

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.

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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.

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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.

The book is essentially a text for the astrophysics student with a good background in mathematics and atomic physics. It starts off without preliminaries. On page 2 we meet the Stromgren sphere and on page 3 we find the basic formula for its radius. The presentation continues apace and, reading at random, one finds hardly a page unworthy of one's attention. I, for one, have learned a lot by reviewing the book.

The first three sections—Interstellar Hydrogen, The Physical State of the Interstellar Gas, and Interstellar Dust—are the basic ones; they occupy about half the book. In the chapters under these headings radio and optical astronomy are properly blended. These chapters are good ones, but the reader should be warned that they are not up to date. As far as I can judge, the text is essentially complete to 1963, and there are selected references included to 1966 and 1967, but the new results and developments of the past four or five years are not represented here. For them one must turn to the published summaries of the Crimean Symposium of the International Astronomical Union, held in September 1969 at Pikelner's home base, with him as one of the principal organizers. The Crimean Symposium volume is or soon will be available in book form. There will be other summarizing volumes to consult—such as the volume based on the Steward Observatory symposium on dark nebulae, globules, and protostars held in Tucson in March 1970, also soon to be in print, or the presentations at the Brighton General Assembly of the International Astronomical Union (August 1970). For the reading of all these, sections 1, 2, and 3 of Kaplan and Pikelner provide ideal background material.

Section 4 deals with Interstellar Magnetic Fields and Nonthermal Radio Emission. This is a research subject in which the authors are preeminent, and it is good indeed to have their introductory material made generally available to English-speaking readers. The unified treatment includes naturally several aspects of the study of cosmic rays, which represent a very important part of the interstellar plasma. The chapter ends with some illuminating discussions of the Crab Nebula, Cassiopeia A, the Cygnus Loop Nebula, and the galactic spur. Again, one notes with some regret that the discussions of these objects include references only to 1966; pul-

sars, radio and optical, are discussed only very briefly in an addendum on pages 402 to 405, and the references to observational data on galactic magnetic fields are out of date. It will be most interesting to read the next edition of the book, in which the authors should express their views on pulsars, neutron stars, and the helical components of the galactic magnetic field.

The book ends with a monumental section (100 pages) on Interstellar Gas Dynamics and the Evolution of the Interstellar Medium. It is a beautiful introduction to the volume based on the Crimean Symposium. The chapter opens with two fine sections, one on shock fronts, the other on ionization fronts. Kaplan and Pikelner write on these topics as true experts—and our anonymous translator has done well in presenting the difficult material in English. The first half of the chapter ends with a good discussion of motions in the interstellar gas, including an analysis of basic observational material on interstellar turbulence.

The concluding chapters, section 5, deal with problems of the evolution of the interstellar medium. This is a subject on which Pikelner has made major contributions, which have not generally received in the West the attention that they deserve. The sections on the gravitational collapse of interstellar clouds, large and small, should be read with care by students and professionals alike. I have personally been much intrigued by Pikelner's work on barred spirals and the role they may play in the evolution of galaxies. It is a pity that there is so little on this subject in the present book and that the treatment of galaxy problems is so brief. We are all looking forward to more books like the present one by these authors.

The printing and binding of the book are up to the standards one expects from the Harvard University Press. The price is high, but, believe me, the book is well worth having. The reproductions of photographs are not quite what they should be, and in my reading I came across several printing and spelling (names!) errors. But basically this is an excellent book. There is much to praise and there are few criticisms to be made. Thank you, Dr. Kaplan, thank you, Dr. Pikelner, and thank you, anonymous translator.

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Books Received

Along the Fourth Dimension. Man's Sense of Time and History. Joost A. M. Meerloo. Illustrated by Carl Smith. Day, New York, 1970. x, 278 pp. \$8.95.

The American Enlisted Man. The Rank and File in Today's Military. Charles C. Moskos, Jr. Russell Sage Foundation, New York, 1970 (distributor, Basic Books, New York). x, 278 pp. \$7.95.

Astronautics and Aeronautics, 1968. Chronology on Science, Technology, and Policy. Science and Technology Division of the Library of Congress. Scientific and Technical Information Division, National Aeronautics and Space Administration, Washington, D.C., 1969 (available as NASA SP-4010 from the Superintendent of Documents, Washington, D.C.). viii, 432 pp., illus. Paper, \$2.

Behavior and Adaptation in Late Life. Ewald W. Busse and Eric Pfeiffer, Eds. Little, Brown, Boston, 1970. xiv, 402 pp. \$13.50.

The Biological Clock. Two Views. Frank A. Brown, Jr., J. Woodland Hastings, and John D. Palmer. Academic Press, New York, 1970. viii, 94 pp., illus. Paper, \$1.95.

Biology of the Reptilia. Carl Gans, Ed. Vol. 2, Morphology B. Thomas S. Parsons, Ed. Academic Press, New York, 1970. xiv, 374 pp., illus. \$16.50.

Calcitonin 1969. Proceedings of the second international symposium, London, July 1969. Selwyn Taylor and Giraud Foster, Eds. Springer-Verlag, New York, 1970. xiv, 570 pp., illus. \$24.80.

Cognition and the Development of Language. A symposium, Pittsburgh, April 1968. John R. Hayes, Ed. Wiley, New York, 1970. xii, 372 pp., illus. \$12.

Computers for Management. Humphrey Sturt and Ronald Yearsley, Eds. Elsevier, New York, 1969. xvi, 200 pp., illus. \$8.

The Diagnosis and Treatment of Diseases Affecting the Nervous System. Frederick Lees. Vol. 1 (xxxii, 392 pp.); vol. 2 (xxiv, 982 pp. + plates). \$38.50 the set.

Differential Amplifiers. L. J. Giacoletto. Wiley-Interscience, New York, 1970. xiv, 242 pp., illus. \$12.95.

Early Experiences and the Processes of Socialization. A symposium, Oxford, Ohio, 1968. Ronald A. Hoppe, G. Alexander Milton, and Edward C. Simmel, Eds. Academic Press, New York, 1970. xii, 220 pp., illus. \$9.50. Social Psychology.

Environment and Human Efficiency. E. C. Poulton. Thomas, Springfield, Ill., 1970. xxii, 330 pp., illus. \$15.50. American Lecture Series, No. 765; American Lectures in Living Chemistry.

Feelings and Emotions. The Loyola Symposium, Chicago, October 1968. Magda B. Arnold, Ed. Academic Press, New York, 1970. xviii, 342 pp., illus. \$11.50. Personality and Psychopathology, vol. 7.

Flight Stability and Control. T. Hacker, Elsevier, New York, 1970. xxiv, 328 pp., illus. \$22. Modern Analytic and Computational Methods in Science and Mathematics, No. 23.

Foundations of Conditioning. Harold B. Falls, Earl L. Wallis, and Gene A. Logan.