BOOK REVIEWS

Gretchen Luepke Bynum, Book Review Editor

HISTORICAL ESSAYS ON METEOROLOGY, 1919–1995: THE DIAMOND ANNIVERSARY HISTORY VOLUME OF THE AMERICAN METEOROLOGICAL SOCIETY. James Rodger Fleming, editor. 1996. American Meteorological Society. 617 p. Hardcover, $60 list/$25 AMS members.

The unifying subject of this book is major events in meteorology in the twentieth century. The editor, James Rodger Fleming, has brought together over twenty essays, thematically aimed at a broad range of major developments in atmospheric science. A few are overtly American: Warren M. Washington's sketch of the history of the American Meteorological Society, James F. W. Purdon and W. Paul Menzel on the U.S. satellite program, Roy Leep's examination of the role of the AMS in the development of televised meteorology, William A. Koelsch on meteorology in American universities, and David D. Houghton on meteorological education generally in the U.S. But the other fifteen base their analyses on research programs and problems, disciplines, and institutions. Fleming lays out for the reader a wide variety of developments in atmospheric sciences, a range of issues and topics not, until now, paid much heed in the history of science.

Several of the essays concern individuals and episodes well known in the history of meteorology. In Edward N. Lorenz's lead essay, Vilhelm Bjerknes, Bernhard Haurwitz, and Carl-Gustav Rossby launch a detailed examination of the development of dynamic meteorology. Lorenz traces the evolution of this research into "two species, . . . along with their subspecies, . . . distinguished from one another by their methodology rather than by the particular meteorological problems they aim to solve." (p. 11). This focus on research methods is critical in understanding the geosciences in the twentieth century. Several essays return to the themes of numerical prediction, calculation methods, and the roles of computers and other new technologies. George P. Cressman discusses numerical weather prediction, Frederik Nebeker takes a broad view of calculation devices, and R. R. Rogers and P. L. Smith relate at length the use of radar in meteorology from 1940 on.

Several essays review areas of meteorological research tightly connected with physics and geophysics. E. Philip Kreider's discussion of lightning research is a more concise and complete review of the topic than this reviewer has seen (including one of his own!). Similarly, the treatments of hydrology by Edwin T. Engman, of climatology by John E. Kutzbach, and of applied climatology by Stanley A. Changnon provide useful starting points for scholars unfamiliar with developments in these fields in the twentieth century. Not to be neglected are essays on clouds, hurricanes, and storms.

Fleming and collaborator Simone L. Kaplan assembled a section of particular utility, an annotated bibliography of works on the history of the atmospheric sciences. Readers who wish to go beyond the essays in Fleming's volume will be thankful for this roadmap. Julie A. Burba's "Historical Photo Gallery," which begins with a humorous snapshot of Jule Charney with his own camera in hand, lends a light and human touch to the volume. Lastly, the closing section of "Notes on Contributors" makes it clear that most of the authors came by their intimate knowledge of this history by living it.

In his introduction, Fleming expresses the hope that this volume should present the "latest word" on the aspects of the history of the atmospheric sciences it considers. Now, even several years after the volume appeared, one can safely assert that this book stands as an essential starting point for any scholar venturing into this neglected area of the history of the geosciences. Fleming is to be commended for an exemplary book and for bringing together this stellar collection of reflections on the formative century of atmospheric science.

Gregory A. Good, History Department, West Virginia University, PO Box 6303, Morgantown, WV 26506; Greg.Good@mail.wvu.edu

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GLOBES AT GREENWICH: A CATALOGUE OF THE GLOBES AND ARMILLARY SPHERES AT THE NATIONAL MARITIME MUSEUM, GREENWICH. Elly Dekker, Silke Ackermann, Jonathan Betts, Maria Blyzinsky, Gloria Clifton, Ann Leane, and Kristen Lippincott. 1999. Oxford University Press, Oxford, U.K. 592 p. Hardcover, US$160.00.

Globes at Greenwich is a large-format book of nearly 600 pages that describes the collection of over three hundred globes at the National Maritime Museum in Greenwich, England. The National Maritime Museum globe collection represents several centuries of global maritime power and, to my knowledge, has the largest globe collection in the world. This delightful book is for those who seek a unique historical experience in the literature of globes. It is a book for the educated layperson as well as the professional, and should be part of the reference collection of both public and college libraries.

The book is divided into two parts. Part One, "Globes and Spheres," explains globes in general, as they were developed and used through history. Part One contains nine chapters: 1) The phenomena: An introduction to globes and spheres; 2) The history of the collection; 3) The construction and conservation of globes; 4) The navigator's globe; 5) Globe making in the British Isles; 6) Clockwork globes; 7) The Demongenet tradition in globe making; 8) Globes in art: problems of interpretation and representation; and 9) Uncommonly handsome globes.

Part Two—The Catalogue (the larger part)—is a chronological and typological description of the individual globes in the collection. The Catalogue is divided into four chapters, two appendices, and a index. The chapters are entitled: 1) Armillary spheres, 2) Islamic globes, 3) Western manuscript globes, and 4) Western printed globes and planispheres. The catalogue is organized in a chronological framework, as globes evolved from the simple to the complex and a typological framework, which explains the different types of globes. The authors define "manuscript globes" as engraved metal globes that are not scientific instruments but decorative items for the rich.

Globes today are used primarily as sources of geographic information, much as we use a reference book or an atlas. Up until a couple of hundred years ago, most information gathered from globes was used to explain time and time-related events. These "interactive" globes were used to explain and help determine the time of day, changing of the seasons, etc. The descriptions of the "interactive" globes in this book reflect the historical, art-history, philosophy, metaphysical characteristics, and the known geography of the world at the time the globes were constructed. In the chapter entitled, "Uncommonly handsome globes," the reader gains an understanding not only of the importance of the globe collection, but also the beauty of individual globes and the superb craftsmanship exhibited in metal, wood, and paper. Globes that represented, explained, and interpreted the new geography brought on by the age of exploration replaced interactive globes.

The change from the 'interactive' globe to the modern globe was dramatic—as dramatic as the new geography brought on by the age of exploration. During the 1400s the first western terrestrial globes appeared. Gerard Mercator's globes were the dominant globes in use until the late 1500s, and his ideas had a great influence on later globe production.

In the chapter entitled "The Navigator's Globe," the use of globes for both celestial and terrestrial navigation is explored. Terrestrial globes produced in non-seafaring nations were different than those produced in seafaring nations. Terrestrial globes produced in seafaring nations included marine data such as loxodrome or rhumb lines. For several centuries mariners used celestial globes to identify and locate stars. The angular distance between any star (such as the Sun) and the Moon was measured and used with tables published in the *Nautical Almanac* to determine longitude. The use of celestial globes started to decline with the invention of the marine chronometer. From 1500 to 1600, the principal use of celestial globes was for astrological purposes. The use of celestial planispheres has replaced the celestial globe. One question remains, however: why is there no known example of an Islamic terrestrial globe?

As discussed in the chapter "Globe Making in the British Isles," the history of globe production began during the age of exploration and followed the evolving ocean-going trade. The growth of newspapers helped foster an interest in science among the general population, which in turn increased the demand for more sophisticated and artistic globes. This included the pocket globe produced in the 1700s for the education and amusement of young ladies and gentlemen. The recent evolution of terrestrial globes reflects the growth of the public school system.

Most clockwork globes are celestial because the globe that represents the Earth revolves in relation to a celestial reference point. The clockwork gives motion to the celestial globe to represent the sky. The mechanism was used to relate the planets and stars to the rotating Earth. An excellent illustration of a celestial globe and its expanded clockworks is on pages 61–62.

