

perhaps any reader inspired by some aspect of the text would explore his or her interest in bookshops or track it down in libraries via the topic or the personalities listed throughout the text. These are, however, but minor quibbles about a splendidly produced book which will enable a large proportion of the public to understand, appreciate and support highly specialized endeavours at present largely obscured by technical language.

R. R. HARDING

Nancollas, G. N., ed. *Biological Mineralization and Demineralization*. Berlin, Heidelberg, and New York (Springer-Verlag): Life Sciences Report 23, 1982. viii + 417 pp., 105 figs. Price DM 52.00 (US \$23.10).

Although the title of this book suggests matters of interest to Earth Scientists, there are in reality only two papers of marginal interest, except perhaps for very specialized applications (e.g. studies on bone collagen). One is concerned with problems of crystal growth and dissolution which is an interesting theoretical study, some of which is relevant to aspects of diagenesis. The other, concerned in part with the organic matrix of the molluscan shell, is of limited interest to palaeontologists.

J. FERGUSON

Bates, R. L. and Jackson, J. A. *Our Modern Stone Age*. Oxford (W. H. Freeman), 1982. viii + 136 pp., 134 figs. Price £13.30.

Those who know Bob Bates as the author of the only student textbook on Industrial Minerals, and as the witty author of the back page of *Geotimes*, will not be surprised that he has combined these talents to produce a readable and informative book on his favourite subject. It is also a much-needed book; industrial minerals do not have the glamour of gems, nor the metallic attraction of ores, but our whole industrial society is dependent upon them. This needed saying, and Professor Bates and Julia Jackson have said it effectively and forcefully.

The book begins with a startling demonstration of the dependence of everyone in the industrial world on minerals by pointing out that consumption averages 11 tons annually for each US citizen. He introduces his subject by showing which of those minerals preponderates. Then follows a series of sections on individual mineral substances, starting with limestone, through salt, sand, clays, to diamonds. In doing so there are sections on transport ('Rocks en route') and mineral processing ('The Dissassembly Line'), and the reader is introduced to these matters with great skill. The variety of uses to which each mineral is put is also spelt out. In the

process of this description, we are introduced to a wide range of topics—thus in describing silica sand we are given a brief summary of the palaeogeography of the North American Ordovician; even palaeontology gets a showing (in relation to Devonian limestones and diatomites).

When we reach Florida Phosphates and Canadian Asbestos ('Two Industries with Problems') the serious purpose of the book is revealed, and we begin a careful and well-balanced discussion of the environmental problems of the minerals industry—and in 'Blast it Out and Break it Up (But Not in My Neighbourhood)' the theme is developed. The fundamental conflict between the citizen who needs minerals to live, and that same citizen who does not want to be inconvenienced by their extraction, transport or processing is illustrated by a wealth of examples. The tone of the discussion is always moderate and reasoned; but the message is clear and forceful—a proper balance needs to be struck, and the means to achieve that balance are so far a notable failure.

This is a 'popular' book, in the sense that it could be read with pleasure and profit by any intelligent 12-year-old; but I would like to make it required reading for any cabinet minister, chief executive or chief planning officer who is concerned with minerals. From this side of the Atlantic, the fact that the majority of the examples are North American is a disadvantage. But if some are tempted to say that we order things better here, then any one in the industry could rapidly disillusion them.

In addition to the single purpose of the book, it is remarkable for the amount of information, on an enormous range of subjects, that is contained within a mere 135 pages. Add to that a series of informative, clear diagrams and photographs which properly illustrate the text, and you have a book which is indeed a triumph.

J. E. PRENTICE

Best, M. G. *Igneous and Metamorphic Petrology*. San Francisco and Oxford (W. H. Freeman), 1982. xx + 630 pp., 453 figs. Price £20.95.

For many years now those of us involved in the teaching of petrology have been acutely aware of the lack of a really good modern textbook on igneous and metamorphic petrology suitable for senior undergraduate courses. Most existing texts were either introductory and suitable only for first-year students or so advanced as to be of use only to postgraduates. The last few years have seen the publication of a number of textbooks on igneous and/or metamorphic petrology in attempts to rectify this situation, but the various authors, approaches adopted, and degrees of success have

served mainly to demonstrate how difficult it is to write a comprehensive text on 'hard rock' petrology embracing modern concepts yet pitched at a suitable level for undergraduates. This new book by Best successfully integrates fundamental principles, classic field and petrographic approaches with modern theoretical, experimental, and geotectonic concepts, and the author is to be congratulated for producing what is, despite the minor criticisms mentioned below, possibly the best undergraduate text on petrology for over twenty years. It is clearly the result of a great deal of careful thought, painstaking attention to detail and dedication to undergraduate teaching.

