

tion of equilibrium is justified for the situations considered in this book, it is not justified when studying mineral assemblages. Given, then, that an equilibrium thermodynamic approach is of considerable use in petrology, students should have a reasonable appreciation of this approach before going on to diffusion and kinetics, at least at the level presented in this book. My experience is that it is difficult to teach the former, let alone the latter, in a crowded undergraduate syllabus (however unfortunate that may be).

It is unfortunate that the production of the diagrams is not better—though I gather that a ‘misunderstanding’ between the author and their publisher, Blackwells, was the cause—certainly Blackwells can have no reason to be proud of this and the authors every reason to be annoyed. Incidentally, I like to see G–X loops have infinite slopes at the axes for thermodynamic correctness.

A valuable addition to the geological literature.

ROGER POWELL

Taylor, R. G. *Geology of Tin Deposits*. (Developments in Economic Geology, 11.) Amsterdam, Oxford, and New York (Elsevier), 1979, xii + 544 pp. Price Dfl. 150 (\$73.25).

Combining both academic and practical information, this book provides a comprehensive overview of the major aspects of the geology and search for tin. The basis for the text was a course given to the Australian Mineral Foundation in 1976 and although the work is aimed primarily at research-exploration and mining geologists directly involved in prospecting and exploiting tin, the well-illustrated text will appeal to a much wider readership. The major topics discussed include: metallogenic provinces, classification of primary and secondary deposits, characteristics of stanniferous granitoids, geological features of tin deposits, exploration philosophy, geochemical prospecting, province-district and ore-body analysis, low-grade deposits, hydrothermal alteration patterns, behaviour of tin in the magmatic, hydrothermal, and weathering environments, drilling-sampling and ore reserve estimation, and tin-bearing minerals.

Over-emphasis of ‘academic’ aspects at the expense of ‘practical’ information detracts from the over-all usefulness of the book to the exploration/mining geologist. The exploration geologist particularly would have appreciated many more case studies illustrating different approaches to searching for tin in a variety of geological environments. Furthermore, the lack of synthesis sections concluding some topics and chapters is a fundamental

weakness. In such a compilation of information and ideas it is the author’s responsibility to summarize and synthesize.

In spite of these critical comments the book contains a wealth of useful information which has never before been incorporated in a single volume. Notable sections include: the author’s comprehensive classification of tin deposits (chapter 3), which integrates environmental, morphological, and mineral-chemical parameters; a discussion (chapter 6) of the most significant geological features of tin deposits and their application to search techniques; a very useful appendix which provides notes and key references for twenty-three of the most important tin provinces; and a comprehensive bibliography. Chapter 10 (co-authored with C. Cuff) provides an excellent review of the mineralogy and crystal chemistry of tin which any mineralogist would find useful.

The high price will discourage most individuals from buying this book but everyone engaged in tin geology will need to refer to it.

N. J. JACKSON

Phillips, W. R. and Griffen, D. T. *Optical Mineralogy: The Non-opaque Minerals*. Oxford and San Francisco (W. H. Freeman & Co., Ltd.), 1981. xiv + 677 pp., 332 figs. Price £19.95.

This book has two parts and was designed to complement the companion volume *Mineral Optics: Principles and Techniques* [MA 72–824]. Part I contains detailed descriptions of the common rock-forming minerals and Part II is a set of detailed tables of most of the non-opaque minerals arranged in order of increasing refringence under five headings—*isotropic*, *uniaxial* (positive and negative), and *biaxial* (positive and negative).

The first part describes the properties of the common rock-forming minerals with emphasis on the optical properties although physical properties, chemical composition (without chemical analysis), structure (with many drawings), alteration products, and occurrence are also included, and a small number of highly selective references (typically from 2 to 10) are cited which enable the reader to enter the specialist literature dealing with each mineral. The arrangement is by chemistry for the non-silicates and by structural group for the silicates. The most important section, especially for student use, is the Distinguishing Features listed for each mineral. Although this is generally well developed, with particular reference to the minerals

most liable to be confused with the mineral being described, in some instances either a more detailed account of the distinguishing features or a more frank statement that the optical distinction is difficult or equivocal would have been helpful. An example is cummingtonite and tremolite, where the high 2V and frequent fibrous nature makes determination of the sign difficult, and refringence can be very similar as regards thin-section appearance. Many descriptions are, however, excellent, e.g. the difficulty of distinguishing talc and muscovite is quite bluntly stated.

