BOOK REVIEWS

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DINOSAURS, DIAMONDS, AND THINGS FROM OUTER SPACE: THE GREAT EXTINCTION.

David Brez Carlisle. 1995. Stanford University Press, Stanford, CA. 241p. Hardcover, $45.00. Softcover, $17.95.

If you are looking for an impartial, impassive analysis and explanation of the events that closed the Mesozoic Era and ended the span of existence of the dinosaurs, then this is *not* the book for you. If, on the other hand, you would be interested in reading a spirited, thoroughly subjectively biased, rollicking romp through a whole panorama of modern earth and space sciences as they are envisaged as pertaining to the poor dinosaurs' demise, then this may be the book for you.

Before 1980, paleontologists had the field of speculating on the extinction of the dinosaurs virtually to themselves but in that year, the problem was opened up to all of science by a paper from the father and son team of Walter and Luis Alvarez and their collaborators in which evidence was cited that showed that the Cretaceous/Tertiary (K/T) geological boundary is distinguished by a geochemical anomaly, christened the "Iridium (Ir) anomaly," which they proposed marks the fall-out residue of a cataclysmic asteroidal impact that virtually instantly, in geological terms, extinguished 85 percent of biological Families on Earth including the dinosaurs. The Alvarez paper opened the floodgates and it was no time at all before astronomers, physicists, statisticians, biologists, chemists, not to mention fundamentalist students of the Bible, joined in the frenzy to make their opinions known. In vain paleontologists protested that most of the genera of dinosaurs that had ever lived were already extinct before the end of the Cretaceous so it was only a rump residue that snuffed it at that time, but they could not deny that it was the second most disastrous mass extinction known to exist in the Phanerozoic record (since *ca.* 545 million years ago).

This book, perhaps inadvertently, is a portrayal of the scientific activity of creating and testing of hypotheses. As the philosopher Karl Popper has emphasized, hypotheses, to be scientific rather than dogmatic, must be testable and able to be refuted, at least potentially. In Popper's view, no amount of confirmatory evidence can *prove* a hypothesis but one crucial experiment or observation can *falsify* it. Nevertheless, it is in the nature of scientists to build cases of contributory evidence favouring their hypothesis and simultaneously to attempt to discredit opposing hypotheses. This is what we have in spades in this book. Its author was educated at Oxford University, has had academic appointments in Physiology and Biology at Khartoum (Sudan) and Trent (Canada) universities, and is currently a senior research scientist and research advisor for the Canadian Ministry of the Environment. His principal areas of expertise are biological physiology and marine biology, but judging from the topics covered in this book, his interests are very much broader and more diverse and extend to stratigraphy, paleontology, mineralogy, geo- and cosmochemistry (including isotope and organic chemistry); celestial, fluid and impact mechanics; astronomy, statistics, and probably several others which I have failed to note. This list provides a glimpse of one of the most conspicuous qualities of this book, i.e. its breadth of approach to the subject.

Many volumes have been written on the dramatic dinosaur extinction scenario and one must ask whether another is needed. While a broad consensus has been realized amongst geoscientists on the basic premise of the impact theory, it has many variants and also a smaller body of opinion that favours a more uniformitarian, volcanic origin for the terminal Cretaceous events. This volume espouses a particular "flavour" of the impact model and introduces new ideas proposing the phenomenon that the author believes initiated the cataclysmic events. Briefly, the model Carlisle presents to us is that the terminal event of the Cretaceous Period was due to the collision of the Earth with a carbonaceous chondritic comet and, furthermore, that the event that precipitated the comet into its collision course with Earth was a galactic supernova explosion close enough to our solar system for the shock waves to have such a perturbing effect. His personal contributions to the scientific observations on which the specifics of this hypothesis are based involved a search for what he believes are unique diagnostic indicators of impact, of carbonaceous chondrites and of a supernova, and it is in documenting this quest that he justifies the inclusion of the word "Diamonds" in the book's title. Add to this his discussion of carbon isotope data, his discovery of unique, non-terrestrial forms of amino acids and of supposedly supernova-generated isotopes of silver and iodine, all in or adjacent to the K-T boundary zone, and you have the most interesting parts of his book, at least to me.

The book is structured like a good novel, perhaps like a detective story, which is appropriate since the scientist in this instance is searching for clues like a

celestial detective. Its style is lively, unabashedly promoting of Carlisle's own ideas, blatantly dismissing toward other theories, and full of colourful content and description. I think many readers might find interesting the glimpse he gives us of what got him started on this topic; it all stemmed from a study of the role fungal antibiotics play in inhibiting the biodegradation of pulp mill waste. If the connection is not immediately apparent to you, you will have to read the book, but the account is typical of the considerable abilities of this author to pull together highly disparate observations and lines of argument in synthesizing his model. Along the way, there are many surprising and occasionally distracting digressions. Herein I learned where the birthplace of Sophia Loren is, and also what the range capacity of cattle per square kilometre in the Darfur Desert of the Sudan is, and the incidence of goiter in some maritime coastal populations, and a host of other apparently irrelevant but delightfully useless bits of information. It gets out of hand, though. Most of one chapter devoted to the contemporary climatic and agricultural conditions of three desert regions of the world reads like a student's "What I Did on My Vacation" essay and is quite irrelevant to the book's theme.

Unfortunately, not all the bits of information are accurate, and when I find errors in the author's geological facts I worry somewhat that I may be unconsciously ingesting errors in other areas of science and society where I am less able to be critical. One example is in his Brief Table of Geological Time where he mixes up the terms Precambrian, Archean and Proterozoic, stating that the Precambrian and the Archean are Periods of the Proterozoic Era whereas the Archean and the Proterozoic are much larger scale Eons together comprising Precambrian time, no units of time as short as a Period having yet been recognized during all of Precambrian time. He also does not follow most conventional economic geologists, although he implies he is doing so, when he ascribes the metalliferous ores at Sudbury and other large magmatic ore bodies to cosmogenic sources. If so, one must ask where the most abundant element in the ores, sulphur, came from in such a scenario. The Burgess Shale fossil locality is located near Field, British Columbia, not near Trail, a smelter town quite a distance away. Considering his vaunted Scottish background, one would think he would know that Cambria, the source of the name for the Cambrian geological period, is derived from the Old Celtic name for Wales or a Welshman, not of Scotland. And he is sometimes deliberately mischievous such as when he re-christens the Mesozoic Era as "The Age of Mammals" whereas the conventional descriptor for the Mesozoic is the Age of Reptiles with the Cenozoic Era being termed the Age of Mammals.

The most troublesome aspect of Carlisle's presentation is his abiding faith in his own manual and computer calculations and his expectation that the reader will be trusting enough to accept the results solely on his authority. No details of the constraints on the calculations are ever given. It does not seem to have occurred to him that calculations can be mathematically correct and even elegant without in any way accurately portraying the realities of the natural world or of its events. An example occurs when he explains that the Earth's orbit has been computer modelled back in time for a billion years but shows no perturbation of type he is discussing (due to passage through a giant molecular cosmic cloud). He fails to assure us that the computer algorithm was written to include the effects of such a cloud. If it was not, then the computed orbital history is hardly likely to show such a perturbation.

The book boils down to a exuberant, subjective and wide-ranging exploration of a fascinating subject, written in an extravagant, confrontational and frequently egotistical style that certainly provides a "good read." It also provides lots of challenges, not only those of trying to understand some of the technical topics such as orbital mechanics but also, inadvertently perhaps, concerning the philosophical questions of proof, falsification and use of observations and data in contemporary science. In most instances, complex phenomena are described with admirable clarity and freedom from obfuscating details, but the concept of 2.58 dimensionality in space defeats even his best efforts to enlighten us. The book should be read with a healthy dollop of scepticism, but that does not mean it should not be read. I enjoyed reading it, although I am not yet ready to accept all of the theories (read speculations) that the author tempts us to, at least without more justification than his self-assumed trustworthiness.

I still have another niggling worry, though. It stems from a very recent report of the discovery in the Alberta Badlands, where Carlisle undertook most or all of his field studies, and it concerns the announcement of the find of the complete skeleton of a dinosaur provided with a true beak. The implications of the discovery are that this branch of dinosaurs, the *ornithomimids,* may have evolved into birds. Thus in a real sense the dinosaurs may not be extinct at all; their descendants are all around us twittering mockingly in the trees! Oops!

