

details to be acquired in the field per unit square area varies as $1/S^2$. As the mapping effort per unit area can be expected to be proportional to the number of details to be acquired, the unit cost should vary inversely with the square of S . Herfindahl, by comparing Canadian maps mostly at the scale of 1:500,000 with U.S. Geological Survey maps at the scales of 1:250,000 and 1:62,500, in effect weights the data against the U.S. Geological Survey by a factor of 64, versus 16 and 1 respectively for the Canadian data.

The book's approach seems to be more relevant to collectivist societies than to the highly competitive private system of advanced Western nations. In the latter, private enterprise in the gathering of information about resources goes far beyond what is achieved in a general resource survey.

B. F. GROSSLING

P.O. Box 1265, Washington, D.C. 20013

Fossil Pollens

Aspects of Palynology. ROBERT H. TSCHUDY and RICHARD A. SCOTT, Eds. Wiley-Interscience, New York, 1969. x, 518 pp., illus. \$24.95.

The field of palynology has undergone a profound metamorphosis since its first quantitative applications some 50 years ago. As currently interpreted, the discipline embraces a multitude of taxonomically unrelated "palynomorphs," an enormous span of geological time from the Precambrian to the present, and many applications (from stratigraphic correlation, to paleoecological inference, to reconstruction of evolutionary relationships, to analyses of pollen development). As the editors of *Aspects of Palynology* indicate, the literature has become so decentralized and voluminous that the neophyte is apt to encounter virtually insurmountable problems in perceiving the dimensions and directions of this burgeoning field.

Aspects of Palynology was designed to "summarize in one book the nature, scope, and applications of the study of fossil pollen and spores." Clearly a book of this nature was needed badly. In my estimation, the book achieves the stated objective, although, as the editors admit, there are the weaknesses that one might expect in a collaborative volume that was long in preparation.

Aspects is well organized, beginning with a variety of chapters that provide general background concerning the nature and representation of various "palynomorphs," problems of classification, sources of error, applications of palynology, and the like, and then proceeding to a chronological treatment of the fossil record.

From the standpoint of one interested in the Pleistocene, I find the latter half of the book especially valuable, as it provides ready access to an enormous literature on pre-Pleistocene palynological problems. The service this section of the book provides is incalculable, for up until now that literature could be assimilated only if one was willing to devote considerable time and energy. My one complaint concerning this section would be with the manner of presentation of photomicrographs. "Pre-Pleistocene" workers tend to crop photomicrographs by cutting closely around the outline of the microfossil. The contrast that one perceives then becomes that between the microfossil and the mounting paper rather than that between grain and mounting medium. This is apt to make interpretation of the wall more difficult. It is often impossible to discern the exact surface and sculpture of the grain, for one must distinguish between the cut outline and the real outline. No matter how carefully one cuts, this problem is likely to be engendered and sculptural features are apt to be distorted (by being inadvertently added or eliminated). These problems are evident on virtually every plate in chapters 11 through 16. However, weighed against the value of this section, this criticism is trivial.

The introductory chapters present a number of problems of coverage and overlap. For example, the nature of pollen grains (wall structure, etc.) is discussed in both chapters 2 and 3, but in neither chapter is there an adequate discussion of the chemical composition of the exine. Particularly disturbing is the evolutionary framework provided in chapter 2, a system of classification that is supposed to be "phylogenetically oriented." The system employed is archaic and obscures rather than reveals evolutionary relationships. There is no indication of the fundamental distinction between procaryotic and eucaryotic organisms, of the close relationships between bluegreens and bacteria, of the concept of a major assemblage of organisms that

can be classified as "Protista." Furthermore, *Psilotum* is retained as a living representative of the Psilopsida whereas work of Bierhorst indicates that it probably belongs to the Schizaceae.

The major weakness of the book is the absence of material providing a theoretical background for palynology. The editors have omitted this consciously, indicating that it is available in a number of modern treatises such as the recent edition of Faegri and Iversen. Nevertheless, I think such information should have been included in a volume attempting such a sweeping synthesis. Much has been learned in recent years concerning mechanisms controlling pollen release and dispersal, factors influencing the incorporation of pollen into sediments, the relationship between pollen rain and vegetation, statistical artifacts in pollen diagrams, and the like. All of this background is absolutely essential for the interpretation of fossil spectra, yet it appears only in condensed form in Leopold's superb chapter on the Late Cenozoic.

These reservations will not prevent *Aspects* from becoming an extremely valuable reference book.

DONALD R. WHITEHEAD

Department of Botany,
Indiana University, Bloomington

Matter in Space

The Interstellar Medium. S. A. KAPLAN and S. B. PIKELNER. Translated from the Russian edition (Moscow, 1963), with corrections and additions by the authors. Harvard University Press, Cambridge, Mass., 1970. xiv, 466 pp., illus. \$20.

The Harvard University Press is to be congratulated for having had the good sense to arrange for the translation and publication of this work. The translation is certain to become a part of the basic libraries of most astrophysicists in the English-speaking world. This is one of the three or four basic texts and compendia to which I shall direct the attention of graduate students who are about to become involved in studies of the interstellar medium, and I shall wish to refer to it often in connection with my own researches and lectures. I only wish that the Press had given the name of the translator, who has provided as fine a translation and interpretation as one could hope to have.