"Globes in Art," the chapter dealing with the globe as an icon, points out that the image or icon of the terrestrial globe was, and is, generally thought of as positive, all-embracing, all-pervading, and known. However, in the Middle Ages, Christian beliefs replaced this modern view with one of decay and change: the Earth is sub-lunar and is far away from heaven. The icon of the Earth or globe represented the unknown, the corruptibility of man. Fine-art globes can rarely be attributed to a particular globe maker.

The authors have done a masterful job in using photography to explain their interpretation of the globes. Globe details such as cartouches, celestial, and terrestrial elements, were much more easily understood through the use of photography. The authors were very considerate in not expecting the reader to have a background in Latin. The explanation of the Latin that appears on the globes allows every map/globe enthusiast to enjoy this book. The only item that tripped up this reviewer was inconsistent use of English/metric units in describing the size of the individual globes. It would have been better to give both the English and the metric units all of the time.

This is altogether a fine volume, breathing visual life into this too often neglected aspect of cartography. The book is well written, with excellent illustrations, figures, and tables, and is a celebration of the enormous amount of insight and information that can be gained when a multidisciplinary approach focuses on globes. It is a pleasure to read and sets the standard for books on globes for years to come. It is a work of which authors and editors may be justifiably proud. This book belongs in the library of any one who enjoys globes.

Tau Rho Alpha, Research Cartographer (retired), U. S. Geological Survey, 558 Jackson Drive., Palo Alto, California 94303; tralpha@aol.com

GEOMAGNETISM (RESEARCH: PAST AND PRESENT). Wilfried Schröder, editor, 2000. Science Edition /IDCH-IAGA, Darmstadt Germany. 248 p. Softcover, $30.00.

This book contains a selection of papers from a symposium on the History of Geophysics at the IAGA (International Association of Geomagnetism and Aeronomy) Assembly held in Birmingham, UK, August 1999. Included are introductory remarks by H. Moritz, followed by thirteen papers authored by twenty prominent researchers in the field of geomagnetism. Because I cannot do justice to all in the space allotted, I will focus on a few items, attempting to give a flavor of the overall publication. Although most of my career has been involved with research in paleomagnetism, this volume is of interest to me because the history of geomagnetism is, of course, a significant part of the history of my chosen discipline.

Early studies in geomagnetism, for obvious reasons, focused on its application to navigation. Although the basic magnetic properties of lodestone were known in ancient China and Greece, magnetic compasses were used for navigation for hundreds of years before there was any understanding of magnetism as something other than a mysterious force of nature. The compass needle was once thought to indicate the direction toward the north, or pole, star. Others considered the deviation of the needle to be due to the attraction of landmasses or to buried deposits of lodestone. Early seafarers were even subject to severe punishment if found with garlic or onion on their breath because of a fear that the odor could demagnetize a ship's compass!

In the lead article, "Geomagnetism and Fundamental Science," G. P. Gregori takes us on a whirlwind historical tour from the time of the first magnetic charts of the early 1500s to Gilbert's publication of *De Magnete* (1600), where he showed that the magnetic field is essentially that which would be produced if the Earth were itself a uniformly magnetized sphere. This revelation made it obvious that the deviation of a compass needle could not be caused by the pole star. The first published isogonic chart as constructed by Halley is then discussed, as is the discovery of secular variation (Gunter in 1624) and westward drift (Gellibrand in 1635) of the magnetic field—all leading up to the publication in 1686 of Newton's *Principia Mathematica.* With this new theory, it became evident that gravity, not magnetism, was the force that controlled celestial motions. The chronicle continues with Ampère's (1820) proof that magnetic and electrical fields are related, Gauss assuming the responsibility of developing the magnetic observatories in 1834, and on to modern studies of the origin of the geodynamo.

The articles by M. Mandea, "French Magnetic Observation and Theory at the Time of *De Magnete,*" and P. Ultré-Guéard and M. Mandea, "Declination and Longitude in France in the Early 17th Century," discuss observational measurements of the field and the problem of determining longitude. Among the important items noted here are Nautonier's realization (~1602–1604) that the dipole field is tilted with respect to the Earth's rotational axis, and the completion of the Paris Observatory in 1670. With the latter, the first systematic program for measuring the geomagnetic field was initiated and has continued to the present. D. R. Barraclough follows with an excellent summary of the subject in "Four Hundred Years of Geomagnetic Field Charting and Modelling." He includes some fundamental discoveries in geomagnetism and provides a succinct description of geomagnetic field models—including the first "modern" mathematical model, which was produced by Gauss in 1839.

Since the early emphasis on its navigational aspects, geomagnetism has turned

more toward fundamental research into the Earth's interior and the near-space environment. The articles "Edmond Halley and the Earth's Magnetic Field" by A. Cook and "Edmond Halley's Voyages in the *Paramore* and the First Isogonic Chart of the Earth's Magnetic Field" by T. D. G. Clark were particularly interesting to me, because Halley apparently was among the first to bridge the gap between the two aspects of geomagnetism. He recognized a need for and set up expeditions to collect observational data, and he also published the first charts of equal magnetic declination for the entire Atlantic Ocean. He later foresaw that the magnetic field must have its origin in the Earth's interior and recognized the problem of geomagnetic secular variation. He also realized that there was a connection between the Earth's field and the aurora. Although many know Halley for his work in astronomy (i.e., Halley's comet), Cook also reminds us that Halley, as Clerk of the Royal Society, prompted Newton to begin writing his *Principia Mathematica* and saw to its eventual publication.

Those interested in near-space environment will find several articles of interest. O. Beckman, in "A Magnetic Storm—Simultaneously Registered at Two Sites in 1741," recounts the observation by Celsius and Hiorter of the connection between a sudden displacement of a magnetic needle and the appearance of an aurora. H. Yoshida describes Tanakadate's research on electrical currents between the Earth's surface and the atmosphere in "A. Tanakadate and His Study on Vertical Currents." A. Àdàm, P. Benze, and J. Verö describe the establishment of the Nagycenk Observatory ("The Nagycenk Observatory and Its Long Data Series") in 1957 and its recording of the Earth's electromagnetic field. H. and K.-H. Bernhardt briefly describe the career of Julius Bartels in "Remarks on Life and Scientific Work of Julius Bartels (1899–1964)." Finally, M. Colacino, O. Ferrante, and M. R. Valensise comment on the ill-fated scientific expedition of the airship *Italia* in "The Unpublished Correspondence Between Nobile and Eredia for the Preparation of the 1928 Polar Expedition."

It is important to remember that much of the highly significant early research in geomagnetism was occurring at a time when scientific inquiry was not always well received. G. Scalera uses case studies in "Religious Dogma and Earth Sciences at the Turning Point of the Renaissance" to examine the reaction to certain scientific ideas and why they might have differed. Finally, G. P. and L. G. Gregori provide a perspective on "Archaeoastronomy (An Updating) and Anthropological Aspects of Architecture." The authors introduce the term "anthropological architecture" to convey the idea that early civilizations used the design, plan, and orientation of buildings and monuments for the management of time and space (for example, seasonal measurement and geographical orientation, among others).

In any collection of papers such as this, the focus of each is on certain aspects of the history of geomagnetism from the viewpoint of the different authors. Many, however, refer to some degree to earlier and/or related studies, so a coherent picture eventually emerges. Extensive reference lists can be found in the papers presented, and readers wanting to pursue subjects in greater depth can easily do so. Scattered throughout the volume are a few sketches, maps, and notes (thankfully translated) from some of the early researchers that I found quite interesting. Because the book is in paperback and is a reproduction of articles submitted by many authors, it is not uniform in typeface or style of presentation. However, this does not detract greatly from the content; this method of publishing should put the price of the volume well within reach of a broad audience, who should enjoy reading it, as have I.