An opening chapter covering such fundamentals as thermodynamics (at a level suitable for *geology* undergraduates), classification of rocks and plate tectonics, introduces the rest of the book which consists of four parts, namely, (I) Magmatic Rock Bodies; (II) Magmatic Systems; (III) Metamorphic Bodies and Systems; and (IV) The Early History of the Earth and other Planetary Bodies.

Part I is strongly biased towards calc-alkaline rocks with more pages devoted to calc-alkaline volcanics and plutonic bodies than all other igneous types together. Particularly noticeable in contrast is the rather restricted treatment of alkaline rocks with its tendency to concentrate on topics such as the nephelinite-carbonatite association and kimberlites at the expense of more abundant rocks such as alkali olivine basalts. The author wisely 'soft pedals' on the complex nomenclature of alkaline rocks, but the inclusion of 'madupite' on the one hand and no mention of 'teschenite' on the other will seem strange to petrologists outside the USA. In treating individual topics the author generally shows an excellent sense of proportion, providing adequate explanations but resisting the temptation to become over-involved in interesting and currently fashionable subjects; the treatment of ophiolites is a good example of this. More conservative petrologists, however, may find the treatment afforded to layered intrusions rather sparse and the absence of high-alumina basalt as a magma type might puzzle others.

The section dealing with Magmatic Systems (part II) is comprehensive and the author is to be commended for the way in which quite complex aspects of the physics and chemistry of magmas (including the cooling of magmatic bodies, kinetics, nucleation and crystal growth, constitutional supercooling, and phase equilibria) are explained lucidly with only the minimum recourse to the mathematics and long formulae guaranteed to cause panic in all but the most numerate of geology undergraduates. The concluding chapter of this section, on Magma Generation, Diversification

and Ascent, provides an excellent state of the art review.

In part III, as in the preceding parts, emphasis is placed on the processes involved in the formation of rocks rather than on detailed accounts of field relations and petrography. The author correctly considers that the understanding of processes furnishes students with a better basis for the interpretation of metamorphic rocks than the knowledge provided by sterile descriptions of the rocks themselves. Perhaps, however, he can be faulted for pursuing this approach too far in that Chapter 12 (Field Relations of Metamorphic Bodies) is of rather meagre proportions, omitting, for example, descriptions of metamorphic terrains with granulites or Group B eclogites. The great strength of the author's approach however, is that in emphasizing the intimate association between different metamorphic regimes and lithospheric plate boundaries he stresses the importance of geophysical and tectonic studies to interpretative metamorphic petrology. The chapters on the origins of fabric and mineralogical and chemical aspects of metamorphic systems provide particularly good treatments of intrinsically difficult topics.

The inclusion of a section on the Early History of the Earth and Other Planetary Bodies (part IV) seems to be rather extending the scope of the title of the book, and it is of this section that most readers are likely to be critical. While the author's discussion of this subject is certainly thought-provoking, it is understandably rather speculative. Some of the topics considered, such as the significance of trace element and isotope data to the interpretation of the evolution of the mantle are fairly sophisticated and seem rather out of place in a text which is pitched (so successfully throughout the rest of the book) at the senior undergraduate level. However, we prefer to take the view that this section should be regarded simply as a 'bonus' and should not be allowed to detract from an otherwise outstanding textbook.

