

that needs to be simultaneously collected. The approach adopted in this book is very easily followed, the descriptions being particularly lucid. It is important to build confidence in a student new to mapping as many find the amount of data to be collected together with simultaneous analysis a daunting task. Five chapters of the book deal with the handling of specific features, explaining clearly what procedures to adopt, allowing the student to easily comprehend the observations required in a structurally complex area. The text is thus capable of building the confidence to map such an area. The summary tables at the end of each section which describe what observations have to be made, what to be measured and the results which may be expected from an analysis of the data, are particularly useful.

The way that structural features are explained is very good, and the book can even be considered to form an introduction to some of the more advanced structural texts, as it explains simply many complicated features. The additional reading lists also naturally lead in this direction.

Illustrations are plentiful and have been thoughtfully devised. The only weak point is the way in which some of the photographic illustrations have reproduced, losing some of their detail. However, since it is important that price is kept low this can be excused. Most students probably map in areas of deformed sedimentary rocks, but I feel that a little could have been added (perhaps in the section on polyphase deformation) on gneissose rocks which can pose slightly different problems. However, the author is to be congratulated on producing such an excellent text. The whole range of mapping techniques that an undergraduate student will require are described and the book will still be immense help to post-graduates setting out on their research work. The book represents extremely good value and is thoroughly recommended.

C. R. L. FRIEND

Elliott, I. L. and Smee, B. W., Eds. *Geoexpo/86: Exploration in the North American Cordillera*. Rexdale, Ontario (Association of Exploration Geochemists), 1987. x + 220 pp. Price (Post free from A.E.G., P.O.B. 523, Rexdale, Ontario, M9W 5L4 Canada). \$ Canadian 45.00.

This book contains 22 of the numerous papers presented at a symposium on the theme of exploration in the North American Cordillera, and which was held in Vancouver in May, 1986. The Cordillera has traditionally been important as regards precious metals production and the majority of the papers are naturally concerned with

gold mineralisation, particularly in Alaska, British Columbia, and northwestern U.S.A. There are useful reviews of mineralisation and descriptions of individual deposits in these areas, case histories involving geochemical exploration, and applications of isotopic and fluid inclusion studies to genetic modelling. There are additional papers on such diverse topics as gallium, trace elements in tourmaline, massive sulphides from the Juan de Fuca Ridge, the application of ion chromatography to exploration, and diamond exploration.

This publication is well-produced and constitutes a very useful summary of mineralisation and exploration in the region. It can be recommended for those interested in exploration and mineralisation in the Cordilleran environment and precious metal mineralisation in general.

D. H. M. ALDERTON

Jones, M. P. *Applied Mineralogy: a quantitative approach*. London (Graham & Trotman) 1987. x + 259 pp., 171 figs., 37 tables. Price £45.00 h/b; £19.95 p/b.

The title of the book—*Applied Mineralogy*—hardly gives the potential buyer any real understanding of what its contents are. It is only when the subtitle (*a quantitative approach*) is also included that an estimate of the contents can be made. The book deals with *mineralogy* from the view-point of the mineral engineer, and almost every chapter is geared to this approach. The author describes modern methods for obtaining accurate quantitative data on minerals and mineral products, and the interpretation of such data.

Chapter 1 starts with a general background to minerals in industry and the role of the mineral engineer. Table 1.1 is dated (1982 BGS source) and a more up-to-date one could have been compiled from the *Mining Annual Review*. In Table 1.4 the quality of diamond (as mined) is given as 1 part in 1–10 million parts, but diamond is economic down to 7 carats per 100 tonnes of 1 part in 50 million. In the mineralogical section of this introductory chapter several mistakes or curious omissions occur such as the Al_2SiO_5 minerals being left out of Table 1.5 which deals with commonly occurring polymorphs; the reader is told erroneously that feldspar is 'commonly written *felspar*', and that a modal analysis is given in terms of weight per cent of minerals (Table 1.6). However such mistakes are rare and most of my comment deals with the structure and content of the book itself. Chapter 2 is on sampling procedures and the discussion includes rock core and other forms of sampling rock or orebodies, but the bottom line is usually

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