Ed Mankinen, U. S. Geological Survey, 345 Middlefield Road, Menlo Park, California 94025

THE ICE FINDERS: HOW A POET, A PROFESSOR, AND A POLITICIAN DISCOVERED THE ICE AGE. Edmund Blair Bolles. 1999. Counterpoint, Washington, D.C. 257 p. Hardcover, $24.00.

The Ice Finders by Edmund Blair Bolles is a fascinating small book that reads like an adventure novel. At times I could not put it down but had to keep reading the exciting account of ice age discovery. The book is built around three men. Elisha Kent Kane represents the heroic poet, Louis Agassiz is the learned professor, and Charles Lyell is portrayed as the master politician. Bolles emphasizes that all three key people in this discovery of the ice age began by being wrong, but "being wrong, even in science, turns out to be a not-so-terrible way to begin" (p. 29). According to Bolles, these three men "changed our understanding of the earth's history, climate, and role of ice on earth" (p. 15).

The roles of Agassiz and Lyell are well known for history of geology. Agassiz is generally regarded as the father of the glacial theory, while Lyell's impact came through his series of influential geology textbooks. Bolles describes Agassiz's conversion to the glacial theory in the conventional manner based on the "glacial triangle" –Jean-Pierre Perraudin, Ignatz Venetz, and Jean de Charpentier—who convinced Agassiz in 1836 in the field. Agassiz quickly brought on his old schoolmate, Karl Schimper. Both were hugely enthusiastic about their new understanding of past glaciation, and Schimper coined the concept of a great ice age in his poem "Die Eiszeit."

Agassiz converted William Buckland to the glacial theory in Scotland in 1840, and Buckland in turn convinced Lyell of the former glaciation of Scotland. This major accomplishment was combined with Agassiz's publication of *Études sur les glaciers* (1840), which for many scholars marks the general scientific acceptance of the glacial theory. However, the so-called glacial theory existed at several different levels for various scientists in the 1840–1850s. Some believed only in limited expansion of glaciers, while others had more radical ideas. The notion of glacial seas filled with drifting icebergs persisted also and proved to be at least partly correct for some regions.

Agassiz promoted the most radical version of the glacial theory, in which ice sheets had spread from the North Pole to the Mediterranean and caused extinction of all pre-existing life. Furthermore he became involved in controversies with others—Schimper, Charpentier, and Scottish glaciologist James David Forbes—over claims of priority of discoveries. His continued support for a glacial catastrophe in earth history gradually lost him the respect of other scientists, although he remained highly popular with the public in Europe and North America.

Kane's Arctic career began as a navy medical doctor on the exploratory team sent in 1850 to search for the lost ship and crew of the Franklin expedition. As a result of this and earlier exploits he became quite a celebrity; he went on a speaking tour to drum up support for another Arctic expedition in search of Franklin. In 1853, he sailed off to find Franklin plus an ice-free passage to the North Pole. What he found, of course, was ice-clogged seas and immense glaciers along the coast of northwestern Greenland. That he survived through two polar winters and returned in 1855 to tell his tale is a near miracle and testament to his leadership under adverse conditions. What he told the public was dramatic proof that huge glaciers emerge from the inland ice of northern Greenland. Kane's book, *Arctic Explorations in the Years 1853, '54, '55* (1856), became a best seller which popularized the icescapes and harsh climate of the far north; however, he never recovered physically from the Arctic ordeal and died in 1857.

Lyell, whose support for the glacial theory had waned since 1840, was reborn

in complete acceptance of the power of former glaciation in Switzerland, Scotland, and elsewhere. However, unlike Agassiz, Lyell believed glaciers to be part of the uniform operation of past and present processes on the Earth's surface. The importance of Greenland as a modern-day analog for past glaciation was emphasized in his book, *The Geological Evidences of the Antiquity of Man* (1863), in which he also acknowledged the ancient origin of man. Agassiz, on the other hand, did not waver from his position that a great ice age was the latest catastrophe in earth history. He mounted an expedition in 1865–1866 to Brazil in hopes of proving that ice sheets had extended into the tropics. His contention that the Amazon basin had been glaciated astounded other scientists, who discounted the idea, but Agassiz furnished little actual proof. His reputation was effectively ruined.

Bolles's primary thesis is that the glacial theory remained controversial and was accepted by few until Kane's dramatic descriptions of northern Greenland provided the poetic proof of vast glaciers. According to Bolles, Kane's crew had "found the Greenland ice sheet . . . It was an ocean of ice, a mass 400 feet high at its border that covered Greenland from end to end and from east to west" (p. 62). Kane may have provided the imagery of glaciated Greenland, but he certainly did not discover nor prove the existence of the Greenland ice sheet. In fact, the interior of Greenland was so little known that in the 1870s the notion of an ice-free oasis in central Greenland was still considered quite possible. It was not until Fridtjof Nansen succeeded in crossing the ice sheet in 1888 that its true existence was confirmed to the world.

The book is structured in a time line that jumps between Kane, Agassiz, and Lyell. This makes for interesting reading and is an effective approach. However, mixing Kane's exploits in the 1850s with episodes for Agassiz and Lyell in the 1830–1840s tends to confuse the true historical relationship of events. Bolles's focus on Kane, Lyell, and Agassiz also leaves out important Scandinavian contributions to the glacial theory, but only so much is possible in a relatively short book. A few sketch maps are included, but without scale bars or latitude-longitude grid. More and better maps of key regions and localities would be useful. In spite of these few reservations, I can warmly recommend the book. It's delightful to read and would be especially useful as an introduction for students or courses dealing with the history of glacial concepts. In fact, I plan to adopt it for my course on ice age environments (http://academic.emporia.edu/aberjame/ice/).

James S. Aber, Earth Science, Emporia State University, Emporia, KS 66801; aberjame@emporia.edu

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AURORA IN TIME (DAS POLARLICHT). Wilfried Schröder. 2000. Science Edition /IDCH-IAGA, Darmstadt, Germany. 156 p. Softcover, $20.00.

The investigation of the aurora has certainly been as complicated a process as the physical phenomenon itself. Many well known researchers have spent time and effort to explain the atmospheric glow, which is visible in the polar regions of the Earth. In history, the aurora has been an important object of geophysical and astrophysical research, because it is close enough to the observer compared to plasma processes within the solar system, but also too far away for a direct measurement of physical properties. It has long been a challenge to explain this irregular, unexpected, and unpredictable phenomenon.

The author, Wilfried Schröder, describes these efforts and puts them into the perspective of the historical periods. He summarizes his major reason for writing this book in his introduction as: "It seems also highly desirable to devote more

effort to historical investigations in meteorology and geophysics in order to elucidate the foundations on which these sciences are based."

Readers should not expect to find many nice, colorful pictures of auroral displays. The number of aurora pictures is very small, all of them are in black and white, and the print quality is generally low. Most of the figures in this book are reproductions of historical documents or photographs/paintings of scientists.

The book is written in German and is essentially chronological in its arrangement. After some very short statements about the nature of the aurora and the motivation for the book, chapter 2 describes the knowledge about the aurora in antiquity and the Middle Ages. All reports from that time were descriptions of the sightings. There was no distinction between comet and aurora sightings, because they were both considered atmospheric phenomena and nobody knew the difference. Their interpretation as magic omens relating to human life, war, plague, and disease reflect the knowledge of the people. Chapter 2.3 summarizes very accurately all known reports of aurora (mixed with comets) in the sixteenth and seventeenth centuries. Thanks to the invention of printing there are several documents, even if they are just reports of sightings and speculations as to their portent.

