The Sea Floor

The Sea. Ideas and Observations on Progress in the Study of the Seas. Vol. 4, New Concepts of Sea Floor Evolution. ARTHUR E. MAXWELL, Ed. Wiley-Interscience, New York, 1971. Part 1, xiv, 792 pp., illus. $32.50. Parts 2 and 3, xiv, 664 pp., illus., + foldout maps. $32.50.

This volume of *The Sea* is in fact two volumes, part 1 being in one volume and parts 2 and 3 in another. It is dedicated to the memory of M. N. Hill, who was the general editor of the first three volumes. Since those volumes were published there has been what has been called a revolution in the earth sciences, namely the acceptance of the related concepts of sea floor spreading and plate tectonics by a large majority of earth scientists. This fourth volume is mainly about the sea floor and thus supersedes volume 3; the fields of study covered in volumes 1 and 2, physical oceanography, chemical oceanography, and descriptive and comparative oceanography, receive only 3 chapters out of the 36 in this volume.

I must confess to a certain amount of disappointment in looking at part 1, which is entitled General Observations. This consists of a series of discipline-oriented studies, dealing with, for example, various geophysical techniques or the different rock types found in the ocean basins. Most of the chapters were written some time ago, many bearing dates in 1968. In such a rapidly moving field many of the articles have become out of date, through no fault of the authors. I also found that some of the chapters in this part are very similar to articles previously published. The question is whether this series of chapters is convenient to have under one pair of covers. I suspect that it will be useful to scientists who are not specialists in the various subjects dealt with but want to get a general background in them.

The second part I found much more satisfying. It consists of a series of regional studies of the ocean floor and contains much excellent material. Many of the chapters in the second part combine different techniques that have been used and observations that have been made in the study of a particular area and attempt to arrive at a conclusion based on all the available data. The geology and geophysics of the areas discussed are given in a more complete manner than is usual, and this part hence proves a useful compendium of information. For instance, the chapter on the Mediterranean discusses bathymetry; gravity, magnetics, and heat flow; sediment cores and sea floor photography; seismic refraction, seismic reflection, surface wave dispersion and seismicity; and the geology of the surrounding land areas. It is a pity, as the editor points out in the introduction, that the coverage of the world's oceans is not complete. One deficiency is that there is no general discussion of the Atlantic Ocean, which is brought in only in articles devoted to the eastern margin of North America and the Caribbean.

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Atmospheric Puzzle

The Nature of Ball Lightning. STANLEY SINGER. Plenum, New York, 1971. x, 170 pp., illus. $12.50.

Here is the better of two recent books in English (the other is C. M. Cade and D. Davis's *The Taming of the Thunderbolts*, Abelard-Schuman) about a baffling atmospheric phenomenon which has so far defied duplication in the laboratory and for which there is no adequate theory. Ball lightnings typically are baseball-size, glowing, mobile spheres that appear during thunderstorms, usually after cloud-to-ground lightning. Singer presents a fascinating and detailed literature review (almost 600 references) of ball lightning research and observations. One of Singer's primary reasons for writing *The Nature of Ball Lightning* is that many modern investigators have ignored (or, to put it more charitably, have had no access to) valuable observations and theories from the past, particularly the 19th- and early-20th-century work by such scientific luminaries as Boyle, Arago, Snow Harris, Faraday, Planté, Lodge, Flammarion, Arrhenius, and Toepler. Many of the "new" theories, recently published, were first put forward in the 19th century.

While the descriptions of various ball lightning observations and the cataloguing of ball lightning characteristics are well done, the description of experiments and theories relating to ball lightning is a disappointment. The author states, "An attempt has been made to emphasize the physical meaning of the results. The mathematical expressions, although more concise, are usually omitted in the discussion, which should not prevent their regeneration by the reader when desired." What actually appears, however, is an abstract of each experimental and theoretical paper with little effort at explanation, identification of nonsense, or reconciliation of the conflicting views and numbers found in the different papers. Speculation is sometimes presented as if it were fact. The nonspecialist is bound to be confused. An inordinate amount of space, over 15 out of a total of 170 pages, is spent discussing the confinement and various properties of low-density, collisionless plasmas. Almost none of this discussion is applicable to the high-density, collision-dominated plasmas that occur in atmospheric air at lightning temperatures and below. The space could have been better spent in explanation of the more reasonable theories.

In chapter 3, "electric field" in units of volts is erroneously used in place of the proper "potential difference"; and "electric field gradient" in units of volts/meter is erroneously used in place of the proper "electric field" or "potential gradient." This type of error should not occur in a book about a phenomenon that may well be electrical. Singer states in chapter 3 that not all lightning flashes are preceded by leaders, a statement for which a reference would be of considerable interest.

The 594 references are arranged both in alphabetical order according to the author's name and by subject classification, a valuable asset.

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Space-Time Philosophy

The Conceptual Foundations of Contemporary Relativity Theory. JOHN COWPERTHWAITE GRAVES. M.I.T. Press, Cambridge, Mass., 1971. xii, 362 pp. $15.

Einstein's theory of general relativity, essentially unchanged since its conception in 1915, has often been hailed as one of the great revolutions of our basic ideas about nature. Since 1955 renewed interest has centered on the "geometrodynamical" interpretation, and unsuspected and fascinating features of this theory have emerged as more powerful mathematical methods have been applied to it. Yet, the most fundamental concepts in geo-