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MINERAL BOOKS: FIVE CENTURIES OF MINERALOGICAL LITERATURE. *Wendell Wilson, Editor. 1995. The Mineralogical Record, Tucson. 192 p. Hardcover, $49. Softcover, $24.*

The thirteen chapters and brief editor's preface are all devoted to some aspect of the history of mineralogy books and the activity of collecting them. In addition there are several articles and book reviews republished

from earlier issues of the *Mineralogical Record* in the two versions bound as books, but not in the original magazine article. This book was originally published as the Volume 26, No. 4 July–August, 1955 issue of the *Mineralogical Record.* In both books a stunning full page color photograph of an artistic double exposure by the Van Pelts of Wayne Leicht browsing in his sumptuous library, as well as the cover picture of the Elector of Saxony's personal edition of Agricola's *De re metallica* (1556) now in the Obodda library in Short Hills, New Jersey was omitted by the binder. In all other regards, all three versions are fine examples of book-making utilizing high quality materials and workmanship and beautifully illustrated with many full-color illustrations and numerous black and white photos and many line drawings of crystals. It is designed to be a companion volume to *The history of mineral collecting 1530–1799* (reviewed in ESH, v. 14, no. 2, 1995).

The first chapter by well-known mineral and book dealer Larry Conklin is a general introduction of mineralogy books and breaks them down into the 6 general categories: regional mineralogies, systematic mineralogies, mineralogical travels and narratives, illustrated mineralogies, mining histories, mining books, and medieval works in which category he places manuscripts, incunabula, and early printed works.

For each category, he gives well chosen examples. He also discusses available bibliographies. (Unfortunately there is nothing in the field of mineralogy of the compass of Dr. John Sinkankas' recent (1993) *Gemology, an annotated bibliography*). He finishes with an excellent short section, for which he is uniquely qualified, on the realities of the market place. This section will be of much value to book professionals for, like other fields of publishing, the business aspects of mineralogy books has its own distinct peculiarities. The article ends with a 2-page glossary of book terms.

The third chapter is a reprint of Chapter 5, "A brief history of systematic mineralogies" from Frank Dawson Adam's 1938 *The birth and development of the geological sciences.* It has been slightly edited in order of conform with the purposes of the present book. There are two good reasons for the inclusions of this "perhaps. . .most quoted reference on early mineralogical literature." It is arguably the most important and best researched history of medieval books on mineralogy ever published, and Adam's book has become very difficult to obtain although any good research library *should* have it. (Even the Dover reprint is now out of print and quite scarce). Adam's discussions of the most important early books can be read with profit by anyone concerned with the history of science. As published here, this important work is much more useful than in the original, because Wilson has appended a bibliography with full citations of all works mentioned by Adams; a feature which is very welcome to the serious student since Adam's citations were usually fragmentary.

Chapter 4, "Gem minerals in early Arabic literature" by Dr. William John Sersen, is a reprint of the article that Sersen published in Vol. 3 No. 2, 1991 of the *Gemmological Digest,* published by the Asian Institute of Gemological Sciences and found in very few libraries. The illustrations are different and a short section of 5 paragraphs in the original on what Sersen called mineraloids was dropped from the *Mineral Book's* version. Otherwise it is the same. Wilson probably dropped these few paragraphs because the term mineraloid was used by Sersen to apply to "amber . . . shell . . . pearls" which is, at best, a curious use of the term coined by the late Dr. Austin F. Rogers and defined as "a naturally occurring, usually inorganic substance that is not considered to be a *mineral* because it is amorphous and thus lacks characteristic crystal form, e.g. opal" (2nd edition of AGI *Glossary of Geology*). It seems appropriate to have dropped this short section since it dealt with organic gems, not minerals.

The fifth chapter is a reprint of a very important but incredibly scarce essay that appeared only in the first edition of Robert Jameson's *System of mineralogy* (1804–1808). In the preface to the first volume of that 3-volume work he reviewed the historical works on systematic mineralogy going back to Agricola. Unfortunately this cogent review of all important works between 1546 and the beginning of the 19th century was dropped from the second (1816) and third (1820) editions. Very few libraries or private collections contain a copy of the first edition, so its reproduction here is quite useful. In addition Wilson has provided a useful bibliography of all works cited by Jameson in a form much more useful to the researcher than the rather cryptic style used by Jameson. Not only does Wilson give the citation fully with everything spelled out, he also offers helpful commentary about other, and frequently better, editions than those cited by Jameson. Most importantly, Wilson adds an addendum (1880–1962) of important systematic mineralogies published after Jameson compiled his list. The 27 entries are all described in sufficient detail by Wilson to put them into proper historical context. This chapter alone would justify the inclusion of this book in any good research library. Many title pages from both Jameson's and Wilson's lists are reproduced.

Chapter 6 is an essay by Dr. W. E. Wilson and T.G. Vallence on Fabien Gautier d'Agoty (1747–1781) and his *Histoire naturelle règne minéral,* published in 1781. This extremely scarce book is incredibly valuable ($30,000 or more for incomplete copies!). There are *no* surviving complete copies. The book commands such a high price because it is a landmark in natural history publication as it is one of the first to contain plates with printed colors. Wilson expended considerable time and scholarship in preparing an 1991 reproduction of d'Agoty's book as a 70 plate complete edition assembled from two copies in private American libraries and one each in the British Museum and Institute of Geological Science in London. The resulting publication was issued as Antiquarian Reprint #4 by the *Mineralogical Record.* This magnifi-

cent reproduction, using state-of-the-art color Xerography and the highest quality paper was bound in leather. It was limited to 52 copies and is now out of print.

Chapter 6 is essentially the preface published in the reprint. It is undoubtedly the definitive work on d'Agoty and his associate's role in the development of printing colored plates in natural history books. Unlike most other early illustrated mineral books, the specimens chosen for illustration were superb. They were carefully selected by Jean Baptiste Louis de Romé de l'Isle (1736–1790) co-founder with Abbé René Just Haüy (1743–1822) of modern crystallography and an obvious judge of fine mineral specimens. Romé de l'Isle also wrote the text. Wilson provides an English translation of the captions to the 70 illustrations.

The seventh chapter is the result of a long research project by Bob Jones on Philip Rashleigh and his famous 2-volume, color-plate-illustrated *Specimens of British Minerals* (1792 and 1802). Philip Rashleigh (1729–1811) was a member of a distinguished Cornwall family. He was among the most important British minerals collectors of the 18th century and "assembled what was surely the finest private collection of Cornish minerals ever assembled" (Wilson, W. E. 1994, 71). It was housed in a special room in the 16th-century ancestral mansion called Menabilly. (Menabilly has been immortalized by the English novelist Daphne du Maurier as Manderley in her famous novel *Rebecca*).

Rashleigh's collection 'is one of the few private mineral collections in the world to have survived more or less intact for nearly two centuries." Most of the collection is in the museum at Truro in Cornwall, other specimens are in the British Museum. In Rashleigh's time collectors and scientists from near and far visited Menabilly to view the collection. Thus, the collection and the book describing it were of importance to early 19th-century mineralogy. It is interesting that although the title of his book refers to British minerals, the vast majority of the specimens pictured are from Cornwall, a few from Derbyshire with only a token number from other British localities.

Jones, a skillful writer, who has published over 500 popular articles and books on minerals tells an entrancing story of not only the collection and the book but also of the famous novelist's enchantment with Menabilly and the role it played in her novel. As a teenager in the 1920s du Maurier actually visited the then vacant house many times and actually managed to gain entry to it.

Chapter 8 is a discussion of James Sowerby (1757–1822) and his famous and remarkable color-plate-illustrated mineralogies. James Sowerby was a member of a family of distinguished naturalists, collectors, artists, and publishers. Sowerby is justifiably famed in botany and paleontology for huge serial works of enduring importance with beautiful hand-colored copper engravings. He also prepared colored plates for a number of other authors.

Larry Conklin, author of this article, has made a particular study of Sowerby's two illustrated mineralogies, *British mineralogy* (5 volumes, with 550 hand-colored plates) and *Exotic mineralogy* (2 volumes, 1811 and 1820 with an index completed in 1835, 167 hand-colored copper plates). Apparently in Sowerby's quite English point of view, anything that was not British was exotic. One does have to wonder a bit at his inclusion of one mineral from Wales in *Exotic mineralogy*! In total, over 1,500 specimens from the best mineral collections in England were depicted.

