A Prospectus of Astronomy

The General History of Astronomy. MICHAEL HOSKIN, Ed. Vol. 4, Astrophysics and Twentieth-Century Astronomy to 1950, Part A. OWEN GINGERICH, Ed. Cambridge University Press, New York, 1984. xii, 198 pp., illus., + appendixes.

Before the 1950's astronomers wrote nearly all the histories of astronomy. In recent decades, however, historians of science have come to dominate the field, particularly the study of astronomy from antiquity to the mid-19th century. By and large, the historians have been more dedicated than their forerunners to comprehending the goals, methods, and conclusions of astronomers working in earlier times. The better historians have also given more attention to integrating enough biographical, institutional, and social-cultural detail into their studies to make them satisfying interpretations of the development of the discipline. One consequence of the historians' greater commitment to interpretative depth has been an aversion to writing comprehensive narrative histories like those published by the astronomers A. Pannekoek in 1951 and G. Abetti in 1952. Hence it is virtually impossible for lay readers, and quite difficult for specialists, to acquire an overview of the new history of astronomy. *The General History of Astronomy*, which is being written under the joint auspices of the International Astronomical Union and the International Union for the History and Philosophy of Science, has the laudable purpose of providing just such an overview.

To judge from the present volume, the first to appear in the series, the *General History* will not only achieve its purpose but also serve as a benchmark for future historical inquiries. Volume 4, part A, covers the birth of astrophysics and the development of major observatories, big telescopes, and important auxiliary instruments and techniques; its companion will cover the history of modern astrophysics and cosmology and the sociology of astronomy. Written by 18 authors from eight countries, the 11 chapters and appendix of part A have a surprising degree of coherence, thanks to the volume editor, Owen Gingerich, once a solar physicist and now a historian of astronomy with exceptionally broad-ranging interests, and the general editor, Michael Hoskin. Another pleasing feature of this volume is its nearly 80 illustrations, a large majority of which have not been published, or widely published, before. Though the editors deserve praise for the volume's coherence and for its illustrations, their decision to encourage (or perhaps require) the authors to hold back much of their documentation was unfortunate. Readers wishing to follow up on the subjects covered are likely to encounter many needless frustrations as a result of the stingy policy regarding references.

Several of the contributions exemplify the strengths of the historian's approach to the history of astronomy. John Lankford does an excellent job of recounting the complex technical developments and social interactions that led to the emergence of photography as a major astronomical research tool between 1880 and 1900. Albert Van Helden contributes two fascinating chapters that illuminate the technical, institutional, and scientific trends influencing telescope building between 1850 and 1950. His chapters are nicely complemented by Barbara Welther's appendix listing the world's largest refractors and reflectors in such a way that the reader can easily identify the four largest telescopes of each type extant at any date within this century. David DeVorkin provides a fine synthesis of his pioneering studies of the origin and early interpretation of the Hertzsprung-Russell diagram. Though the other contributions are all solid, they are generally less ambitious. In particular, the authors of the chapters on the principal observatories seem not to have been given sufficient space to do more than chronicle changes in personnel and research resources.

If they can maintain the standard set in the volume under review and at the same time embrace more generous referencing practices, the *General History*'s editors will be doing very well indeed.

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Processes in the Ocean

Hydrothermal Processes at Seafloor Spreading Centers. PETER A. RONA, KURT BOSTRÖM, LUCIEN LAUBIER, and KENNETH L. SMITH, JR., Eds. Plenum, New York, 1984. xiv, 796 pp., illus. $110. NATO Conference Series IV, vol. 12. From an institute, Cambridge, England, April 1982.

One of the most exciting developments in the earth sciences during the past ten years has been the accumulation of evidence that the world's oceans convect through sea-floor spreading centers driven by heat derived from the creation of the oceanic lithosphere. The discovery in 1979 of hydrothermal (350°C) fluids discharging from chimney-like structures composed of sulfide and silicate precipitates at the axis of the East Pacific Rise at 21°N represented the culmination of many other more indirect investigations into a geologic process of obvious global importance. Hydrothermal convection at sea-floor spreading centers plays an important role in the cooling of newly formed oceanic lithosphere, in the global geochemical cycles and mass balances of many elements found in seawater and the oceanic crust, in the formation of metallic mineral deposits analogous to some types of ancient ore deposits, and in the development of biological communities based on a previously unrecognized form of chemosynthesis. The first workshop devoted to interdisciplinary studies of such processes resulted in the volume reviewed here.