Throughout the book fundamental principles and concepts are explained in an exceptionally lucid manner and particularly good use is made of beautifully drawn diagrams with extensive, self-contained captions to put over quite complex ideas, for example the explanation of Rb/Sr isotope systematics on pp. 57-9. Throughout the text definitions of key terms (set in heavy type) are skilfully introduced while extensive use is made of 'boxes' to explain concepts mentioned in the main text, e.g. Geothermal gradients or Chemical potential. The book is remarkably free from printing errors and mistakes, but it is unfortunate that some of the few present could lead to confusion, such as two or three >'s which should be <'s and the definition of

a peralkaline rock as one with  $(\text{Na}_2\text{O} + \text{K}_2\text{O}) > \text{H}_2\text{O}$  (p. 218). The only general criticism of the book might be that there is an over-emphasis on North American examples, especially of igneous bodies, and the absence of several classic metamorphic examples from the Alps, Scandinavia, Scotland, and central Europe is regrettable. Inevitably, the very strength of this text—its emphasis on current ideas and state of the art review—will lead it to becoming dated much more rapidly than its more descriptive predecessors, but we have no hesitation in recommending this extremely good modern text to all serious students of petrology.

D. A. CARSWELL  
F. G. F. GIBB

Picot, P. and Johan, Z. *Atlas of Ore Minerals*. Orleans (BRGM) and Amsterdam (Elsevier Sci. Publ. Co.), 1982. 458 pp., 335 pls. (227 in colour). Price 920.00 FF (US \$170).

This is a translation of the original French text (1977). Like the original, it is remarkable for the many high-quality colour photographs taken in reflected light under crossed nicols and reproduced here with startling clarity. The bibliography is brief (nine items), the authors' intention being to group together homogeneous data based solely on personal observations and measurements, avoiding compilation of inconsistent information. Thus the reflectivity measurements which accompany the descriptions of most species have all been obtained under identical operating conditions and the identities of all the minerals have been checked by X-ray or by electron microprobe.

The first part of the book is devoted to the importance of a metallographic study, the preparation of polished sections and the techniques of observations in reflected light. Some common parageneses are listed and there are numerous tables of reflectances, colour, polarization colour, internal reflections, twinning, minerals tending to euhedral shape, etc., and a determinative table for the main Pb, Bi, Cu, Ag(Sn) sulphides and sulphosalts. This is followed by a useful summary of procedures to be followed in reflected light observations, and with fifty-four black-and-white photomicrographs showing various textures.

The second part mainly consists of mineral descriptions, 369 species being listed in alphabetical order (except some twenty minerals new since the French edition, which are grouped at the end of this section). Here the emphasis is placed on the importance of chromatic phenomena under crossed nicols in determining opaque minerals; 225 colour photographs are included and represent the first serious use of this medium. Under each mineral,

one of the longest entries is the paragraph 'criteria of determination' in which distinguishing features and comparisons with other species are given. X-ray cell parameters and XRD powder reflections are also listed but at the end of the book the five strongest lines of all the minerals described are listed and conveniently divided into fifty-eight groups by strongest line, the minerals being listed in decreasing order of the second strongest line.

The text of the first part refers to plane-polarized light and polarization colours under crossed nicols, but there is some incipient confusion in that the captions to the photographs describe conditions of observation as OL or PL. However, this is not a book destined for library shelves; it is a laboratory manual for use at the bench, and as such any minor uncertainties will soon be clarified. In their preface the authors state that their hope is that the book will 'seem easy enough for beginners, sufficiently elaborate for experts and finally, clear and appealing enough to be used by all': they have surely succeeded brilliantly in these aims. It is unfortunate that the five years between publication of the French and English editions has led to a price increase of more than 265 per cent.

However, the three main strengths of this magnificent work—reflected light colour photographs, data from personal observations, and use of carefully checked specimens—make it an essential tool for all concerned with studying, or teaching, reflected light microscopy of ore minerals.

R. A. HOWIE

Howarth, R. J. *Handbook of Exploration Geochemistry, Vol. 2: Statistics and Data Analysis in Geochemical Prospecting*. Amsterdam and New York (Elsevier Sci. Publ. Co.), 1982. xiv + 438 pp. Price Dfl. 235.00 (US \$100.00).

One of the natural consequences of improved geochemical analytical facilities has been the voluminous generation of analytical data. Because geochemists (particularly those engaged in mineral exploration) have traditionally avoided using elaborate interpretative techniques and have relied on the more empirical approaches, the full potential of these data has not always been fully realized. This text aims to correct this tendency by introducing the various techniques of data analysis that can be used to extract as much information as possible from a geochemical exploration programme. As the series editor states in the foreword, 'The processing and interpretation of geochemical data is one of the most difficult—and one of the most important—stages in the successful application of exploration geochemistry.'

The text has been divided into two parts. The first