British mineralogy remains the most comprehensive topographic mineralogy of the British Isles ever published. The two volumes of *Exotic mineralogy* covered the rest of the world. Conklin considers that *Exotic* is "second in importance only to Sowerby's own earlier work *British mineralogy* in the mineral color-plate book category and had that work never been published, *Exotic mineralogy* would be the most significant mineral color-plate publication *ever* in terms of size, scope, and quality of workmanship." Both works are extremely rare. Conklin estimates that "perhaps fewer than 100 complete copies of *British mineralogy* and far fewer . . . of *Exotic mineralogy*" survive. He could ascertain the existence of only 50 and 24 respectively. Fortunately a 52-copy limited reprint of *Exotic mineralogy* has been published (1993) by the *Mineralogical Record.* It is now out of print and has already become a valuable and sought-after collector's item. The originals of both "*British*" and "*Exotic*" would currently command over $10,000 each on the contemporary market.

Chapter 9 is a short review by Dr. W. E. Wilson of Nickolay Ivanovitch Koksharov's *Materialien zur Mineralogie Russlands* which appeared in 11 volumes between 1853 and 1891. In this massive publication Koksharov described over 200 mineral species from Russia. This work is noted for both its illustrations of actual specimens and for numerous very precise crystal drawings.

Chapter 10 is a compilation for all parts of the world of regional mineralogies by Arthur E. Smith. It is a very valuable bibliographical tool as a starting point to find out what is available in topographic mineralogies.

Chapter 11 is an interesting and amusing reminiscence by Louis Zara, editor of the remarkable, beautifully illustrated mineral magazine, *Mineral Digest* of which there were 8 "volumes" (issues) in the 1970s. They were all large format, stunningly illustrated for the time, and with articles by many famous authors, but unfortunately poorly bound so that they tend to break apart when used. In spite of that, they have now become a collector's item.

Chapter 12 is a brief introduction to bookplates by Larry Conklin. It is illustrated by examples from the library of Herbert P. Obodda which is generally acknowledged as the finest private mineralogical library in the world. For each of the selected examples Conk-

lin gives an interesting thumbnail sketch of the mineral collector to whom the book once belonged.

Chapter 13 is a review by Stephen E. Prober of *Gemology, an annotated bibliography* (1993) by Dr. John Sinkankas. This important work has won high prase and several awards for its completeness and high level of scholarship.

Chapter 14 is a brief description by W.E. Wilson of the mineralogy library of the *Mineralogical Record.* This important research tool of about 2,500 volumes is one of the finest mineralogical libraries in the world.

There are also several articles and reviews reprinted from earlier issues of the *Mineralogical Record* including a report on the first mineralogy book (1798) published in the U.S. (Philadelphia). It was discovered by Dr. John Sinkankas, who was able to establish that it was a knock-off of an article in Volume 12 of the third edition (1797) of *The Encyclopedia Britannica; or a dictionary of arts, sciences and miscellaneous literature etc.* "the word *Britannica* not being applied until sometime later." In our own copy it is designated on the title page as *Encyclopedia Britannica.* The article in the *Encyclopedia* was credited to the second edition of Cronstedt's *Mineralogy* (1788). This article originally appeared in the Winter, 1971 issue of the *Mineralogical Record.*

A reprint of the very useful list of topographic mineralogy works on various U.S. states by Arthur E. Smith and Donald R. Cook that had originally appeared in the *Mineralogical Record* in February, 1979 in included. To this is appended a list of additions and updates published by Arthur E. Smith in the May–June, 1987 *Mineralogical Record.*

W. E. Wilson's description of Hebenstreit's *Museum Richterianum* (1743) is reprinted from the September–October, 1990 issue of the *Mineralogical Record.* This article was prepared by Wilson to apprise Record readers of the publication of a high quality reprint as a second in the series of Antiquarian Reprints. This huge book measures 27.5 × 41 cm and weighs 8 pounds! Only 30 copies of the reprint were produced.

Wilson also includes the description from the September–October, 1991 *Mineralogical Record* of Antiquarian Reprint #3, Nehemiah Grew's *Musaeum regalis societatis* (1681) which was published in 50 examples in 1991.

There is also a brief article from the March–April, 1990 issue of the *Mineralogical Record* by Wilson about *Victor Goldschmidt and his atlas of crystal forms.*

In the third volume of his epic second edition (1783) of *Cristallographie ou description des formes propres a tous les corps du regne minéral* the celebrated French mineralogist and crystallographer Jean Baptiste Louis de Romé de l'Isle (1736–1790) published a very valuable 45-page list, by author, of works that pertained to crystals. In the July–August, 1989 *Mineralogical Record* W. E. Wilson published an abbreviated version of this list which is reproduced here.

In our opinion this is a very valuable and scholarly work that belongs in every reference library and on the shelves of serious mineralogists, geologists, chemists, science historians, and of course, bibliophiles.

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SCIENCE FOR ALL: STUDIES IN THE HISTORY OF VICTORIAN SCIENCE AND EDUCATION. *William H. Brock. Variorum Ashgate Publishing Company. Brookfield, Vermont. 1996. 332 pp. $89.95.*

PUBLIC SCIENCE AND PUBLIC POLICY IN VICTORIAN ENGLAND. *Roy MacLeod. Variorum Ashgate Publishing Company. Brookfield, Vermont. 1996. 325 pp. $92.95.*

Here is an experiment I did at the library of the U.S. Geological Survey in Reston, Virginia. The purpose of the experiment was to examine the introduction of graphs into periodicals publishing papers on scientific subjects. For this purpose, a graph is an illustration of the functional dependence of one variable on another, using scaled distances along different axes.

The sources of data were the first 200 pages in the *Philosophical Transactions of the Royal Society* and the *Quarterly Journal of the Geological Society* for the years 1850, 1900 and 1950. In this time order, *Phil Trans* showed 0, 2, and at least 35 (possibly 69) graphs, and *Quarterly Journal* showed 0, 0, and 7 graphs, including three ternary phase diagrams but excluding geologic cross sections.

The 1850 *Phil Trans* sample with zero graphs included the classic experiments of Joule on the mechanical equivalent of heat, presented in nine tables, one of which was well over two pages long. The 1900 *Phil Trans* sample with two graphs had one that showed properties of steam and another that showed travel times of seismic waves, neither with labeled axes, one without a figure title and the other without a figure number. It is clear that Victorian and contemporary scientists differ in this important, but little noticed, way on what constitutes scientific communication. As is true for a scientist today, the daily life of a Victorian scientist was greatly affected by many unexamined practices. It is a job of the historian of science to identify and reconstitute such practices that were too much a part of the scene to be remarked.

These two books, which are the selected, previously-published essays of a historian of science education (Brock) and a historian of science policy (MacLeod), provide such texture to the daily life of Victorian scientists. There are 19 essays in Brock and 9 in MacLeod, but they sum to about the same number of pages. The books are well-bound copies, reduced to common size, of the original publications, including original pagination. The few illustrations are poorly

reproduced. Each book has an index common to all essays, but the index in MacLeod is considerably more complete. The remainder of this review describes the findings of selected essays. Roman numerals identify essays according to the publisher's scheme used in both books.

• The occurrence of graphs in scientific publications appears to be related to the introduction of graphs into schools by teachers in Victorian Britain, and probably elsewhere. Brock (XIII, XVI) describes the introduction of 'squared' paper into the teaching of science during the later part of the 19th century, and he gives particular credit for this introduction to John Perry and William Ayrton, each of whom had been assistants to William Thompson in Glasgow and then lecturers beginning around 1875 at the new engineering college in Japan. By entering upon their new teaching positions free of precedent and regulation, they could experiment with their teaching in Japan in ways not easily done in Great Britain. When they returned to teach in London, they used this experience to require work with graph paper. The grid originally had to be custom-made by the student or scientist, but by the turn of the century, the larger market for graph paper resulted in abundant, inexpensive printed supplies. As some students matured into scientists, the obvious advantage of the graphs in communicating results led to their more common use in scientific publications.