Chapters 3.1 and 3.2 summarize the aurora research after the Maunder minimum at the end of the seventeenth century. The fortunate coincidence of the sudden re-appearance of the aurora and the improved political and cultural development of the major European nations after the disaster of the Thirty Years War led to major advance in the interest in the phenomenon. Chapter 3.3 shows the major progress in the understanding of the aurora in the nineteenth century based on experiments with magnetic and electric fields. Chapter 3.4 describes how the aurora research became an international effort culminating in the combined efforts of several nations during the first Polar Year 1882/1883. All these chapters are well written, show the relation between certain achievements and subsequent new efforts, and give credit to many important persons in the history of geophysics. Everybody who is interested in the science history of the sixteenth and nineteenth centuries will find many references and interesting details in the historic development of aurora research.

The title of chapter 3.5 (Latest studies of aurora) creates too many expectations. Too many topics are only briefly mentioned and not completely explained, like the meaning of global magnetic indices and the altitude of auroral emissions. Many very important achievements in aurora research are either missing or just briefly mentioned, like the great advances in plasma physics or the very extensive spectroscopic research about the origin, the excitation, and the physical meaning of the different lines of the auroral spectrum. In some ways the reader gets the impression that the author is describing the knowledge of the mid-1960s. Progress in the recent understanding of auroral processes, mostly obtained from satellite and ground-based radar measurements, is not discussed.

The mixture of references and footnotes makes it sometimes difficult to read the text. There are too many unimportant footnotes with just the name of a person, years of birth and death, and a general statement like "Professor of physics". The reader is always distracted by a footnote, because important information is expected. It would have been much better if a summary at the end of the book would have provided all names, dates, professions, and other information about all mentioned persons, and footnotes would have concentrated on additional information about the reason and historical importance of certain theories and discoveries.

Harald U. Frey, Space Sciences Laboratory, University of California, Berkeley, California 94720-7450

THE DIAMOND MAKERS. Robert M. Hazen. 1999. Cambridge University Press, Cambridge, U.K. 244 p. Softcover, $15.95.

There is virtually no way that *The Diamond Makers* could miss being an excellent work of great interest to geologists, mineralogists, gemologists, and science historians as well as the layman who enjoys a good read. It is a new and revised edition of *The New Alchemist: Breaking Through the Barriers of High Pressure* (1994). That work received rave reviews and this should as well.

The Diamond Makers is the story of the struggle to learn how to synthesize diamonds. The pioneers endured innumerable failures, not to mention explosions, and sometimes bitter rivalries. The long quest was eventually successful and scientists slowly pried open Nature's secrets sufficiently to enrich all of our lives. The word "diamond" usually conjures up natural gem diamonds with all of their romance, mystery, and high prices. The goal of the pioneers—the diamond makers—was not primarily concerned with gems but with an incredibly important industrial product. Because of its great hardness (10 on the top of the Mohs hardness scale) it can do many things that no other substance can do or do so well.

This is a fascinating book written by a master storyteller who has thoroughly researched his subject. He has picked a subject that has no end of exciting drama and many fascinating characters. Dr. Hazen not only brings narrative skills that would do credit for a good novelist to bear on his subject, but he is well qualified by his training and career as a research scientist at the Carnegie Institution of Washington's Geophysical Laboratory. He not only knew personally many of the actors in the suspenseful drama of the long road to successful diamond synthesis. Most importantly, he understands what they were doing and why, and has the rare ability to explain it in a manner that those of us without a background in high pressure physics and chemistry can readily understand.

The book is illustrated with decorated covers and many well-chosen black-and-white photographs and diagrams. It is well made and clearly printed on good quality paper. There is a good index and at the end of each chapter, there is a section called "notes" that includes numbered footnotes and bibliography.

There is little to criticize in this excellent work, but we have to take exception to the statement that "diamonds put the brakes on light like no other known colorless substance." (p. 5) It is a good line but ignores the colorless silicon carbide "moissanite," which is currently causing a great deal of concern among jewelers. The refractive index (R. I.) of diamond is high at 2.417, but moissanite has refractive indices of 2.65 and 2.69 according the tenth edition (1990, p. 135) of Basil Anderson's *Gem Testing*.

As a Californian we have to point out that colorless benitoite (which is hexagonal) has dispersions of o = 0.039 and e = 0.046, whereas diamond (isometric) has a dispersion of 0.044, which means that benitoite at least can do as well or better than diamond "in its ability to reveal the rainbow." But this is pure nit picking. The important point is that the work is exceptionally informative, has virtually no detectable errors, and most important is so well written that once started it is virtually impossible to put down.

We hear a great deal in these highly political times about what can and should be done to improve the quality of American education, especially science education. Placing a copy of his book in every high school and junior high library in the county would certainly be a good starting place. The story of diamond

synthesis research is so excitingly told that any lay-person, even relatively young ones, would have a hard time putting it down once started and by the time he or she gets to the last page they will have painlessly picked up a lot of science and, most important, have come to realize that science can be pretty exciting stuff.

Si and Ann Frazier, 6331 Fairmount, #306, El Cerrito, California 94530; siannfraz@aol.com

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N. L. BOWEN AND CRYSTALLIZATION-DIFFERENTIATION: THE EVOLUTION OF A THEORY. Davis A. Young. 1998. Mineralogical Society of America Monograph Series #4, Washington, D.C. 276 p. Softcover, $16/$12 for MSA members.

Davis A. Young has had the privilege to summarize the scientific career of Norman Levi Bowen, the single most influential igneous petrologist of the twentieth century. Bowen championed the role of crystallization-differentiation as the predominant cause of diversity in igneous rocks to such a successful degree that it is hard for us now to appreciate the lack of understanding and the confusion of competing ideas at the beginning of the twentieth century. Anyone with a college degree in geology has been taught something about the granite minimum, the incongruent melting of enstatite, and the albite-anorthite binary melting loop as demonstrations of how crystal-liquid equilibria and separation of early-formed crystals control the compositions of igneous rocks. Bowen, through a series of mineral-melt experimental studies in simplified compositions, was directly responsible for these and numerous other discoveries that underpin the field of igneous petrology.

Professor Young's book, *N. L. Bowen and Crystallization-Differentiation: The Evolution of a Theory,* follows Bowen's career through twenty-four chapters, grouped into six sections. As Young explains, at the beginning of Bowen's scientific life it was seriously entertained that the diversity of igneous rocks resulted from melting of wholly separate, compositionally distinct earth shells, from unmixing of immiscible liquids, from segregation and concentration of molten components within melts due to gravity or to temperature gradients, or from assimilation of diverse, compositionally distinct, country rocks. Bowen was confronted early with the problem of igneous differentiation while mapping mafic sills in Quebec. He sought to apply the newly developing techniques of physical chemistry to better understand igneous processes, and this brought him to the Massachusetts Institute of Technology for his Ph.D., and through there to the Geophysical Laboratory of the Carnegie Institution of Washington. Based on surprisingly few experiments, Bowen showed that separation of early-formed crystals from melt could account for the major compositional differences between common igneous rocks, a process previously hypothesized by Charles Darwin. Separation of crystals from melt could be via gravitational sinking of crystals, by progressive, overgrowth zoning of crystals, or by late squeezing-out of residual liquids from largely crystallized magma bodies.

Bowen wrote well and his ideas spread rapidly among younger scientists, but some of his contemporaries and elders were less receptive. Much of Professor Young's book chronicles disputes between Bowen and his former adviser, Reginald Daly, over liquid immiscibility, with his contemporary at the Geophysical

Laboratory, Clarence Fenner, over assimilation and the importance of iron versus silica and alkali enrichment in residual liquids, with Harry Hess about the unlikelihood of ultramafic liquids, and with Herbert Read over whether granites crystallize from magmas or by the chemical replacement of other rocks. Bowen wins to a greater or lesser degree in all of these disputes, which makes for entertaining reading and carries material that otherwise might be overly technical.

