

vertical thermal structure of the tropical oceans, more vigorous circulation, partitioning of pelagic biotas biogeographically, and increased ocean productivity. East-west biogeographic differences are also recorded during the Miocene, and these changes are attributed to tectonic restriction of the Indonesian and Middle American seaways. The profound oceanic thermal changes during the Miocene, brought on by the development of permanent polar ice sheets, also had major impact on the terrestrial environment, but this is not intended to be a part of the book.

This book is important to marine geologists and paleontologists of all sorts, including those dealing exclusively with shallow-water, near-shore situations, and to people interested in terrestrial and climatic history as well because of the close linkage between the oceans and climate. Its 23 authors and the editor have provided more knowledge about the oceans than is available for any other time except the Quaternary.

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## Interplanetary Dust

**Properties and Interactions of Interplanetary Dust.** R. H. GIESE and P. LAMY, Eds. Reidel, Dordrecht, 1985 (U.S. distributor, Kluwer, Hingham, MA). xxvi, 444 pp., illus. \$64. Astrophysics and Space Science Library, vol. 119. From a colloquium, Marseille, July 1984.

This collection of 80 papers presents a rather up-to-date account of knowledge of and research on interplanetary dust. Following the format of the colloquium from which it derives, the volume contains seven sections: on observations of zodiacal light and the F-corona; space and related ground experiments on interplanetary dust; laboratory studies of interplanetary dust collections; experimental and theoretical studies of grain optics; relationships of interplanetary dust to comets and meteoroids; dust-plasma interactions; and dynamics of interplanetary dust. The term "dust" is restricted to very small particles excluding meteors.

All but two of the sections start with invited reviews that summarize the state of their field and provide useful reference sources. Although not labeled as such, Leinert's paper on the dynamics and spatial distribution of dust has many features of a brief review. Weinberg's review of zodiacal light observations and the contributed papers that follow it present a very up-to-date account of this, the oldest phase of inter-

planetary dust research. Included are brief accounts of balloon-borne infrared measurements and IRAS (Infrared Astronomical Satellite) observations.

In his review of laboratory investigations of optical properties, Zerull briefly describes the theoretical aspect of the problem and then outlines the experimental procedures for studying scattering by individual particles. These include microwave analogue studies, laser and electrostatic levitation, and the use of fine threads for particles sufficiently large compared to thread diameter. The analogue technique, now most vigorously pursued at the Ruhr University at Bochum Laboratory, where Zerull is located, receives the most emphasis. Because particles are scaled up to centimeter dimensions this procedure also permits the composition, structure, and shape of a particle to be readily fabricated. It also requires a large laboratory for carrying out the measurements.

Dust-plasma interactions have received less attention but can have significant effects. These are described by Fahr and Ripken for the heliosphere. Other areas of current interest are planetary rings, particularly for Saturn, and cometary dust tails.

Brownlee's chapter on the collection of interplanetary dust is disappointing in view of his extensive and exciting contribution to the field. About a third of the chapter is an account of Hemenway's early work. The report from the McDonnell Center for Space Sciences by Fahey *et al.* together with Brownlee's review provides a good summary of analytical work on individual particles. As techniques improve and skills in applying them are developed, the study of individual particles will become a major approach to research on interplanetary dust.

Missing from the book is discussion of experimental investigations of the formation and properties of grains condensed from cosmic-type gas mixtures. Study of properties of such grains and their thermal metamorphosis and hydration effects is an important complement to the analysis of interplanetary grains.

An interesting and often valuable feature of symposium proceedings is a report of the discussions that followed presentation of the papers. In this volume only a small fraction of the papers are followed by such reports.

This book on the whole is valuable for finding out where research on interplanetary dust is heading and what its present status is. It is a source of references to work through 1984 but does not stand on its own because of the brevity of the papers.

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## Some Other Books of Interest

**Advances in Plant Nutrition.** Vol. 1. P. B. TINKER and ANDRÉ LAÜCHLI, Eds. Praeger (Greenwood), Westport, CT, 1986. xviii, 301 pp., illus. \$40.95.

Because of the success with which fertilizers have been used, the editors of this new series note in their introduction, the study of plant nutrition has come to seem stagnant. However, in view of "signs that the subject may once again be entering a period of excitement and rapid development," they have judged it "an appropriate time to launch a series [that will] bring out comprehensive reviews on topics of current interest within the discipline as a whole." Both fundamental science and practical application will be included, and especially, it is hoped, work that joins the two. The inaugural volume contains accounts of six topics: the efficiency of nitrogen fertilizers in cereals as related to climate (Craswell and Godwin); breeding for nutritional characteristics in cereals, especially as related to trace elements (Graham); nutrient uptake rates as related to inorganic tissue components (Glass and Siddiqi); the functions of calcium (Hanson); the role of adenosine triphosphatases in nutrient absorption (Leonard); and the potential use of nuclear magnetic resonance in the study of plant nutrition (Loughman and Ratcliffe). As is intended for future volumes, the present volume includes an "Editorial" describing promising research trends on other topics in the field.

—K.L.

**Some Mathematical Questions in Biology: Muscle Physiology.** American Mathematical Society, Providence, RI, 1986. x, 234 pp., illus. Paper, \$35. Lectures on Mathematics in the Life Sciences, vol. 16. From a symposium, Detroit, MI, May 1983.

**Some Mathematical Questions in Biology: DNA Sequence Analysis.** American Mathematical Society, Providence, RI, 1986. x, 124 pp., illus. Paper, \$28. Lectures on Mathematics in the Life Sciences, vol. 17. From a symposium, New York, May 1984.

A symposium entitled "Some Mathematical Questions in Biology" is an annual feature of the AAAS meetings. These volumes represent proceedings of two of the most recent in the series.

The volume on muscle physiology contains papers on the molecular mechanism of muscle contraction by H. E. Huxley, the role of ATP hydrolysis in muscle contraction by E. Eisenberg, a model of the contractile process based on component studies by M. B. Propp, a mathematical method for deter-