The 30 papers in the volume are grouped into eight sections each of which begins with an overview paper. The book includes a useful 13-page appendix that summarizes landmark studies related to hydrothermal processes at sea-floor spreading centers in approximate chronological order.

The most interesting sections in the volume are those on hydrothermal convection, basalt-seawater interaction, mass balances and cycles, and hydrothermal mineralization. In the section on hydrothermal convection, the overview paper, by Sleep, reviews controversial subjects such as the mechanism by which seawater penetrates deep levels of the oceanic crust and the geometry of hydrothermal circulation and its relationship to the magma chamber and discusses the two other papers in the section, by Taylor and Lister, and then proposes an alternative geometry for axial hydrothermal circulation.

The section on basalt-seawater interactions contains relatively little new material. It is dominated by discussions of the results of experimental studies, although attempts to integrate such results with the measured vent-water chemistry and the petrography of samples recovered from the sea floor are described (for example, by Mottl). In general, the papers in this section serve to point up unresolved problems, such as the failure of the experimental runs to produce significant quantities of chlorite or albite (which are abundant in the sea-floor samples) and the lack of water and rock samples from a single locality or hydrothermal system. The latter problem

could be resolved by deep drilling in the vicinity of hydrothermal vents. None of the papers in this section appears to recognize the potential value of integrating theoretical calculation of high-temperature aqueous speciation and chemical mass transfer with the currently available experimental and field results.

In the section on mass balances and cycles, the overview paper, by Turekian, is particularly valuable because it discusses the results of the other papers in the section in the context of hydrothermal processes in the oceans. All the papers in the section contain new data and ideas. Von Damm *et al.* present new data on the chemistry of the 21°N vent waters. Welhan and Craig present data on the abundances and isotopic compositions of methane, hydrogen, and helium in the 21°N vent waters and conclude that the hydrothermal methane was extracted directly from basalt by the circulating seawater and hence has an abiogenic origin. However, a paper by Lilley *et al.* and one by Jannasch in another section both suggest that bacteria may play a role in determining the methane and carbon dioxide contents of the vent fluids. A paper by Simoneit is the only paper in the volume dealing with results from the recently discovered petroleum-bearing hydrothermal vents in the Guaymas Basin, Gulf of California.

The section on hydrothermal mineralization contains a paper on the currently active sulfide chimneys near 13°N (Hekinian *et al.*) and a paper on ancient sulfide deposits in the Mesozoic Tethys Ocean (Robertson and Boyle). Though the discovery of active sulfide mineralization in the ocean has been stimulating, the papers in this section clearly indicate that the present-day systems should be studied in much more detail before their significance with respect to ancient metallic ore deposits can be understood. This point is emphasized in the overview paper, by Skinner, which contrasts the tectonic settings and host-rock lithologies of the present-day rift-related sulfide deposits and those of the ancient massive sulfide deposits that appear to have formed in back-arc basins.

The value of this volume is that it deals with virtually every aspect of hydrothermal processes at sea-floor spreading centers, both modern and ancient, that has been investigated to date. Such broad coverage is possible because most of the research bearing directly on the hydrothermal processes is, as the editors point out, at an early stage of description and interpretation. In ten years' time it will probably not be possible to achieve such broad coverage in a single volume. I highly recommend this volume both to people who want an introduction to the field and to active researchers in it. The inclusion of readable color maps and illustrations and excellent photographs, both color (taken from submersibles) and black-and-white, helps to make the volume attractive.

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Honoring Munk

"It's the Water That Makes You Drunk." A Celebration in Geophysics and Oceanography—1982. In Honor of Walter Munk on His 65th Birthday. (La Jolla, Calif., Oct. 1982.) Institute of Geophysics and Planetary Physics, Scripps Institution of Oceanography, La Jolla, Calif., 1984. vi, 118 pp., illus. Paper. Scripps Institution of Oceanography Reference Series 84-5.

The title of this book comes from a story told by W. Markowitz at a dinner during the time of Walter Munk's preoccupation with problems of the earth's rotation. It is said that a logical scientist decided to determine the cause of drunkenness. On successive days, he consumed large quantities of scotch and water, bourbon and water, and vodka and water. Becoming very drunk in each case, he concluded that the water was responsible. Water may not have made Walter Munk drunk, but it has certainly provided him with a lifelong intellectual high, as this volume attests.