Young also writes well and has researched Bowen's professional life thoroughly. Bowen received some of the highest professional recognition possible within the earth sciences, but died an apparently deeply depressed man in 1956 at age 69. Young suggests Bowen's unhappiness may have been due to poor health, but the book does not cover Bowen's personal life in detail. The omission of personal details is appropriate for a publication of a scientific society, and such details would have overly lengthened the book and detracted from its focus on development of a comprehensive theory of igneous petrogenesis.

The book concludes with a chapter summarizing post-Bowen developments, and this is the only chapter that I found unsatisfying. Having been led through controversies between Bowen and his adversaries, the reader is primed for resolution of the mysteries. Who was right and why? For the dispute over iron versus silica enrichment we are left with a single, dated reference to Osborn (1959) that differences in oxygen fugacity may account for iron versus silica enrichment. Much subsequent and more definitive work has been completed on this subject. We are never given a resolution to the origin of Fenner's often-cited mafic inclusions in Katmai rocks, despite considerable subsequent work at Katmai by Wes Hildreth of the U.S. Geological Survey. The Soret effect, whereby chemical components separate in a liquid due to a thermal gradient, is mentioned as having been proposed for silicic magmas, and investigated experimentally by Walker and Delong (1982), but no reference is made to the comprehensive experiments of Chip Lesher on the Soret effect that showed that the sense of chemical separation is inconsistent with the type of chemical zoning found in silicic magmas. For assimilation, we are told that petrologists believe this to be a local and volumetrically minor process, with no mention that assimilation combined with fractional crystallization is the most widely accepted explanation for the chemical and isotopic zonation of the enormous circum-Pacific, continental-margin batholiths [via the AFC—Assimilation Fractional Crystallization process (DePaolo 1980, 1981)] and the arc volcanic rocks of the Andes [via the MASH—Mixing Assimilation Homogenization process (Hildreth and Moorbath 1988)]. Magma mixing is also discounted despite the comprehensive mineral-chemical evidence presented for it by Sakuyama (1981) for volcanic rocks from Japan, and by numerous other workers elsewhere. This final chapter appears not to have received the close attention of those on Bowen's life and achievements, as it fails to meet the excellent standard established by all those preceding it.

Despite this minor shortcoming, Professor Young's book makes a good summer read for the specialist. More important, it will help those teaching igneous petrology to present Bowen's discoveries in the context of the prevailing wisdom of his time, and by providing details of the controversies he faced and overcame, thus enlivening what are, all too often, dry lectures. Bowen was one of those remarkable individuals who was the right person to arrive at the right place at the right time to achieve great things, as Professor Young's book so clearly demonstrates.

Tom Sisson, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, California 94025

PLANNED INVASION OF JAPAN, 1945: THE SIBERIAN WEATHER ADVANTAGE. H. S. Yoder, Jr. 1997. American Philosophical Society, Philadelphia, Memoirs, v. 223. 161 p. Hardcover, $35.00

The book's title suggests Siberian weather *per se* might be helpful during a military operation. In actuality, this short, highly readable treatise describes the checkered five-month existence of MOKO, a top-secret, U. S. Navy weather expedition to Siberia during the latter half of 1945. Authorized verbally by Premier Stalin at the Potsdam summit conference in late July of that year, MOKO's goal was to establish two Class-A weather stations far to the north of Japan in order to supply accurate weather information prior to Operation Olympic, the massive Allied invasion of Kyushu scheduled for November 1, 1945.

The site of MOKO's main effort (19 officers and 41 enlisted men) was to be near the provincial capital, Khabarovsk, close to the Mongolian border and a large Soviet Army weather central. A secondary effort (8 officers and 24 enlisted men) would simultaneously be posted to Petropavlosk (Kamchatka Peninsula), 1,700 km to the east-northeast. Creation of this latter base was relatively straightforward. On September 6, 1945, a U. S. naval vessel dumped Commander C. J. McGregor's unit, plus tentage and supplies, on a Pacific Ocean beach prior to its moving inland where, with 'Sea Bee' help, a weather facility was built using Quonset huts.

Establishing and operating the larger American weather establishment within a former Russian summer rest camp 36 km away from Khabarovsk was far more complex and frustrating. Soviets, some reticent, some obstructive, were responsible for the unit's housing, food, heat, security, and land communications. Nevertheless, Captain Arthur A. Cumberledge, USN, and his team, by working desperately in spite of a primitive locale and cold weather, transmitted from the now open facility its first six-hourly weather observation to Guam on September 20. Then, as Fleet Weather Central, Khabarovsk, the first regional bulletin was issued on October 15. Both dates, it should be noted, fell within the time frame required for supporting what had become the defunct Operation Olympic.

Lt. Hatten S. Yoder, Jr., USNR, besides performing regular aerological duties, was appointed historian for Expedition MOKO (in Japanese, MOKO means Mongolia). Later on, after demobilization, Yoder became so expert in the behavior of rocks under high temperature and pressure that he became the youngest geologist yet elected to the prestigious National Academy of Sciences. Although a long-term hope was to tell MOKO's story in the clear, 50 years had to pass before security considerations no longer controlled. Then, after interviewing seven fellow participants, including the estimable Captain Arthur A. Cumberledge, USN, and inspecting archival material at the U.S. Naval Meteorology and Oceanography Command, Stennis Space Center, Mississippi, Yoder found MOKO's main events remained "... as clear as if they happened yesterday."

Dr. Yoder's narrative opens with an explanation of why top ranking naval officers, plus President Harry S. Truman, demanded there be reliable and accurate weather data from Siberia to support Operation Olympic, a wintertime amphibious assault twice the size of the prior summertime assault against Normandy. During Lend-Lease negotiations as far back as mid-1941, American military meteorologists vigorously urged their Soviet counterparts to improve drastically the quantity and quality of Asiatic weather reports being exchanged on a regular basis. Some improvement occurred but it was still a sore topic at the Potsdam summit four years later. As a consequence, agreement was reached on August 2nd that the

MOKO expedition could proceed on a top-secret basis so the Japanese would not learn 'neutral' Russia was showing local favoritism to Japan's mortal enemy.

Military orders for MOKO personnel were cut two days later, a set of which came to Lt. Yoder at Floyd Bennett Field, Long Island. By then, he had spent 18 months aboard "baby flattops"—(USS *Baffins* (ACV-35) and USS *Mission Bay* (CVE- 59)—following graduation from the University of Chicago's second class in military meteorology (November 1942). At the Seattle staging area, the Khabarovsk adventurers, six of whom spoke Russian, learned that they, plus 60 tons of gear, would move west beginning August 20, 1945. Transport would be via three, brand-new, R5D aircraft (C-54's in Army Air Force parlance) of Squadron VR-516. Before doing so, however, atomic warfare began on August 6, Soviet forces invaded Japanese-held Manchuria on August 8, and Japan surrendered unconditionally on August 14. Even so, three days later the Soviets advised MOKO was still 'GO'. Participants would wear naval uniforms, but guns and cameras were strictly forbidden.

Upon reaching the interior of the Soviet Union, the expedition found an

> . . . extreme example of how a bureaucracy based on fear can distort the character of an otherwise friendly people . . . When divorced from the bureaucracy they appeared to be more like Americans than other people in the world . . . Their friendly, outgoing, pioneering spirit was matched by their rugged endurance, persistence and hard work.

As for women, even in the massive gangs of political prisoners seen by Yoder doing roadwork at Yakutsk, there was no task that a Russian male could do that a woman could not do as well. Even as the American flight reached the huge Khabarovsk airdrome on August 26, 1945, a returning Russian flight of nearly 100 aircraft (mainly fighters and bombers) from embattled Manchuria appeared to be manned largely by female aircrews.

