

about the estimation of the percentage of economic material present, and what the statistical errors are likely to be. In Chapter 3, fractionation of mineral particles is dealt with, and again the discussion is on mineral liberation from loose grain samples. Mineral identification in Chapter 4 should, I think, have come earlier in the book, and it is physical properties that are dealt with here. One wonders, however, why other mineral properties such as lustre, transparency and tenacity have been omitted. Chapters 2, 3, and 4 deal quite briefly with their subjects, but the topics considered, as with all discussion in the book, appear to require a fairly detailed knowledge of mineralogy by the reader. Mistakes, however, are few, but Fig. 5.2c (in Chapter 4) shows a crystal with 3 cleavages (and not two as is stated).

Chapter 5 on the polarising microscope is poor; it reads as a 'primer' for someone who already can use the microscope and understands optical mineralogy. Table 5.2 is a particularly confusing one which summarises 'effects during examination of minerals in crossed polars' and has a column headed *crystal symmetry* which means *crystal system*, and ignores the trigonal system completely (the trigonal system is also ignored in the Appendices); and another column headed *class* under which is listed isotropic, uniaxial and biaxial.

Chapter 6 on the theory of image analysis, and chapter 7 on modern image analysers are very informative, but again very terse, and the amount of information given to the reader on each page is quite great, and in my own case, often unassimilable. Chapter 8 which deals with the interpretation of mineralogical images is an excellent chapter containing many useful data, but again it is rather short, and I would have preferred a much expanded chapter here with many more worked examples.

Chapter 9 deals with the various methods of X-ray analyses—XRD, XRF, X-ray microanalysis, and SEM. The methods are all dealt with briefly, including DTA, but it would be impossible (as with the polarising microscope chapter) to learn how to use these techniques in actual practice from this book.

In chapter 10, the role of mineralogy in mineral processing is summarised, and it is here that the author's view of the role of the book becomes clear. Mineralogical information for the mineral industry can be used to locate and determine the extent of a suitable deposit, control the planning of a mine, control the process testing operations and so on, with many such uses listed.

The appendices comprise a large part of the book, with Appendix 1 dealing with mineral separation, RI determinations, sample preparation for microscope work, point-counting procedures

etc. Appendix 2 discusses a determinative scheme for mineral identification by mainly physical methods and tabulates the main properties of some common minerals with a subsequent division into four mineral groups according to SG values ( $< 2.9$ ;  $> 2.9 < 3.2$ ;  $> 3.2 < 4.2$ ;  $> 4.2$ ). Appendices 3 and 4 give elements, atomic mass and atomic number, and Appendix 5 gives selected minerals in ascending order of their mean atomic number. In Appendix 6 minerals are arranged according to elemental composition 'Al-bearing minerals, Sr-bearing minerals etc.).

The book is expensive and, although a useful compendium of identification techniques and quantitative procedures for the mineral engineer, each process is usually dealt with only briefly and it is doubtful if the book could be used as a laboratory manual. In spite of some of my comments I personally found the text often interesting and informative, and would certainly recommend that our library purchase a copy.

C. D. GRIBBLE

McKie, D. and McKie, C. *Essentials of Crystallography*. Oxford (Blackwell Scientific Publications) 1986. viii + 435 pp. Price: cloth £25.00, limp £12.95.

This book, as the authors explain, is developed from their 1974 book *Crystalline Solids* and thus embodies another decade of experience in actual teaching at Cambridge in an atmosphere with front-line research close to hand. In particular it now includes an important chapter on the electron microscopy of crystals, an area which competes increasingly with traditional X-ray methods but complements them in many ways. Readers are made aware of the possibilities of neutron diffraction and of the synchrotron. There is nothing directly about computing, but it is assumed that readers will be able readily to convert their understanding into programs. Many other topics could have been included and the time has passed when everything necessary could be put into one volume. The exercises (with answers) are about mineral and metallic materials rather than biomolecular. The writing is clear and concrete and not over-mathematised. Altogether the book is a useful text for an M.Sc. in crystallography and an answer to the complaint that protein crystallographers know only how to operate the standard suites of programs. Methods of crystal structure analysis are discussed only in outline.

Altogether it is most useful to have a modern textbook covering the material of orthodox crystallography. After mastering this, one can move

to the problems of disorder, incommensurate structures, transformations, quasi-crystals and computer-intensive crystal structure analysis of proteins, on a secure basis.

A. L. MACKAY

Arem, J. E. *Color encyclopedia of Gemstones* (2nd edition) New York (Van Nostrand Reinhold), 1987. vii + 248 pp. Price £39.95.

The updated edition of this book is as attractive as the first (1977) and with about 30 new species of gemstone added, as well as some new varieties of already established ones, the text is again of considerable importance to the gemmologist.

As before, the gem species are arranged alphabetically, though attention has been paid to the grouping of minerals in families where appropriate. This and other mineralogical matters are lucidly discussed in the preceding chapters, which also include useful explanations of colour measurement and specification. Details of the alteration of colour are specifically omitted, however. I would recommend the early portions of the book as an excellent study of the geology and mineralogy of gemstones.

In the descriptive portion of the book, entries take the same form as before with all important features provided, as well as notes on the commercial significance of the stones. Tables give the properties of some major gemstones which occur in a wide variety of environments, and this makes it easier for the reader to find the details he wants at a glance. Particularly welcome to this reviewer is the continuation of this section into the field of man-made products—the first time that they have received just this kind of well-deserved recognition. They are also illustrated in colour.

It is, of course, the colour pictures which were so great a feature of the previous edition and they are even more beautiful this time round—and there are more of them. All that expert positioning and lighting can do has been done and the specimens thus look their best. It is idle to criticize this as some have, as gemstones are meant to look beautiful and

these superb pictures are completely successful. I recommend readers to look first at the coloured pictures of the manmade stones (bismuth germanium oxide and cadmium sulphide, for example) to see what a manmade product can look like.

There are several lists and tables as well as a bibliography and index. For such a book the price is amazingly reasonable and it will lift the spirit as the stones themselves do.

M. O'DONOGHUE

Woodward, C. and Harding, R. *Gemstones*. London (British Museum [Natural History]), 1987. 60 pp., 150 colour photos. Price £4.95.

This beautifully produced and illustrated booklet features many of the cut and rough stones displayed in the Gemstones Exhibition at the Geological Museum and also some of the fine crystals and cut gems on view in the Mineral Gallery of the British Museum (Natural History), as well as famous gems from other world collections. There is a useful and authoritative text and in addition to the photographs there are several colour diagrams.

R.A.H.

Hoffman, S. J. *Writing Geochemical Reports: Guidelines for Surficial Geochemical Surveys*. Rexdale, Ontario (Assoc. Exploration Geochemists: Special Vol. No. 12), 1986. 29 pp. Price \$ (US) 5.00 or \$ (Cdn) 7.00 including postage (from Assoc. Explor. Geochemists, PO Box 523, Rexdale, Ontario M9W 5L4, Canada).

Too often the report is treated as the final chore needed to complete a project. These guidelines indicate the type of information needed so that others can make an independent and intelligent interpretation of the same geochemical data. This document can also be used before fieldwork begins, to ensure collection of all pertinent facts required for a geochemical report.

R.A.H.