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## BOOK REVIEWS

*OPTICAL MINERALOGY.* By David Shelley, Elsevier, Amsterdam. 1985, 312 pages. $37.50 (second edition).

This is the second edition of a book originally published in 1975. In the preface the author states that the main purpose of optical mineralogy is to identify minerals successfully. He believes that the student is best served by a one-volume reference containing an integration of all the information normally required, and he hopes that the book "will prove useful for all stages of undergraduate and later work." There are a number of people (including me) who do not agree with the integrated single-volume approach.

The changes and additions to this edition were made by the author in response to criticisms that the first edition had too little coverage of optical theory. He has expanded the section on techniques, including a chapter on spindle-stage techniques. Other new features include an explanation of the stereographic projection and forty plates of microphotographs in color. Finally, five minerals have been added to the descriptions.

The book contains 130 pages of theory and techniques and 174 pages of tables of determinative mineralogy and mineral descriptions. The determinative tables emphasize index of refraction and birefringence, with shorter sections on anomalous interference-colors and colored minerals.

The mineral descriptions contain very little information about crystal structure and mineral chemistry. The descriptions are well laid out and emphasize crystal sections rather than block diagrams to relate optical properties to crystallography. The selection of rock-forming minerals is quite reasonable. Shelley does point out inadequacies of optical mineralogy in the determinatin of certain minerals, *e.g.*, paragonite *versus* muscovite.

The chart of interference colors is very helpful, but the color plates of microphotographs are too small to be useful. The black-and-white microphotographs interspersed throughout the text are generally quite helpful. There are inconsistencies in the optical data presented in the tables in this and other optical mineralogy texts. For example, the $2V_x$ of andalusite is given as 73°–86°. Using the *minimum* values of indices of refraction listed yields a $2V_z$ of 84°. Other examples, *e.g.*, sillimanite, could be cited.

The book will serve as a reasonable undergraduate text on optical mineralogy, but the depth of coverage of techniques, optical theory, and mineral descriptions is probably not suitable for more advanced workers. In my opinion, the coverage of optical theory is too condensed to be appropriate for beginning students of optical mineralogy. Teachers will have to decide if the reduced cost of one text will offset the lack of coverage in certain areas.

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*GEOCHEMICAL THERMODYNAMICS.* By Darrel Kirk Nordstrom and James L. Munoz. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, Calif., Don Mills, Ont. 1985. 477 pages, $56.00 (CND).

This is an up-to-date, well-organized, clearly presented text covering a wide range of applications of thermodynamics to geological problems. The book begins with a discussion of the scope of the subject and moves on to the behavior of gases to lay a foundation for the discussion of classical thermodynamics. Applications of thermodynamics to metamorphic systems, ranging from simple to rather complex phase-equilibria, are covered in great detail. The foundation for examining sedimentary and diagenetic systems is clearly presented in terms of the relationships between aqueous species and solid phases. The text contains numerous examples of calculations that complement the theoretical aspects discussed in the text and guide the student in terms of possible applications. One of the strongest points of the book is the discussion, in the final two chapters, of measurement and evaluation of thermodynamic data. Compared to the treatment of metamorphic and aqueous systems, the treatment of thermodynamics applied to igneous processes is weak. More certainly could be included here.

The text was written for graduate-level courses; however, I have found it suitable for my third-year undergraduate course. There is a good balance of theory and application, and the book is superior to any other available text at the graduate or undergraduate level. The concise summaries at the end of each chapter are a useful guide to the more important points. Students in the course have found these to be very helpful. The problems, also at the end of each chapter, are pertinent examples of the concepts discussed, although many appear to be too time-consuming for an undergraduate audience. The book is an excellent source of references to thermodynamics and applications to petrology.

I can strongly recommend this book, having used it for a third-year undergraduate geochemistry course. It is most appropriate for physical geochemis-

try courses with an emphasis on thermodynamics and intended for graduate or senior undergraduate students. Researchers in petrologically oriented fields will also find the book useful.

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*AN ATLAS OF HYPERSTEREOGRAMS OF THE FOUR-DIMENSIONAL CRYSTAL CLASSES.* By E.J.W. Whittaker (1985). Published by Clarendon Press, Oxford, U.K. 200 pages. Price: C $81.25.

The theory of four-dimensional crystal symmetry, an obscure concept, has a practical application in the interpretation of modulated crystal-structures, like those of plagioclase and antigorite. The text uses a geometrical approach with limited matrix-algebra to represent the four-dimensional crystal classes rather than the analytical group-theory used by other authors. After dealing with one-, two-, and three-dimensional space, the problem of dealing with four-dimensional space and symmetry, although abstract, is treated by analogy. New symbols are derived for the additional 14 symmetry elements and the 227 four-dimensional crystal classes, of which 44 are enantiomorphic. The crystal classes are discussed in the order of the 23 crystal families, where some families are subdivided to give 33 crystal systems. The geometrical representation is by the use of stereopair drawings, where four-dimensional space may be shown.

The text is short, concise and accurate. The information is developed in a logical manner. The book is well produced with large, clean type. Although the size of the stereopair diagrams is excellent for the crystal classes of low symmetry, the same size makes the interpretation of crystal classes with high symmetry difficult.

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