• At the close of the Victorian era, a leading science teacher used a parody of Shakespeare to describe the development of British science teaching: "Some schools are born scientific, some achieve science, and some have science thrust upon them." Science was thrust upon the schools by a system of examinations (Brock, XVIII). Beginning around 1860, openings for careers in the Civil Service, the Army, and most professions in England depended increasingly on success in competitive examinations. This led parents who could afford it to send their children to those schools where students were most successful in examinations and entrance scholarships. This led the less successful schools to increase their emphasis on passing the examinations, which required increasing emphasis on teaching science.

After a period of varying format and standards, an examination system evolved by about 1874 that was, in effect, largely geared to supplying Cambridge University with its annual intake of superior science students, typically about one percent of the school-leaving population. Student's taking these exams were held to a high standard. Lyell's *The Student's Elements of Geology* (1871) was one of the science textbooks recommended for the Cambridge Higher examinations. Questions on evolution were common in the geological and zoological exam papers of the 1880s.

Boys were examined in at least four subjects at one sitting, and girls were allowed two sittings, taking two subjects at a time. Group 4 was the science group from which students could choose not more than two subjects. The intending geologist could chose Physical Geography and Elementary Geology as one of the subjects, but on average, this was the least popular of the four or five science options available for examination in the last quarter of the nineteenth century. The most students ever to take the Geology exam in one year was 83 students in 1897, of which 61 passed, including 18 with distinction. To achieve distinction, the student usually had to take a practical laboratory exam.

• On the basis of its title, "The Alkali Acts Administration, 1863–1884" (MacLeod I) would appear to be a bore, but the essay identifies the Acts as a Victorian reaction to a problem of the physical environment that has analogs in late 20th century legislation. MacLeod originally published this essay in 1965, and it is pertinent to events that were leading to the passage of the amended United States Clean Air Act in 1970. Sodium carbonate, needed in the manufacture of glass, soap, and textiles, was produced in England by the Leblanc process beginning in 1823. In the first step of this process, sulphuric acid is added to common salt, producing HCl gas as a waste product that went up the chimney and turned to hydrochloric acid when the HCl met water vapor in the atmosphere. The acid rain from this process denuded the countryside. It was to preserve their country environment, that is, to protect their property and not to preserve the public's health, that landowners promoted the Alkali Act.

The regulation was an initial success because manufacturers could profitably convert the waste HCl to hypochlorite and commercial bleach. The volume of HCl that escaped was quickly reduced to less than one percent of the volume generated, but because sodium carbonate production increased significantly, the escape of even less than one percent of the HCl and other unregulated gases kept the neighboring countryside barren.

Robert Angus Smith, the Chief Inspector under the Act, identified many environmental questions now rather familiar to us because of concern about air pollution, such as aerosol transport, "chemical climatology," the requirement for manufacturers to use the "best practicable means" to control the gas, and so on, but the operation of the Alkali Acts has some startling contrasts with the Clean Air Act. The Alkali Acts were tightly limited in scope, and few enforcement actions were instituted against the manufacturers, although Smith knew the chemistry of the business and negotiated improvements that reduced emissions. Acid rain and attempts to control it must have been part of the shared knowledge of Victorian geologists, but neither weathering as a geologic process nor geochemistry were features of Victorian geology.

If the Alkali Acts were a Victorian analog of the Clean Air Act, then the Salmon Acts (MacLeod II) were an analog of the U.S. Clean Water Act. The two acts were similar in that they both had limited objectives whose attainment was initially under the control of small, highly motivated staffs. For three Chief Inspectors under these Acts, their work was the occasion of their own deaths: Smith died in office, Ffennell died

two months after retiring for ill health, and Buckland (the son of Dean Buckland the geologist) died on the job from overexposure to the wet and cold. Huxley was appointed to replace Buckland under the Salmon Act, but Huxley was not as interested in the work as Buckland.

- It is not possible to do research without money, and there were few sources of money for Victorian scientists if they did not inherit it. One source with prestige, but often with not much buying power, was a pension granted by the Crown from the Civil List (MacLeod, V). In the beginning of the nineteenth century, the Crown had personal control of the money, and it was used to buy legislative compliance by awarding pensions to Members of Parliament. Gradually, control of the money was acquired by Parliament, and pensions were awarded for service to the state on the recommendation of the Prime Minister. Until the 1830's scientists rarely, if ever, received them.

Peel tried to establish the custom of awarding pensions to outstanding scientists while they were young and productive, and Faraday in his mid-forties and Airy in his mid-thirties received such pensions in 1835. Later Prime Ministers used pensions to reward elder statesmen of science, most of them Fellows of the Royal Society, or to support indigent scientists or their surviving wives and daughters, independent of scientific merit.

MacLeod (V) provides detailed discussion of the history of pensions for scientists, but this effort is somewhat spoiled by seven remarkable tables, of which six contain arithmetic errors or do not show what the accompanying text says they show. For example, if the column headings of Table 1 are correct, then the numbers in the last column of Table 1 must be wrong, or vice versa. The text says that Table 2 shows pensioners most commonly were between 60 and 70 years old and quite poor, but there are no data in Table 2 on economic standing. In referring to Table 7, the text says that "Mathematics and geology, two very popular fields by Victorian standards, surprisingly received no pensions at all." However, of 103 pensions identified by field in Table 7, 10 went to mathematics and 6 to geology! The data presented are interesting, but the errors that can be found raise questions about those that might not be so easily seen.

In addition to those articles discussed above, the geological historian might be interested in: Brock II on the British Association, Brock V on the selection of authors of the Bridgewater Treatises, MacLeod III on Lighthouse Illumination, and MacLeod VI on medals given to Victorian scientists.

These books provide texture to the life of Victorian scientists by making explicit some aspects of their background that went without saying in their times. The books seem useful works for specialists in Victorian science and libraries serving such scholars.

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CHARLES DARWIN: THE MAN AND HIS INFLUENCE. *Peter J. Bowler. 1996 reissue [1990]. Cambridge University Press. 250 pages. Hardcover, $49.95; Softcover, $15.95.*

This volume is a simple reissue of Bowler's 1990 Darwin biography; it has no value added. That decision was unfortunate, one for which the publisher should be criticized as, inexcusably, even simple errors in the index remain uncorrected. Bowler complains in the introduction about the need for far-reaching, general retracings of Darwin's life by scholars intimately familiar with original documents. This complaint may have been true in 1990; in 1996, it fundamentally misleads. Witness Janet Browne's (1995) superb *Voyaging* and Desmond and Moore's (1991) *Darwin.* He easily could have expanded his preface or added an afterward to note such developments. (Bowler claims to be outside that "Darwin industry" himself, though that could be disputed.) Likewise, at the time of this book's writing, the Darwin *Correspondence* project had published only three volumes (covering Darwin letters through 1846); by 1996, it added six more (covering through 1861). Bowler relies heavily in his early chapters on the first three *Correspondence* volumes, so readers justifiably might wonder how he might now rework the middle chapters using these additional volumes. Cambridge's mere reissue of this book seems a wasted opportunity and was unfair both to Bowler and to purchasers of the book.

Though now out-of-date as a concise biography of Darwin, this book serves some useful purposes. For scholars, it offers a compact summary of Bowler's work on evolutionary theory and theorists of the late nineteenth century. This is especially true for his writings on neo-Lamarckism and what he calls the non-Darwinian revolution. The presentation here is crisper and perceptively better integrated than in his popular survey text, *Evolution: The History of an Idea.* Here also is a sharper analysis of political affiliations and agendas for social change—no doubt a result of Bowler's sympathy with Desmond and Moore.

Bowler has long insisted we shift focus from Darwin to Darwin*ism,* then see the varied Darwinists as only a fraction of the total range of researchers working to explain evolution. He wants modern evolutionists to stop jumping from Darwin to Mendelism's solution for the problem of variation and understand that most late nineteenth-century researchers had strong—often compelling—empirical and ontological reasons for rejecting Darwin's claim that the natural selection of chance variations explained the origin of species. Bowler argues that Darwin's legacy *from the perspective of his nineteenth-century successors* was quite dif-

ferent from the legacy those working in the twentieth century believed they had inherited. The former credited him with opening a new path in the century's discourse on the fixity of species: giving legitimacy and a mechanistic framework to the politically and theologically radical concept of transmutation. But few drew conclusions as radical—*i.e.,* as divergent from their existing ontologies—as did Darwin with his heavy emphasis on chance. Few were prepared to go as far as he on this crucial point. Thus, though he served as catalyst for the conversion to evolutionary ideas, converts by and large rejected Darwin's attempt to move chance to the center of life's history. The far-reaching enthusiasm during this period for progressivist interpretations of evolution represented their assimilation of a newly credible interest in transmutation into continuing ontologies holding life as both purposeful and ever improving.

