

tion geophysics. Advanced texts treat such topics as the earth's gravitational field, satellite geodesy, and elastic wave propagation. To proceed from one to the other and to the journal literature normally requires a detour through mathematical physics.

Interpretation Theory in Applied Geophysics (McGraw-Hill, New York, 1965. 603 pp., \$17.50), an excellent and important volume by two Canadian geophysicists, F. S. Grant and G. F. West, attempts to bridge the gap. Grant and West propose to supply the essential material from mathematical physics in a concise form, and to relate this material to the physical measurements obtained in geophysical exploration. One may question whether they have succeeded in materially reducing the mathematical demands on the readers, but they have compressed a tremendous amount of information into a volume of some 600 pages.

The subject matter of geophysical exploration is treated under three headings: seismology, gravity and magnetism, and electromagnetic conduction and induction. Each section is complete in itself and each receives equal space. This division of subject matter is a natural one because the mathematics can be developed from the Helmholtz, Laplace, and diffusion equations respectively. Each of the 18 chapters is preceded by a useful summary of its contents and its relationship to other chapters.

Within each section, the authors have attempted to provide an introductory chapter for perspective, one or more chapters to develop the underlying mathematics, and several chapters to show the use of these results in interpreting physical measurements in terms of geological structure. Relatively little attention is given to measurement techniques, instrumentation, field procedure, or corrections.

The section on seismology treats elastic wave propagation in uniform and nonuniform media, plane and spherical waves in layered media, surface wave dispersion, seismic ray theory, and many other topics. Tensors, contour integration, and other such mathematical tools are used where needed. Individual topics are treated competently, but the overall impression is one of too many scattered items treated too briefly. Despite such chapter titles as "Analysis of seismic records" and "Seismic interpretation," the would-be interpreter will find that much

of the discussion is of a peripheral nature.

The second section develops potential theory for use in the interpretation of gravity and magnetic measurements. Detailed interpretation procedures, some presented here for the first time, are based on geological models such as sheets, cylinders, or blocks. Emphasis is given to identifying characteristic features of the anomalies as a basis for interpretation.

The section on electrical conduction and induction disposes of the former in a brief but fairly advanced discussion. A chapter somewhat misleadingly titled "Electromagnetic theory" precedes an excellent, thorough, and partly original discussion of induction effects in geological structures. Characteristic features of the anomaly curves are again emphasized as interpretational tools.

The book is directed to advanced students and professional exploration geophysicists. Certain portions will interest earthquake seismologists, geologists, hydrologists, geodesists, oceanographers, and radio engineers.

This volume will immediately take its place as a basic text and reference in solid-earth geophysics.

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Botany

K. R. Sporne's new pocket-sized book, **The Morphology of Gymnosperms** (Hutchinson, London; Hillary House, New York, 1965. 216 pp., \$3), is the first comprehensive treatment of gymnosperm morphology since Chamberlain's *Gymnosperms: Structure and Evolution* (1934). In the meantime many important discoveries have been made, especially in paleobotany and embryogeny, and these have considerably altered some of our notions about evolution and relationships within the gymnosperm complex.

Ten of the 12 chapters treat the nine orders—Pteridospermales, Bennettitales, Pentoxylales, Cycadales, Cordaitales, Coniferales, Taxales, Ginkgoales, and Gnetales—that the author recognizes. These are distributed among the three classes Cycadopsida, Coniferopsida, and Gnetopsida, but no divisional taxon is named. On page 18 Sporne explains that, because many regard the group as representing an

evolutionary level rather than a formal taxon, he prefers to use the common noun "gymnosperms" rather than "Gymnospermae." This alludes, of course, to the naked seeds, which they all possess in common, and leaves open the possibility of polyphyletic origin. However, on page 196, he says that "the evidence which is available at the moment seems to favour the view that the gymnosperms are monophyletic."

Each chapter begins with a formalized diagnosis of the order that it treats. Families are listed under some of the orders, and in the case of several of the families the genera are named. For most of the taxa, whether order, family, or genus, pertinent facts are cited concerning habit, distribution, anatomy, reproductive morphology, embryogeny, and affinities. Chromosome numbers are given where known.

The book is well written in a readable and understandable style. It is illustrated only with drawings, taken mostly from other sources. Although small, the drawings are well made, suitably grouped, and clearly reproduced. An excellent bibliography of 230 entries is appended, and the index is complete. Factual and typographical errors are few. There are some passages, however, that may be a bit puzzling at first—for example, the statement that the genus *Libocedrus* has five species confined to New Zealand and New Caledonia (p. 145). Sporne does not explain that the incense cedar of Oregon and California was transferred to the genus *Calocedrus* many years ago. For the most part controversial matters are impartially dealt with, and arguments for both sides are usually given. Sometimes the author expresses his preference, sometimes he does not.

It is a good book to possess, and constitutes suitable reading for students at all levels.

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General Anthropology

For the past decade mathematicians and engineers have found their exclusive preserve—the computing center—more and more violated by strangers of dubious credentials from other sides of the campus. Social scientists and