Unfortunately, six days prior to the Americans' arrival, President Truman canceled the highly favorable Lend-Lease program to the Soviets. Without this incentive, Soviet officialdom, both in Moscow and locally, discouraged the MOKO effort wherever possible. Among the bones of contention were coding of American administrative messages, telephonic land-line censorship in which the monitors would ask the Americans to speak more clearly, and the installation of a radio-jamming facility just outside the cantonment once Navy radio-teletypes began transmitting weather bulletins to the outside world. Life inside the barbed wire was just as complex. A score of Soviet personnel were assigned as cooks, waitresses, fuel stokers, and maids, with the latter apparently in the direct employ of the NKVD. Moreover, by Thanksgiving Day in late November, Russian-supplied fuel and food levels were minimal.

On December 5, 1945, the Red Army Chief of Staff requested, via channels, that the Khabarovsk and Petropavlosk Fleet Weather Centrals cease operation within the next ten days. Accordingly, the latter unit simply sailed away aboard the USS *Sarsi* (ATF-11) two weeks later. Extracting the landlocked Khabarovsk unit was far more complicated as Chief of Naval Operations Ernest King ordered its 80 tons of equipment to be removed as well as personnel. Fortunately, two cases of vodka facilitated moving the gear by rail 650 km south to Vladivostok where the USS *Starr* (AKA-67) evacuated the group (without Lt.(jg) Byron Uskievich's Russian-born, pregnant wife who lacked an exit visa) on January 2, 1946.

As would be expected of a past-president of the History of Earth Sciences Society (1995–1996), Dr. Yoder's book is well indexed and illustrated. Not only is the tome an understated but intriguing story of applied science under stress but it also succinctly documents a touchy facet of Soviet-American relations at the close of World War II. As for another associated touchy issue, whether President

Truman should have proceeded with Operation Olympic rather than dropping atomic bombs, the author and the reviewer agree that ending the war quickly saved far more lives than by having hostilities drag out into the spring of 1946.

Lt. Colonel Charles C. Bates, USAF (Ret.), 136 W. La Pintura, Green Valley, Arizona 85614; bartiebee@aol.com

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RESTLESS GENIUS: ROBERT HOOKE AND HIS EARTHLY THOUGHTS. Ellen Tan Drake. 1996. Oxford University Press, New York. 386 p. Hardcover. US $55.00.

Robert Hooke (1635–1702), like Newton and Darwin, was one of the greatest minds that England has ever produced, but to many, not to mention the public at large, he is an individual hardly known. Only 'Hooke's Law' of elasticity bears his name, yet he was perhaps the most multi-faceted, multi-talented scientific genius of them all. For a variety of reasons, especially the animosity of Newton and his supporters then and now, Hooke's reputation resides today in a limbo of relative obscurity. Ellen Drake has made a major effort to correct this, at least regarding Hooke's 'earthly thoughts' about geology, in this comprehensive memoir published in 1996 by Oxford University Press.

It is divided into two major parts: first as Part I, "Robert Hooke's Life and Work" of 120 pages, divided into nine chapters that are followed by 24 pages of notes and bibliography. A preface and a 4-page general introduction precedes this first section. Drake begins Part I by chronicling the life of Hooke (early years, Oxford days, the Royal Society, *Micrographia,* Hooke's ideas on gravity and celestial mechanics, the great fire and rebuilding of London, Hooke's work with watches, the Cutlerian Lectures, and the last several decades of his life). In a second chapter she again discusses Hooke's early life and the influence of the local geology of the Isle of Wight, his boyhood home, on his geologic thinking. Drake continues, in following chapters, to provide necessary background; first an overview of seventeenth-century theories of the Earth and then a synopsis of Hooke's own theory of the Earth (the Earth in space, the formation of rocks and minerals, the origin of fossils, tectonics, and cyclicity). Additional chapters expand on "Hooke's Concept of Polar Wandering on an Oblate Spheroid Earth," "Hooke's Theory of Evolution and Attitude Toward God and Time," "Plagiarism or Paranoia?" and lastly a "Final Assessment."

Part II, the larger section of the volume, consisting of 207 pages, is Drake's annotated transcription of Hooke's twenty-seven lectures delivered to the Royal Society between 1668 and 1700. Because these materials were not specifically prepared for publication at the time, they are, in the words of Richard Waller, who collected and first presented them in his 1705 *Posthumous Works of Robert Hooke,* not "methodically digested." Drake has transcribed the lectures into modern type, while retaining the spelling, punctuation, capitalization, and font styles (italics or roman) of the Waller edition. In addition, Drake substitutes her own extensive marginal comments for the brief ones provided originally by Waller. As an aid to comprehending Hooke's ideas about geology, in a 4-page introduction to Part II, Drake identifies seven generalizations (propositions) about fossils, eleven concerning the substance of fossils and why they occur where they do, and finally four generalizations about earthquakes.

Earthquakes are only the purported subject of these lectures, however, because the real topic, of course, is the Earth itself, its landscape, and what we now call the rock cycle, with Hooke showing special concern for sediments and their con-

tent. Diastrophic movements are included in his use of the word "earthquake," as well as volcanic activity and the processes of erosion and redeposition. This intent is seen in the full title of the collected talks: "Robert Hooke's Lectures and Discourses on Earthquakes and Subterraneous Eruptions. Explicating The Cause of the Rugged and Uneven Face of the EARTH; and What Reasons may be given for the frequent findings of Shells and other Sea and Land Petrified Substances, scattered over the whole Terrestrial Superficies."

Drake's memoir concludes with two appendices (Waller's notes concerning the last two of Hooke's fossil plates and a list of London monuments and buildings that were designed and built by Hooke), plus a comprehensive 12-page index. Hooke's seven plates that were originally published in 1705 as part of the discourses are included, as well as 61 illustrations appropriate to Part I.

Restless Genius is a major and significant contribution to the literature about, and indeed by, Robert Hooke. In it Drake strives mightily to defend and enhance the reputation of Hooke. Her efforts make Hooke's 'earthly thoughts' about geology not only accessible but also comprehensible to those (even the general reader who may stumble upon them) perplexed by the difficulties engendered by seventeenth-century writing style and an unfamiliar world view, not to mention the controversies due to the feud with Newton. This volume caps Drake's two decades of work on Hooke and is highly recommended, especially for researchers and scholars.

William M. Jordan, Department of Earth Sciences, P.O. Box 1002, Millersville University, Millersville, PA 17551; ljordan@mail.acponline.org.

WOUNDING THE WEST: MONTANA, MINING, AND THE ENVIRONMENT. David Stiller. 2000. University of Nebraska Press, Lincoln and London. 212 p. Hardcover, $25.00.

In the western part of Montana along the upper reaches of the Blackfoot River near the Continental Divide lies an old abandoned mine—the Mike Horse Mine. It dates back to 1898, the year a veteran prospector named Joseph Hartmiller filed two claims—the Hog All and the Mike Horse—on forty-plus acres of land surrounding a silver vein that, according to Hartmiller, his horse, Old Mike, had stumbled across. Hartmiller had been looking for gold, but he was not one to look a horse's gift in the mouth. He organized the Mike Horse Mining Company and began drilling, blasting, and mucking (i.e. removing the broken rock) in search of ore. For the next eighty-odd years, miners tore out rock, crushed it, grabbed the metal, and dumped the tailing (leftover debris) around the mine. David Stiller gives a clear and concise account of these operations, and in what amounts to nearly half the book, he details the assortment of businesses that owned, leased, and worked the land. In the second half of the book, Stiller focuses on the consequences—environmental degradation. Hardrock mining scars the land, poisons the water, and kills the fish. This is Stiller's theme and he has used the biography of one particular mine to illustrate the wounding of the west.