The survival of natural selection into the twentieth century, Bowler stresses, was by no means guaranteed and very nearly did not occur. Selectionists resurrected this dimension of Darwin's work and centered his legacy around it only after they developed ways for assimilating chance (and the consequences indeterminacy had for their world views) into their understanding of evolutionary processes. If Bowler succeeds at anything in this work, it is to reinforce his well-demonstrated point that late nineteenth-century evolutionary studies was a complex entanglement requiring careful unwrapping and comparison with later activity. We should not assume, he reminds us, that previous generations lacked sophistication, reason, and subtlety.

For non-specialists and undergraduate students—people Bowler refers to as "ordinary readers"—this book provides a textbook-level introduction to nineteenth-century evolutionist thinking. Bowler purposefully covers well-trodden ground while assimilating recent (prior to 1990) developments in scholarship. The writing is enthusiastic and easy flowing, clearly intended for the student market. Readers unfamiliar with the topic will walk away from this work with a fair overview of what nineteenth-century discourse on transmutation and origins basically entailed and with who involved themselves in that discussion. Bowler also uses a historiographically conscious voice: pointing out common myths and interpretive biases in Darwin scholarship. Though quite useful in moderation, this nearly constant reference to historiography hampers the presentation and may prove confusing in teaching environments. The notable exception to this is his analyses of how Darwin's legacy was (and is) used as an ideological tool by many and varied writers. Alas, while promising to show readers where ideological biases lay in other Darwin biographies, Bowler fails to discuss his own! Overall, however, the effort to keep readers conscious of what is being read—its origins, omissions, emphases, and spin—is a laudable goal.

Instructors using this text will find several additional difficulties. The chapter of Darwin's post-*Beagle* years includes a jumble of unnecessary detail regarding his many notebooks. Likewise, some of the sections on late nineteenth-century evolutionists seem a mere menagerie of people and books. This is useful information, but novices easily might lose their way. The strongest positive in this book is Bowler's familiar separation of the intertwined concepts of evolution and progress. Additionally, the style of this work—part of the publisher's series of individual scientists—will interest students of biography as a genre for its advocacy of several novel (in 1990) historiographical twists and turns. The series' effort to place eminent scientists in their personal contexts, giving them lives "outside the laboratory" and their ideas cultural and political contexts, makes this book a fine replacement for out-of-print student-level biographies of Darwin and Darwinism. Overall, Bowler's effort provides a respectable starting place for those beginning Darwin studies or for those needing a framework for understanding nineteenth-century evolutionary studies.

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WILD RIVER. TIMELESS CANYONS: BALDUIN MÖLLHAUSEN'S WATERCOLORS OF THE COLORADO. *Ben W. Huseman. 1995. Amon Carter Museum of Western Art. 232 pages. 51 color illustrations, 165 black and white, 5 maps. Hardcover, $70.*

This book is a visual treat. It is the catalogue of a display of forty-six recently discovered, fine water color or landscape paintings by the Prussian explorer, natural historian, scientific illustrator, travel writer, courtier, and (in his late years) vastly popular novelist, Heinrich Balduin Möllhausen (1825–1905). In the days before reliable photography, each scientific expedition had at least one artist. Between 1851 and 1858 Möllhausen held this position on four long traverses across the wilderness of the American West. This book is the visual record of his last trip: the U.S. Army's Ives expedition; the second steamboat to ascend the Colorado River and the first European party to travel along the river at the bottom of the Grand Canyon.

The book contains full-color, full-page reproductions of the 46 landscape paintings. Each picture is discussed in one to three pages. These short essays document (with numerous end notes) that the paintings were the basis of etchings and lithographs used in the military and scientific reports of the expedition, and in Möllhausen's own popular travel books. In each case, Huseman includes the appropriate etchings and lithographs along with black and white photographs of the modern landscapes. He compares all of the images to each other, and to landscape descriptions in Möllhausen's diaries of the trip and his travel books. Huseman shows that the paintings and writings are almost al-

ways both compatible and complementary. But most of the printed "copies" are different (some are very different) from the painting, and all the nineteenth century images are different from the photographs.

This is not just a case of who is "right." Huseman clearly stated that photography also distorts landscape somewhat, and that the region has changed over the last century. The point of the comparisons was to examine the political requirements, aesthetic biases, and scientific knowledge which caused the images to be so different.

The artist wrote that his paintings needed to represent the stratigraphic continuity of the beds within the Grand Canyon. In many cases the paintings convey this better than modern photographs. But the etchings made from the paintings often lost the stratigraphy in an effort to convey the romantic nineteenth-century aesthetic of the sublime wilderness, which the copyists carried in their own minds and which they got from Möllhausen's poetic field notes which some of them are known to have read. There is even less stratigraphic verisimilitude in some of the lithographic "copies" of the etchings. There has been a great deal written recently of the social construction of reality in general and science in particular. Without using any of the usual vocabulary of that debate, this book is on the front line in the study of that process.

This book is a splendid record of the effect of geomorphic knowledge on a thoughtful landscape artist. In his early work, Möllhausen drew unlikely or impossible drainage systems; or worse, mountains without any sense of drainage. But in these mature paintings, we see in each picture the canyons are a unified hydrologic system which has eroded and conveyed away a vast quantity of rock and soil. Interestingly, the accompanying etched and lithographed "copies" (and even the photographs) display the geomorphic ideas more poorly, or in many cases, incorrectly. The author points out that here too, the romantic landscape theory overwhelmed the data.

Perhaps most of all, this book is a visual lesson about the interwoven set of transitions which created the modern field sciences. Möllhausen was a highly skilled, but amateur, wilderness naturalist. He was a generalist. He was tutored and sponsored at the Prussian court by Baron Alexander von Humboldt himself, and he married the Baron's private secretary's daughter.

The book contains a scholarly 68-page biographical sketch with 239 thoughtful and well researched end notes. It is well written, and wildly interesting reading. It includes numerous hairbreadth escapes from Indian attacks, adventures on dangerous mountain slopes, hunger, thirst, blinding snow, and "searing heat."

Huseman is obviously well prepared for this task. He is the author of a study of Möllhausen's part in the earlier Whipple expedition. He is well versed in the history of the nineteenth century exploration of this region. He has looked at the art and read the publications, letters, and journals of all of the major and most of the minor figures who appear in this tale. He also incorporated small but very important bits of art history and intellectual history into the story of this naturalist adventurer.

There are only a few problems. After his travels Möllhausen went on to write 50 popular novels about the American frontier so that he became known as "The German Fennimore Cooper." These were translated into most of the modern European languages and had a profound effect on European attitudes toward English-speaking North Americans. This was barely mentioned in this book. There is an irritating little problem with the numbers of the figures which are listed as 1a, 1b, 1c, 2a, 2b and so on in the text, but 1A, 1B, 1C, 2A, and so on in the captions.

The author is not an historian of science, and there is little explicit in the text about geology or biology beyond the walls of the canyon. Some readers might think that it would have been valuable to include much more about the exciting changes in the field sciences in the very decade in which these adventures were taking place. However, Huseman is a thorough worker, and though I have not read the manuscripts from which he worked, I firmly believe that he did not cover this material because it was not there.

This book is a beautiful object, a true coffee table item, but it also provides deep visual and personal insights into late romantic natural history exploration and the transition to the modern earth sciences.

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FROM FAUST TO STRANGELOVE. REPRESENTATIONS OF THE SCIENTIST IN WESTERN LITERATURE. *Roslynn D. Haynes. 1994. Johns Hopkins University Press, Baltimore, Maryland and London. 417 pp. Hardcover, $55.00; Softcover, $15.96.*

As all earth scientists know, the popular conception of "the scientist" places us very firmly on the sidelines. Nowadays at least, that conception focuses upon the physicist, with chemists and mathematicians in his umbra and medical men, psychologists and (oddly) engineers somewhere in his penumbra. Only when asked about the status of geologists or biologists would the average citizen admit, rather surprisedly, that yes, they are scientists also.

