachnologist as a central figure and the threat to New England's natural environment as a principal concern. However, never hitherto have Langton's writings contained quite so strong a scientific component. The result, for this historian of science at least, is an entertaining and thought-provoking work.

At its beginning, the Kellys have just arrived in Oxford, where Homer has secured a one-term lectureship on the theme of the Concord transcendentalists. However, his activities become focussed in the University Museum, where he is fascinated alike by the fossils—the scanty remains of the dodo, in particular—and the brooding statues of great scientists. He begins to read *The Origin of Species* and finds it both entrancing and mentally stimulating. His habit of reading passages aloud is *not* welcomed by Mary, however; her concerns are much more mundane!

Homer's delvings into Darwin intertwine with a plot that includes not only two murders, but also a search for the crabs lost from Darwin's *Beagle* collection and several jealousies that may be amorous or scientific, but are alike destructive. A philosophic "crime" also gains attention for, in a late chapter, Homer places, before a "judge and jury" of the Museum's statues and skeletons, the question: did Darwin kill God?

The lesser crimes are consequences, not only of present actions but also of actions in past times. They, at least, are resolved by the book's end. Whether Darwin's greater "crime" has been resolved, it is up to the reader to decide.

Each chapter is headed by a quotation from Lewis Carroll or (more often) from Darwin. The book is decorated by attractive sketches made by Jane Langton in Oxford (and, in particular, in the University Museum). This is a witty and thought-provoking novel, with so many sidelights on the history and philosophy of science that it deserves to be read by any subscribers to this journal—yes, even by those "dry-as-dust" individuals who, poor things, normally scorn to read fiction.

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INTERESTING PUBLICATIONS

Gerald M. Friedman, EDITOR

Since the start of this journal, Founding 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 Gerald M. Friedman, Brooklyn College and Graduate School of the City University of New York, ℅ Northeastern Science Foundation, Inc., Rensselaer Center of Applied Geology, P.O. Box 746, Troy, NY 12181-0746 U.S.A.

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TREASURER'S REPORT FOR 1997

$25,392.08	**Carried forward from 1996**		
–$16,912.40	**Expenditures in 1997**		
		$12,637.40	to Allen Press for ESH v. 15(2) and 16(1)
		$ 4,275.00	operating expenses (office, computing, membership directory, mailings)
		$16,912.40	total expenditures in 1997
+$18,678.76	**Income in 1997**		
		$17,060.00	membership dues and institutional subscriptions
		$ 888.76	interest on checking account
		$ 730.00	page charges, monetary gifts, sale of back issues
		$18,678.76	total income in 1997
$27,158.44	**Balance forward into 1998**		

Explanation:

In 1997 the society continued to maintain an approximately balanced financial situation with the year's income exceeding the year's expenditures by a modest amount. Although the society's finances are in good shape, some caution should be used in interpreting the balance forward into 1998. First, that balance includes some pre-paid individual dues and institutional subscription payments for 1998, that is, funds received to publish volume 17 of *Earth Sciences History*. Second, the society produced the membership directory as well as v. 15(2) and v. 16(1) of *Earth Sciences History* in 1997, but the second issue for the 1997 membership, v. 16(2), did not appear by the end of that year. The balance forward into 1998, therefore, includes that portion of the income from 1997 dues and subscriptions earmarked for v. 16(2). Nevertheless, at current publication and mailing costs, the society is bringing in approximately the funds required to cover its expenses, and has a moderate cushion of savings for protection against rapid increases in publication costs or postage. This positive, stable situation exists because of our steady membership and because of the careful management of journal production costs by Mott Greene, editor in 1997. The society also benefits greatly from the service of our assistant treasurers, Stuart Baldwin (U.K.), Barry Cooper (Australia), Jordi Martinell (Spain), and Keith Tinkler (Canada), whose time and effort make HESS membership affordable and more convenient to many individuals living outside of the U.S. Donations and page charges are also important and were received in 1997 from E. Bataitis, K. Bork, R.H. Dott, W.D. Grafton, L. Laporte, U. Marvin, W. Schröder, M.P. Weiss, and the University of North Carolina at Charlotte. Thanks to you all for your continued support of HESS and *Earth Sciences History*.

Respectfully submitted,
Dorothy Sack, HESS treasurer