To an extent, the book is persuasive. Stiller, a former hydrogeologist and environmental consultant, explains in detail the geochemistry of acid mine drainage and the ecology of cutthroat trout (among other things) in a technical, yet casual manner. His descriptions of the steps in the clean-up project are also easy to follow. But the tale of the Mike Horse is told with little passion. For what is clearly an issue Stiller feels deeply about, there is too little human dimension to the story. Stiller tries to interject a feeling for the land through the somewhat

romantic imagery of his own explorations and the recollections of local inhabitants. But the result is a two-toned narrative: a leaden and at times dull mining history traced with a vibrant and colorful travelogue.

This is an odd juxtaposition and highlights some of the flaws in the book. To anyone not familiar with the Blackfoot River area of Montana (and this reader is one) the moving descriptions needed geographical stability. A map, for example, showing the major cities (Helena, Butte, Missoula) and other recognizable landmarks (the Rocky Mountains) would have helped to locate the story. More to the point, readers need historical orientation—a way of linking a very local focus to a larger perspective. What is the significance of the Mike Horse? What is its place in the history of Montana, mining, and the environment? Stiller mentions in several places and at the very end of the book that the Mike Horse is a typical hardrock mine, "nothing exceptional" and "no different" than some half a million other old mines that pock the landscape and pollute the American West. This is certainly cause for alarm, and Stiller's point is well made—the ordinary has for far too long been the accepted (or rather the unacceptable) status quo.

But the Mike Horse is not an ordinary mine. For a few years in the 1960s, the Anaconda Copper Mining Company, at one time the world's biggest and most powerful firm, was thinking of developing it. The plans fell apart when Anaconda collapsed in the early 1970s after its Chilean mines were nationalized—the one chapter in the book where Stiller does branch out. The Mike Horse then came under the control of another big firm ASARCO (American Smelting and Refining Company). As a result, when it came time for environmental clean-up (in the 1990s), the Mike Horse, unlike the vast majority of western mines, had a financially solvent owner that the government could target. What is more atypical, ASARCO took charge of the clean-up without government oversight and even paid for it.

This business-backed environmental action leads Stiller into a moral quandary. He asserts many times (especially near the beginning) that the blame for wounding the west belongs with the mining companies. He is willing, however, to absolve them of wrong-doing (this occurs near the end in his discussion of ASARCO) on the grounds that individual companies, ever since the 1872 General Mining Law, have had no incentive (financial, legal, or moral) to do so. Rapacious greed and rampant destruction of the environment were the *modus operandi* of American hardrock mining. According to Stiller, business is business.

The cliché is a poor substitute for serious analysis, and Stiller's pro-business solution to the problem of environmental degradation is likewise weak and unconvincing—"Create a business environment that values land and water, and miners will protect and restore them." (p. 180). How to do that is left unexamined. Stiller seems to agree with ASARCO in thinking that government regulation, while important and necessary, at times actually prevents mining companies from cleaning up because of the fear of litigation. (ASARCO's unprecedented actions were designed precisely to forestall government interference.) Stiller puts even less stock in social and political activism; corporate calculus, not environmentalism, will bring change.

This leaves us stuck in the muck. If the hardrock mining business was (and still is) all about taking the metal and running, as Stiller has described it, there is little hope of a new environment. The old environment will remain as clear and deadly as the region the upper Blackfoot runs through. So if you go for a walk in the woods around that river (or any other old mining region), enjoy the breathtaking scenery, but watch your step, and don't bring your fishing pole.

Paul Lucier, Dibner Institute for the History of Science and Technology, MIT E56-100, Cambridge, MA 02139; plucier@dibinst.mit.edu

FROM TOP TO BOTTOM: A SMALL SCIENCE DEPARTMENT'S 120-YEAR STRUGGLE TO DEVELOP AND SURVIVE AT VANDERBILT UNIVERSITY (1875–1995). Leonard Alberstadt. 1995. Eggman Publishing, Inc., 3012 Hedrick St., Nashville, TN. 201 p. Soft-cover. $19.00 plus shipping.

Three groups will benefit from this well documented history of a small geology department's inception, evolution, and introspection. University administrators should be required to read this book. Alberstadt's attention to details, and his insider's view as a faculty member and department chairman, of the university's political climate and of the growth to a major medical institution, will appeal to Vanderbilt alumni foremost. There is considerable detail of the struggle and plenty of insider information about the Vanderbilt notables. Alumnus beware, however, for you will not find this to be the typical "rally behind the greatness of your alma mater." Alberstadt delves below the skin of Vanderbilt's successful medical school reputation to show you the willing and unwilling sacrifices made by others, misfortunes inflicted on other academic units by past administration, and what other potential successes were lost to achieve this legacy.

For the second interest group, geology faculty everywhere, the history of Vanderbilt geology is a mirror for many other geology programs. All geology programs fit into larger organizational structures in which ambitions of individuals can alter university developmental directions. New faculty must become aware of the importance of knowing the legacy of your new home. Contingent decisions made long ago have set the stage for the current and future status of your department. Alberstadt has provided you with a real example of this in a "not so large and famous" geology program, typical of many departments. This book is an insider's primer of how an academic department works and how it interacts with other departments and university governance.

For anyone interested in the history of geology, this is a treasure trove of information concerning notable people in the history of geology, not just Tennessee geology. Vanderbilt, having the second oldest geology program in the southeast, was founded in 1875 and geology was at its core, at a time when geology figured prominently in education for all. Through the years, Vanderbilt geology has produced State Geologists, figured prominently in war-effort science, and was involved in many historical events, such as the famous Scopes Monkey Trial. Vanderbilt was home to many influential geologists such as Gerard Troost, James Safford, Alexander Winchell, L. C. Glenn, Bruce Wade, J. K. Roberts, W. B. Jewell, and E. R. Pohl. Alberstadt's history includes discussion of the notable graduates from the program providing early career perspectives. Alberstadt uses University records, archived letters, and personal interviews to explore aspects of Vanderbilt geology's growth and early potential as well. Geology at Vanderbilt, like at some of our institutions, has largely become a secondary, almost invisible, science as disciplines such as nuclear physics and microbiology blossomed.

I think that this book, especially the last half which documents the past decades of Vanderbilt geology's plight, should be required reading for university administrators, and demonstrates the book's universality. Alberstadt succeeds in his purpose of documenting how administration decisions can stifle the efforts of a department to expand and grow, and even lead to decline. Administrators could benefit from seeing, from beginning through current, the long-reaching role they play in the success of programs, especially small programs. This is a case study of how seemingly good decisions make nearly insurmountable obstacles for a department to remain stable, much less grow. Introspection is a valuable tool that leads to improvement through identifying weaknesses, capitalizing on strengths,

and most importantly identifying likely avenues of action. Administrators typically see academic programs through balanced-budget glasses and donor-dollar-value score sheets. I have visited this department myself and can attest to the accuracy of much of what Alberstadt laments. I have worked in the cramped storage rooms filled with museum-quality and historical mineral and fossil collections that are languishing due to lack of support and recognition of their potential, which still exists.

Alberstadt has given Vanderbilt, and us because his department is no different than yours or mine, a real example for faculty and administrators to gauge their plans and actions for helping their departments become the best they can be. I marveled at the parallels between Vanderbilt geology's continued struggle with the university for status, space, support, and recognition and the issues I have witnessed at every institution I have been associated with. Alberstadt summarizes the utility of his book for us all in his last paragraph, asking ". . . is it unreasonable to expect that geology receive the same responsible, professional, and intelligent attention as provided the other natural sciences at Vanderbilt? The answer to that question can be found in the words of former Chancellor Alexander Heard, spoken to (past department chair) Willard Jewel . . . 'The geologists should not be discouraged. We will not wait another ninety years to supply their wants.'" Heard that one before? What a great Christmas present to your administrator this book would make!