That was not always the case, as this wide-reaching and fascinating survey shows. During the "explorations" phase of scientific development, in the mid to late 19th century, naturalists and geologists were at the centre of the scientific stage. Their discoveries were, in general, readily understood and discussed excitedly. However, as the years passed, scientists became increasingly conceived as white-coated figures conduct-

ing esoteric investigations in laboratories—investigations whose results were presented in a jargon that was ever less familiar, and, in consequence, ever more forbidding. Since the investigations and results of the biologists and geologists remained generally unthreatening and even comprehensible—well, they couldn't be *real* scientists, could they?

The stages of this transformation, as reflected in contemporary novels or short stories, are laid out clearly in the successive chapters of this work. They make salutary reading for any scientific historian and, if we earth scientists find ourselves less and less in literary view, that is the way of things. In this book's first half, our discipline features quite prominently, not only through the writings of Jules Verne, Sir Arthur Conan Doyle, R. Austin Freeman and H. G. Wells, but also in those of such main-line novelists as Thomas Hardy (pp. 121–122), Philip Gosse (pp. 119–191) and George Gissing (p. 126). In the novels reported in the second half, in contrast, only one earth scientist, a micropalaeontologist (p. 305), figures. (The reference to a crystallographer, on p. 305, is to one of Wells's creations—and a chemist, at that). My own recently published overviews of the representations of geologists in fiction (in *Geology Today,* and in *Useful and Curious Geological Enquiries Beyond the World,* Branagan & McNally, eds. 1994, 1995) may not seem to accord with this view, in that I have noted quite a few other references; but none of these are in works likely to fall within Dr. Haynes's purview and few even approach the high quality of Verne's or Wells's writings.

Since this excellent account of the changing attitudes in literature so clearly mirrors the changing attitudes in society, it should be of great interest—and great concern—to us. True, the generality of geologists—geochemists and geophysicists may be exceptions—are not regarded with particular distrust or hostility by the average man or woman. However, that attitude to scientists in general is affecting us adversely, as the progressive erosion of public funding for earth science in museums, universities and government makes distressingly evident.

Yet many of us earth scientists are warriors in the forefront of the battle for a better environment and most of us, by our researches, are enriching the fund of knowledge of human-kind. As the writings of Stephen Jay Gould and others, and certain of the more inspired radio and television channels, have shown, our discipline is intellectually exciting and can be made so to the average person.

I can only trust that if, twenty years from now, Dr. Haynes publishes an updated version of her study, the new chapters may reflect a more positive literary image of scientists. If that is so, then I suspect that the new literary heroes will be naturalists or biologists, geologists, geographers or palaeontologists or even physicians or astronomers. As for the physicists and chemists, the psychologists and the engineers, I fear that—justly or otherwise—their image has been irredeemably tarnished.

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HOME IS WHERE THE WIND BLOWS. *Fred Hoyle. 1994. University Science Books, Mill Valley, California. 443 p. $32.50.*

In a valedictory editorial when he retired after 22 years as editor, John Maddox took credit in tightening the standards for reviewing manuscripts submitted to *Nature.* Maddox did admit to two exceptions: in one, he decided never to send manuscripts by Fred Hoyle to referees. Presumably, the publication of Hoyle's well-written autobiography, *Home Is Where The Wind Blows,* did not depend on referees either.

The book begins with a Preface by Margaret Burbidge that is a personal biography in under five pages. The autobiography is in three parts: 1915–1939, 1939–1958, and 1959– . It includes nine maps, 24 plates showing a wide range of people and places, and a good index. Part One takes Hoyle from birth to marriage and a Cambridge fellowship, a time interval that has been covered before in *The Small World of Fred Hoyle.* Part Two takes him through the war years, his major scientific work, travels in Europe and America, and time at Caltech. Part Three covers his years as Plumian Professor, a position to which he acceded upon the retirement of Harold Jeffreys and from which he resigned in 1972. The closing date of Part Three is left to the reader's imagination. It might be 1980, because few events in the book are dated after then. It might be 1994, because the book was published then. Perhaps the date may never arrive, and Hoyle's work will represent him into the future. Or perhaps Hoyle means to be around indefinitely in the way that he claims Raphael's Renaissance madonnas can be seen today in the piazzas of Florence.

You can read this book as a narrative that tells the story of how one bright boy from a Yorkshire village came to be Plumian Professor of Astronomy and Experimental Philosophy at Cambridge. It did not happen by accident. The book surely shows the child to be father of the man. Along the way, Hoyle pays tribute to his parents, to teachers, especially Alan Smailes, headmaster of Bingley Grammar School, to selected faculty, especially Eddington and Dirac, and to colleagues at Cambridge and elsewhere. Hoyle tells his side of controversies involving big-bang vs steady-state cosmologies (see especially pp. 409–412) and his work as Director of the Institute of Astronomy (originally, Institute of Theoretical Astronomy). The Director's administrative battles throughout Part Three are the least successful part of the book for the general scientific reader.

Hoyle is best known for his collaboration with Bondi and Gold during the late 1940's in the development

of the steady-state theory of the universe, which (for Hoyle) developed out of his research on the synthesis of heavier elements. However, fifty years later, most cosmologists believe that the big-bang theory (a term coined by Hoyle) is effectively proven, and that the steady-state theory is not correct. Hoyle does not see it this way; he considers the supposed supporting data for the big-bang to be an illusion, and the prevailing opinion of cosmologists to be a form of mass delusion.

To a non-specialist, Hoyle's comments on this hubris are interesting, plausible, and descriptive of what prevails in other, less grand research subjects. Hoyle's first-hand observations on the social nature of scientific thinking should eventually help revise the popular conception of the "scientific method." His present ideas on the steady-state theory, which Hoyle calls the C-field theory, are discussed mainly in the final chapter (pp. 400–408).

Hoyle is a prolific writer on many fundamental topics. This book is concerned more with the itinerary of his scientific life than with the exposition of his science. Whole chapters of his scientific work that he has published elsewhere appear here as general statements in a paragraph or a few pages, without reference to his previous work—the tips of icebergs lurking out of sight on library shelves. This hands-off approach to his own published work is consistent with a principle Hoyle sets out in a peripheral way: "After publishing, . . . an idea must look after itself. It is out in the world, and it must grow up if it can" (p. 243). A Darwinian approach to his intellectual offspring.

Several tips of Hoyle's icebergs protrude from the surface of this book to mark his work on biology and paleontology. In two paragraphs, he mentions his work on the origin of life (p. 395). He does not specifically mention his published hypotheses that life and disease arrived on earth as cosmic dust, or his claim that the *Archaeopteryx* fossil in the British Museum is a fake. He briefly repeats his claim that Darwin was given too much credit for his theory of evolution (p. 272). In his unreferenced work, the implication of impropriety is stronger. It is so difficult to reconcile Hoyle's claims with Darwin's *Correspondence* that Hoyle's statements on Darwin reduce his authority on other subjects. But Hoyle does have a clear claim on our attention for his work on the origin of the heavier elements and their relative abundance in the sun and elsewhere in the universe, a subject fundamental to any understanding of earth history. He credits V. Goldschmidt's geochemical data on the relative abundance of elements as an important source of information.

For historians, the book is particularly of interest for its description of life at Cambridge and for its comments on the scientists Hoyle has known or met. The two men at Cambridge during Hoyle's years who most influenced geology were Jeffreys and Bullard. Hoyle considered Jeffreys a friend, modest to a fault, disinclined to jump to conclusions, although Hoyle regrets that Jeffreys surrendered some attributes of the Plumian professorship, making them unavailable to him when he came into the position. Hoyle uses the stock interpretation of the history of continental drift as a lesson in how scientists fail to recognize truth, without mentioning Jeffreys' lifelong opposition to the idea. We learn that Jeffreys smoked cigarettes from a cigarette holder, but not that he lived to be 98. On the other hand, Hoyle considered Bullard to be a cheerful establishment man, "but I would have run a mile rather than rely on Teddy" (p. 357).