Munk's delightful autobiographical sketch at the beginning of the book gives glimpses of the great range and depth of his contributions to oceanography and geophysics. He writes modestly: "During my career I have worked on rather too many topics to have done a thorough job on any one of them; most of my papers have been superceded by subsequent work. But 'definitive papers' are usually written when a subject is no longer interesting. If one wishes to have a maximum impact on the *rate* of learning, then one needs to stick out one's neck at an earlier time." He has certainly done this. From his early work on wave generation in the '40's and wind-driven ocean gyres and earth wobble and spin in the '50's, to more recent contributions on radar clutter, swell propagation, internal waves, tides, and low-frequency oscillations and his present involvement with ocean acoustics, he has shown exquisite taste and consistent depth of perception. He himself does not say so, of course, but the other contributors do not hesitate to do so.

Klaus Hasselmann shows how Sverdrup and Munk's pioneering work on wave prediction has flowered in the subsequent 40 years; Christopher Garrett explores the dynamical processes that seem to be involved in determining the form of the celebrated Garrett-Munk spectrum of internal waves; Carl Wunsch entertains us by discussing the contrasts between the theoretical oceans, the laboratory oceans, and the real ones; Gordon MacDonald gives a more serious review of the greenhouse effect and acid rain, and Adrian Gill offers a less serious note on the tides of the euripus. An ode introduces Stanley Flatte's informal but informative account of internal wave tomography, and Roger Revelle explains why it is important to be lucky.

There are other contributions as well; this is a joyful publication honoring one of the deans of modern oceanography and geophysics. It is a delight to read and will be a treasure to keep.

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Books Received

Altered Endocrine Status during Aging. Vincent J. Cristofalo *et al.*, Eds. Liss, New York, 1984. xvi, 260 pp., illus. $44. Modern Aging Research, vol. 6. From a symposium, Philadelphia, April 1983.

Analgesics. Neurochemical, Behavioral, and Clinical Perspectives. Michael J. Kuhar and Gavril W. Pasternak, Eds. Raven, New York, 1984. x, 341 pp., illus. $82.50. Central Nervous System Pharmacology.

Broken Earth. The Rural Chinese. Steven W. Mosher. Free Press (Macmillan), New York, and Collier Macmillan, London, 1984. xiv, 317 pp. + plates. Paper, $8.95. Reprint, 1983 edition.

The Caffeine Book. Frances Sheridan Goulart. Dood, Mead, New York, 1984. xii, 210 pp. Paper, $8.95.

Deconvolution. With Applications in Spectroscopy. Peter A. Jansson, Ed. Academic Press, Orlando, Fla., 1984. xvi, 342 pp., illus. $69.

Ecological Communities. Conceptual Issues and the Evidence. Donald R. Strong, Jr., *et al.*, Eds. Princeton University Press, Princeton, N.J., 1984. xiv, 614 pp., illus. $60; paper, $22.50. From a symposium, Wakulla Springs, Fla., March 1981.

Lysosomes in Biology and Pathology, 7. J. T. Dingle, R. T. Dean, and W. Sly, Eds. Elsevier, New York, 1984. xx, 479 pp., illus. $125.

Magnetic Resonance. Introduction, Advanced Topics and Applications to Fossil Energy. Leonidas Petrakis and Jacques P. Fraissard, Eds. Reidel, Boston, 1984 (distributor, Kluwer Boston, Hingham, Mass.). xii, 807 pp., illus. $98. NATO ASI Series C, vol. 124. From an institute, Maleme, Crete, Greece, July 1983.

The Psychopharmacology of Smoking. G. L. Mangan and J. F. Golding. Cambridge University Press, New York, 1984. x, 257 pp., illus. $49.50.

Quantum-Mechanical Tunnelling in Biological Systems. Don DeVault. 2nd ed. Cambridge University Press, New York, 1984. xii, 207 pp., illus. $44.50.

The Total Synthesis of Natural Products. Vol. 6. John ApSimon, Ed. Wiley-Interscience, New York, 1984. xii, 291 pp., illus. $44.

Transcription and Translation. A Practical Approach. B. D. Hames and S. J. Higgins, Eds. IRL Press, Washington, D.C., 1984. xviii, 330 pp., illus. Paper, $24. Practical Approach Series.