Many of the minerals are accompanied by black-and-white photographs of their thin-section appearance, and this is most disappointing as indeed almost all such photographs are—exceptions including the excellent illustrations of plagioclase extinction angle determination (albite and Carlsbad-albite methods) and a number of other minerals with birefringence of about 0.010 which only require black and white. I really think that black-and-white photographs yield such an unsatisfactory result that unless colour is available (as with the recent book by MacKenzie and Guilford: *Mineral. Mag.* 43, 1075) the appearance can be quite misleading. For instance, that of chlorite (p. 291). One appreciates that with the price already £20 it would have been undesirable to increase it further with costly illustrations.

It is regrettable that the amphibole description should retain terms formally abolished by the IMA in 1977, such as barkevikite and basaltic hornblende, and use classifications of the alkali amphiboles glaucophane-crossite-riebeckite, and the calcic amphiboles tremolite to ferroactinolite, which conflict with the approved recommendations for amphibole nomenclature, but it is appreciated that optical properties are less and less clearly diagnostic of many amphibole varieties.

Part II is comprehensive and enables most non-opaque minerals to be tracked down and includes occurrence and a reference to the literature for each mineral. Minerals which are close to the boundary between anisotropic and isotropic, biaxial and uniaxial, positive and negative occur under both of the relevant headings to assist in identification.

The only typographical error noted was in the footnote on p. 140. The book is well produced with excellent binding and certainly fulfils the authors' claim to replace now out-of-print texts of comprehensive optical mineralogy such as Winchell and Winchell and Larsen and Berman. It will be a most useful laboratory and library reference book and is reasonably priced for almost 700 pages. It is strongly recommended.

B. E. LEAKE

Cronan, D. S. *Underwater Minerals*. London and New York (Academic Press), 1980. xvi + 362 pp., 93 figs. Price £24.80.

During the past few years there has been an increasing interest in underwater mineral deposits. This has been accompanied by an explosion of literature on the subject, scattered in diverse journals, theses, and reports. This book attempts to pull together the literature and to provide an up-to-date text for both undergraduate and postgraduate students.

The first few chapters deal rather briefly with placers and aggregates, authigenic minerals, and phosphorites; in each there is a mixture of brief descriptions of the various mechanisms involved and mention of actual localities, but somehow not enough of either, though the authigenic section (which deals with zeolites, baryte, and feldspars) has some inspiring SEM photographs. It may be sufficient to say that the cassiterite deposits of south-east Asia have been well reviewed in the literature and need not be considered in detail here, but in this case it is perhaps unfortunate for a student reader that two of the three references are to papers in *Geol. en Mijnb.* and the third to *Tech. Bull. ECAFE*, not a selection always easily available to undergraduates.

In the succeeding chapters on manganese nodules and encrustations and on metalliferous sediments the author gets more into his stride and produces pertinent and useful summaries of recent research and current views. The distribution, mineralogy, growth characteristics, bulk geochemistry, and formation of ore-grade deposits of manganese nodules are discussed in detail in a relatively lengthy section (pp. 61–169) and this is followed by an equally informative section (pp. 170–227) on metalliferous sediments, with details of those from the Red Sea and the mid-ocean ridges. In both chapters the concepts are reinforced by geochemical and analytical data. There is a brief section on sub-surface deposits, including those of continental shelves and of the deep-sea floor, and a useful discussion on the interrelation between sub-sea mineral deposits and their relationship to ocean evolution and developing mid-oceanic ridges. The remaining chapters deal with exploration methods, both direct by various sampling and analytical techniques, and indirect using geophysical and geochemical methods, and exploitation or its possibility, using various ingenious concepts. Some 600 references are listed and 103 analyses of manganese nodules are given in an appendix.

The book is well produced and well illustrated with photographs and diagrams. It is eminently