The Cambridge of his student days was home to Rutherford, Chadwick, and Aston. He has known many of the important twentieth century astronomers, including Baade, both Burbidges, Willy Fowler, Hubble, Sandage, Slipher, Struve, and many others. He once locked himself out of Chandrasekhar's quite secure, but otherwise vacant, home, undressed on a cool spring morning in Wisconsin. Batchelor, known for his turbulence research, was a competitor for power in Hoyle's administrative time who "rusted in" to a supposedly rotating chairmanship.

Hoyle comes across in his own words as a very remarkable man, but despite the wide range of his published work, he comes across also as somewhat parochial. It is to be expected from a man who will explain the universe that religion is not beyond his attempting, and Hoyle does that in the closing pages of this book. The chapter is entitled "A Lucky Ending." One comes away with the impression that, lucky for Him, God located most of His twentieth century prophets at Cambridge University, and put the overflow at Caltech.

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JOHN SMITH OF DALRY, GEOLOGIST, ANTIQUARIAN AND NATURAL HISTORIAN. PART 1—GEOLOGY. *Ayrshire Archaeological & Natural History Society. 1993. Ayrshire Monographs no. 16. Ayrshire Archaeological and Natural History Society, Ayr, Scotland. 53 p. Softcover, price not indicated.*

John Smith of Dalry (1846–1930), irreverently known to his contemporaries as "Fossil Johnny," was a prolific contributor to knowledge of the natural history, the prehistoric remains, the landscape and the rocks of his native Ayrshire. There were venturings to other localities in Scotland and England and once, even, to the island of Gotland, Sweden, but his studies had a close regional focus. After some thirty years of employment as a coal pit and ironworks manager, he resigned from the latter position around 1890 so that he might devote his life wholly to his studies; he never married. The researches that were to be considered of greatest importance were on Ayrshire's archaeology; these are the topic of the second monograph on Smith. However, he was also the author of some 67 geological

publications and it is to these that this first slim volume is devoted.

It begins with a brief biography by R.B. Wilson, followed by an over-succinct, but well illustrated, note by W.D. Ian Rolfe on Smith the "self-made scientist." After that, Wilson presents a general overview of Smith's geological work; John E. Pollard discusses Smith's important studies of Devonian and Carboniferous ichnofossils; J.D. Peacock assesses his work on Quaternary deposits and fossils, sensibly placing this into the context of Smith's own time; B. Jackson gives a brief account of Smith's work on Carrick agates; and Jenni Calder gives Smith just praise for leading geological and archaeological excursions for ladies, at a time when they were very definitely "the second sex."

Smith was a distinguished member of that devoted body of amateur scientists who have done such a great deal to enlarge our knowledge of the natural world, present and past—and who still do so. In Scotland, he belongs in the distinguished company of Robert Dick of Thurso, Sir William Jardine of Annandale and Hugh Miller of Cromarty. Certainly Smith deserves to be remembered. My single regret is that this volume does not contain a bibliography of Smith's writings; the list attached to the notice by N. Macgregor (*Trans. geol. Soc. Glasgow* 1941), to which we are referred on p. 29, will be readily accessible only to Scottish readers.

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HUGH MILLER AND THE CONTROVERSIES OF VICTORIAN SCIENCE. *Michael Shortland. 1996. New York: Oxford U. Press, 401p. Hardcover, $90.*

My enthusiasm for geology came early and I was around 12 years old when I first read, with great pleasure, Hugh Miller's *The Old Red Sandstone; or, New Walks in an Old Field.* Originally published in 1841, this was one of the very earliest scientific works to attain 'best-seller' status (and that, despite a rather forbidding title). It was to remain long in print, being one of the very few geological works to be honoured by republication in the Dent and Dutton "Everyman" series. Like most of Miller's books, it has a strong autobiographical component: his most unabashedly autobiographical work, *My Schools and Schoolmasters* (1854) was so much admired that it was not only extracted in anthologies such as *Personal Narratives* in the "Junior Modern English Series" (ed. A.J. Merson, 1931), but even reissued as subject for an essay competition by the Free Church of Scotland's Committee for the Welfare of Youth (1880). Indeed, Miller was the most admired popular scientific writer of his time—and justly so, for he wrote with singular vividness and lucidity.

For my part, I went on to read with pleasure such other of Miller's geological works as I could find; by now, I have them all. Moreover, I was inspired also to read Peter Bayne's *Life and Letters of Hugh Miller* in its two massive volumes (1871). This was a mistake, for it is a singularly tedious work, concentrating on Miller's involvement in Scotland's religious controversies (through his long editorship of the Edinburgh newspaper *The Witness*) and written in an irredeemably turgid style: only the quotations from Miller's own writings enliven it. For me, that work so exactly exemplifies the worst in biographical writings that I have come to characterize all tediously written lives as "bayneful!"

Before and since that time, there have been a plethora of shorter biographies of Miller, of varying quality and interest. Four of these—by T.N. Brown (1858), W. Bingham (1859), J.L. Watson (1880) and W.K. Leask (1896)—are in considerable measure adulatory, stressing Miller's attainments in rising from humble stonemason to distinguished Scot; W.M. Mackenzie's "critical study" (1905) is, despite its title, also to be ranked among these. After that, with the progressive fading of the Victorian respect for the virtues of what Samuel Smiles called "self-help" and an easing of the tensions in the Scottish kirk, interest in Miller declined except in his native Cromarty, where he has remained a revered figure and where his cottage is preserved. (C.D. Waterston's brief biography was written for the National Trust of Scotland and placed on sale there).

By including Hugh Miller among their "giants of geology" (1952), the Fentons paid tribute to his past status; nevertheless, the tide of renewed interest in him has only risen slowly. Richard Dorson published two studies of Miller's work in folklore (1957, 1968); his literary productions were examined briefly by J. Lawrie (1966); George Rosie (1981) presented a selection of his writings, presaged by a succinct biography; and Michael Shortland (1995) usefully edited for publication the lengthy autobiographical letters that Miller had addressed to Principal Baird, a franker document than the later *My Schools and Schoolmasters.* However, the thorough biography which Miller merits has yet to be written.

The work here reviewed does not pretend to fill that void; it is certainly not the "full and rounded portrait" of Hugh Miller that the flyleaf of the dustjacket proclaims it to be. Instead, it is a series of examinations of aspects of that highly talented, extremely industrious and emotionally complicated Scot, casting flashlights upon him from a variety of directions without ever clearly illuminating him.

In his introduction, Michael Shortland reports ruefully how he began, in Edinburgh, a quest for Miller's lost papers and tracked them to Australia, then lost the trace—only to learn, after emigrating to Australia himself, that the papers had travelled back to Edinburgh and were shelved "less than a foot" from where he had begun the quest for them! (p. 2) Any scientific historian will comprehend Shortland's sense of frus-

tration upon making such a discovery and most of us will concur with him that

> . . . neither Miller's life nor anyone else's has ever been as vapidly simple and linear as nineteenth-century biographers imply. Paradox and tension are ever-present, complicating and breaking up narrative neatness. This is not to deny that such neatness was the Victorians' ambition, nor that 'self-improvement' played a significant role in Miller's life. The challenge, as Vincent shows, is to understand this role by examining how Miller fashioned the notion of 'self-improvement', and how his experiences of schooling, labouring, geologizing and writing helped to create a culture in which self-improvement was a commending moral virtue. The challenge is to explain how Miller's life and life story (not necessarily interchangeable) served in the transmission of the ideals of self-improvement to varying audiences. (p. 9)

Basic to any biographical study of Miller must be his partial autobiography *My Schools and Schoolmasters.* This is considered in several contributions, but in particular by David Vincent and David Robb. Though it was certainly based upon that letter to Principal Baird of Edinburgh University—Miller always retained copies of the letters he wrote—Robb is surely right when he suggests that it was published as a response to Thomas Mulock's splenetic criticisms of Miller's views on Scottish education.

The general quality of Miller's writings, and their contribution to the rise of literary natural history, are assessed by James Paradis. He criticizes many of Miller's judgements but concludes justly by writing that, to this day, ". . . Miller's work has retained its unparalleled aesthetic and intellectual vigour" (p. 145).