Michael A. Gibson, Department of Geology, Geography, and Physics, The University of Tennessee at Martin, Martin, TN 38238; mgibson@utm.edu

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SCIENCES OF THE EARTH: AN ENCYCLOPEDIA OF EVENTS, PEOPLE, AND PHENOMENA. Gregory A. Good, editor. 1998. Garland Publishing, Inc. 2 volumes, 901 p. Hardcover, $150.

Since the 1990s, Garland Publishing has commissioned a number of sourcebooks, dictionaries, and encyclopedias, all aimed at producing an impressive body of reference materials in the history of science, technology, and medicine, designed for students and scholars. Unfortunately, too few of these ambitious projects have been completed. Fortunately, however, Gregory Good had the scholarly insights and editorial fortitude to bring his commissioned work to a successful conclusion. *Sciences of the Earth* is a two-volume encyclopedia focusing on the earth sciences. However, its subject matter transcends the traditional confines of any specific discipline (geology, for example) to include information drawn from meteorology, ecology, oceanography, cosmology, geography, geology, paleontology, and geophysics, to name the most prominent areas of scientific investigation, thus creating an extremely comprehensive reference work.

Good begins the first volume with an excellent historiographical essay ("Introduction") in which he not only presents an overview of the history of geology, but also an informative analysis of geology's disciplinary history. As he persuasively argues, geology's relatively modern appearance (nineteenth century) led him to decide not to organize the encyclopedia according to the field's present contents nor after geology's modern formulators. Instead, the 230 articles Good commissioned from over 120 authors are organized thematically. Thus, the encyclopedia avoids the anachronistic tendency often found in such sourcebooks to locate a modern scientific discipline within the context of, for example, the Greco-Roman natural philosophy tradition. Instead, Aristotle's contributions to understanding aspects of the earth sciences are described according to his own obser-

vations in *Meteorologica* and, thus, are found in an entry entitled "Meteorological Ideas in Classical Greece and Rome." Users of the volumes may still obtain biographical information, since Good has arranged a biographical index to accompany the subject index. As a result, the reader will note that the name "Aristotle" is accompanied by over 57 entries in the encyclopedia.

The thematic categories Good has selected are broad and inclusive, instead of narrow and exclusive. Specific headings fall beneath these themes. Thus, the theme "Earth's Interior" includes such separate headings as "Cosmology," "Deluge," and "Earthquakes," among others. Similarly, the thematic category of "Time and the Earth" lists more specific entries under "Geological Time," "Paleontology," and "Scopes Trial."

Each entry is accompanied by a succinct definition of its meaning. "Drilling," for example, begins with the phrase, "The driving of a hole into the Earth" (p. 173). In the entry "Earth, Size of," the reader finds an informative discussion of Eratosthenes's computation of the Earth's size in the third century B.C.E. and the reception of his ideas in the early modern period, followed by the numerous attempts of Enlightenment *philosophes* to provide a more accurate measurement. The author of the entry, Irene K. Fischer, then concludes her informative essay with a discussion of current attempts to measure the Earth's size with unerring accuracy, followed by her own contributions to address geodesy's contemporary problems. A bibliography and list of cross-referenced entries follows each contribution to the encyclopedia.

Sciences of the Earth should find a ready and receptive audience among historians of science, broadly defined, especially for scholars and students not familiar with the history of the earth sciences. The introductory material includes, in addition to Good's excellent essay, a listing of source materials in the history of the earth sciences. As mentioned previously, there is an excellent and comprehensive index for ready reference to topics and individuals. Thus, any specific idea or actor may have information listed among a variety of entries, written by several scholars. This clever strategy provides not only a thorough discussion of the subject, but one that benefits from, in many cases, multiple perspectives. Certainly those who make use of Good's skillful editorial hand and his wonderful encyclopedia will find much of value. The profession could use additional contributions of the same caliber.

Keith R. Benson, Department of History, University of Washington, Seattle, Washington 98195; krbenson@u.washington.edu

INTERESTING PUBLICATIONS

Gerald M. Friedman, CONTRIBUTING 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 2000

$38,694.69	**Carried forward from 1999**	
−$25,144.03	**Expenditures in 2000**	
	$24,288.85	to Allen Press for ESH v. 18(1) and v. 18(2)
	$ 855.18	operating expenses (office, computing, mailings)
	$25,144.03	total expenditures in 2000
+$17,110.96	**Income in 2000**	
	$14,535.00	membership dues and institutional subscriptions
	$ 755.96	interest on checking account
	$ 1,820.00	page charges, monetary gifts, sale of back issues
	$17,110.96	total income in 2000
$30,661.62	**Balance forward into 2001**	

Explanation:

Two issues of *Earth Sciences History* appeared in the year 2000. The published issues, however, were those for 1999, v. 18(1) and 18(2). While the balance carried forward into 2001 appears large, it consists of membership dues and institutional subscriptions collected to pay for v. 19(1) and 19(2) of 2000, as well as a substantial part of the institutional subscription payments earmarked for v. 20 of 2001.

I am grateful to HESS assistant treasurers Stuart Baldwin (U.K.), Barry Cooper (Australia), Rosa Domènech (Spain), and Keith Tinkler (Canada) for their time and effort in helping to make HESS membership convenient and affordable for many individuals living outside of the U.S. On behalf of the society I thank D.C. Agnew, C.F. Berkstresser, K.B. Bork, G.L. Bynum, G.C. Cadee, R.H. Dott, Jr., R.C. Ewing, W.D. Grafton, W.O. Kupsch, M. McBride, S.E. Newcomb, T.R. Osberg, W. Schröder, K.L. Taylor, M.P. Weiss, and E.L.Yochelson for their generosity in providing donations to HESS. G. Friedman, Denison University, the Kansas Geological Survey, the New York Geological Survey, and the University of Minnesota provided page charges to *ESH*. Thanks to all of you for your continued support of HESS and *Earth Sciences History*.

Finally, since this is the end of my last term as HESS treasurer, I wish to thank the members of the society for giving me the opportunity to serve in this capacity over the last six years. It has been a pleasure to work with each of the officers whose tenure overlapped with mine. I am especially grateful to the previous treasurer, Tom Pickett, for his time and assistance when I was first learning the responsibilities. Most of all, though, I have been thoroughly impressed with the warmth and graciousness of the members of this society. I feel that I have made friends all over the world.

Respectfully submitted,
Dorothy Sack,
HESS treasurer (1995 through 2000)

NOTES ON CONTRIBUTORS

Charles C. Bates is co-author of *America's Weather Warriors, 1814–1985* (1986) and of *Geophysics in the Affairs of Mankind: A Personalized History of Exploration Geophysics* (2nd ed., 2000).

William Berry has a long-held interest in geologic time and its history. He is author of *Growth of a Prehistoric Time Scale,* the first edition of which was published in 1968 and the second, revised edition, was published in 1987. He and R. M. Kleinpell taught stratigraphic paleontology at University of California, Berkeley for a number of years, educating students in the use of geologic time scale units in establishing correlations of value in the search for natural gas, petroleum, and other natural resources.

Dr. Alan Cohen is a retired medical practitioner in England, who has had an interest in archaeology for many years. A recent research project for the British Museum led him to discover a small group of dedicated amateur scientists living during the nineteenth century in the Eastern Cape Province of South Africa. Closely connected, either by friendship or family, their work contributed greatly to the establishment of the study of natural history and the earth sciences in South Africa. He is presently engaged in a biography of Mary Elizabeth Barber, who was the linchpin of the group.

Roy MacLeod is Professor of History at the University of Sydney. He was educated at Harvard, the London School of Economics, and Cambridge, and has held visiting appointments at several universities in Europe and North America. He has written extensively in the history of science, and in the history of colonial science, medicine, and technology. This essay forms part of a wider study of science and technology in the history of colonial Australia and the comparative history of other 'settler colonies'.

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