Miller's religious beliefs, and his involvement in the controversies that divided the Scottish church of his time, are examined by John Hedley Brooke and Donald Macleod. The relation of his beliefs to his palaeontological writings are discussed by John Henry, who takes a kindly view of Miller's social attitudes in the context of their time, concluding that:

> Miller's reading of the rocks was a testimony not just to the existence of God but to the nature of his Providence. It was a proof of the truth of voluntaristic theology, which for Miller was bound up with a particular approach to the problem of evil, and that in turn to the correct way of dealing with the social problems of Victorian Britain. (p. 167)

Hugh Miller's achievements in recording Cromarty's folk heritage are assessed coolly, but on the whole approvingly, by David Alston, who recognizes that:

> The strength of Miller's story telling lies in his capacity for visualization and ability to convey his vision to the reader. . . . This high degree of realism . . . gives strength to his geological (and cosmological) writing and description of the natural world. (p. 225)

In contrast, David Oldroyd's assessment of Hugh Miller's geological work casts doubt upon his status as a "giant of geology." Oldroyd notes that Miller considered Cromarty an epitome of the globe and "Always saw the geology of Scotland through spectacles furnished by his detailed local knowledge" (p. 76). At first this was a benefit, but it became less so as Miller sought to grapple with larger concepts. Oldroyd concludes:

> Apart from his palaeontological work, especially his ichthyological researches, I do not think Miller made any important contributions to the progress of geology. That he loved the subject is unquestionable. That he had a profound knowledge of the geological literature of his day, especially in relation to Scotland, is undoubted. That he was an immensely successful lecturer, writer, and popularizer of his science is certain. That he was an inspiration to the young [Archibald] Geikie I do not doubt.
>
> But Miller was fundamentally a writer and journalist. . . . Geology must have been squeezed into his schedule with the greatest difficulty; and although he would probably have wished to give more time to his science, it seems to me that church politics must necessarily have occupied more of his thought than did geology. On the other hand, Miller's great effort to reconcile his science and his religion did surely occupy much of his time in his latter years, and just possibly contributed to his psychiatric problems. . . . (p. 110)

The question as to the nature of those problems is intrinsic to the understanding of Miller's talented, but too often tortured personality. I am not sure that I can wholly accept Shortland's analysis, in his paper "Bonneted mechanic and narrative hero." Yes, Shortland makes a good case for considering that Miller, in his dress, his posings for photographs, and his public performance of feats of physical strength, was deliberately "self-modelling," deliberately colouring his own image in presenting himself to public view. I am less convinced, though, that Miller's aim was a desperate, lifelong attempt to assert his masculinity, continually tempted by frantic fears of its loss that eventually overwhelmed him and drove him into madness. It seems to me much too simplistic—and Miller was not a simple, but a very complex person.

Overwork, then? Was that Miller's problem? In a later contribution, Shortland furnishes a valuable list of Hugh Miller's writings in *The Witness,* estimating that he wrote an average of 10,000 words each week and, over sixteen years, around 10 million (p. 27–28, 295). Such an endeavour is indeed potentially exhausting: indeed, Roy Porter's consideration of "Miller's madness" appears to endorse the longstanding view that his suicide was basically a consequence of mental overload, though with other contributing factors derived from a myth-ridden childhood and subsequent mental wrestlings with problems of religion and guilt. Yet, though noting that the doctors consulting Miller's post-mortem discovered "diseased appearances . . . in the brain" (p. 268), Porter scouts the idea of tertiary syphilis as a possible cause, with the brusque comment that "no-one was likely to tar Miller with that particular brush" (p. 269).

However, I am left wondering. Yes, it is evident that Hugh Miller was passionately in love with his wife Lydia, to whom he paid poignant tribute in his suicide note (quoted on p. 44 and elsewhere). Yet many a husband, albeit essentially faithful, has strayed briefly from the path of marital virtue and has been left with cause to regret that straying. If Shortland's interpreta-

tion of Miller's motivations is correct, such a straying might well even be an attempt to demonstrate to himself his masculinity—and might have so troubled his conscience as to have caused his suicide, as its consequences became apparent. It is a question which surely deserves more extensive consideration than Miller's Victorian biographers would have dared to give it. I regret that Porter, in these more liberated times, did not choose to do so.

This book, then, is well worth reading for the fresh lights that it sheds on Miller and for the excellently chosen illustrations, which include the most extensive series of portraits of Hugh Miller yet published. The text is attractively set and has been quite thoroughly checked; I noted only seven undetected misprints, though three of these—the omission of a noun on p. 82 and of the word "not" on p. 93, plus the date given for the portrait of Miller in the caption to Plate 9 (1908, almost fifty years after his death!)—are somewhat crucial!

However, though much of Miller's life and character is illuminated, much else is left dark. Miller's sense of humour is touched on only incidentally (and only by Paradis), but it leavens the bread of many passages that might otherwise have been dully descriptive. (An example is the delightfully lighthearted description of fossil footprints in Warwick Museum in *First Impressions,* p. 190–191). Too little is said of Miller's relationship with Lydia and nothing at all about their son, also named Hugh and destined not only to be a professional geologist, but also the author of what is arguably the first work of geological fiction (Sarjeant, 1994 Geology in fiction. *In* D.F. Branagan and G.H. McNally, eds., *Useful and Curious Geological Enquiries Beyond the World. Pacifi-Asia Historical Themes.*). Though some of Miller's books gain extended treatment, others receive minimal mention; in particular, *First Impressions of England and Its People* (1847) and *The Cruise of the Betsey* (1858), which I would rank among Miller's best writings.

Yet this work sets Miller's attainments more firmly into context, and assesses his concepts more extensively and critically, than has been attempted hitherto. When that definitive biography is written, its author will surely profit from his perusal of these varied writings.

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INTERESTING PUBLICATIONS

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 members 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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ANNOUNCEMENTS

SSSA COUNCIL'S NEW NAME

The Soil Science Society of America's Council on the History of Soil Science has been renamed the Council on the History, Philosophy and Sociology of Soil Science. The name now parallels that of the International Soil Society committee which has similar interests and objectives. The new name more accurately reflects the mission of the Council which is not only to inform the membership about the history of soil science but also to promote the understanding of the multi-dimensional forces that have shaped the science. These forces include social, philosophical, political, governmental, religious, educational, and economic dimensions. The Council is also interested in the human side of our science: the why as much as the what and how.

We invite the membership to submit research papers on these aspects of soil science for publication in the *Soil Science Society of America Journal.* An excellent example of the type of paper the Council would like to see published is the article by Ron Amundson and Dan Yaalon on E. W. Hilgard in Volume 59, No. 1 of the *Journal.* For more information, please contact:

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KUDOS

During the current year founding editor Gerald M. Friedman, Distinguished Professor of Geology at Brooklyn College and Graduate School of the City University of New York, was elected an honorary Fellow of the Geological Society (of London, England), was given the Russian Academy of Natural Sciences Kapitsa Gold Medal of Honor, received the AAPG's Distinguished-Educator Award, and will be awarded the Twenhofel Medal by the Society of Sedimentary Geology in April 1997.

50TH ANNIVERSARY, G.S.C.

The final countdown to Ottawa '97 has begun! Geoscientists from all over the world will be gathering in Ottawa to hear about the latest research in geoscience and to celebrate the 50th anniversary of the Geological Association of Canada.

Our new Web site address:

http://www.emr.ca/~ottawa97

I will be sending out more information about the scientific program as it becomes available. If you have any questions about the event, please give me a call.

Christy Vodden
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CALL FOR PAPERS

HISTORICAL INVESTIGATIONS OF CENTRAL AND SOUTHERN APPALACHIAN GEOLOGY

A Symposium by the History of Geology Division, Geological Society of America, Southeast Section Annual Meeting, Charleston, West Virginia, April 1998.

We are making plans for this symposium to be held as part of the SE-GSA meeting in Charleston, West Virgina. The subject matter is open to almost anything concerning historical aspects of early geologists and geology in the Appalachian Mountains that contributed to our present understanding. For example, the Rogers brothers, Dana, Butts, White, State Surveys, mountain-building theories, stratigraphy, structure, geomorphology, mineral resources, paleontology, or geophysics.

This symposium is tentatively scheduled as a half-day session, allowing approximately 20 minutes per speaker. If there is enough positive response from interested speakers to also prepare their talk as a full length manuscript, we may be able to publish the symposium papers as a GSA Special Paper. Your reply concerning interest in presenting a talk and whether a full length paper is a possibility would be appreciated.

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