

when new topics are introduced, the fact is noted. Inspection of the contents list reveals that although most chapters have increased in length by around fourteen pages, three have enjoyed considerably greater expansion. They are: The Secondary Environment (56 pp.); Primary Distribution (32 pp.); and Analytical Methods (26 pp.). There is a new appendix listing geochemical characteristics of selected elements modelled on one originally presented by Hawkes and Webb in 1962. Basic information on average abundancies in different rock types, soils, and surface waters; on geochemical associations; on element mobilities in primary and secondary environments; and on geochemical barriers are given for more than thirty, mostly trace, elements.

A major new source of material available to the author is the translated text of *Beus and Grigorian* (1977) in which Soviet ideas and experiences as applied to the primary environment are emphasized. Basic concepts behind the techniques used in the USSR for recognizing and interpreting primary halos and the primary distribution of elements, largely based on the idea of hydrothermal zoning, are incorporated in Chapter 2A, while application of these concepts to mineral exploration is discussed in Chapter 7A. This Chapter includes a new topic of eleven pages on litho-geochemistry in the Soviet Union containing some interesting practical details. An impression of the flavour of the Russian influence can be gained from consideration of the re-definition of geochemical provinces from 'relatively large, well-defined areas of the Earth's crust that have a distinctive chemical composition' to the more rigorous 'large-scale crustal units characterized by common features of geological and geochemical evolution expressed in the chemical composition of the constituent geological complexes (formations), as well as in the endogenic and exogenic metalliferous and non-metalliferous concentrations of the chemical elements'.

Notwithstanding an increased emphasis on the primary environment, the secondary environment continues to be of most importance to exploration geochemists and this is reflected in the large amount of new material presented under this heading. In addition to expansion of first edition sections, there are new topics on arid environments and mobility of uranium and its daughter nuclides in the secondary environment. The author has done his best with the first of these in the face of a paucity of published work, and in respect of the second, has produced an admirably succinct account of a subject with a voluminous literature.

As indicated previously, analytical methods receive a good deal of attention. In the introduction

and section on general principles, progress in high-productivity, multi-element analysis, and the importance of error control are discussed in some detail. Almost all the individual analytical methods described in the first edition are brought up-to-date, atomic absorption spectrophotometry, for instance, with a useful account of the development and application of the heated graphite furnace. Several new topics are introduced including neutron activation analysis, charged particle track analysis, and plasma emission spectrometry. (On a point of nomenclature, it might be better to reserve the word 'spectrograph' for an instrument in which a spectrum is recorded on a photographic plate and to employ 'spectrometer' where measurement by some form of electronic measuring device is used). This chapter constitutes a well-balanced account of the current analytical scene with no significant omissions.

The 1980 Addendum will be welcomed by all who use the first edition of this book. Prospective purchasers who do not own a copy of the latter would do well to obtain the second edition, combining the first edition and the Addendum. It is well-bound but not unwieldy—for all its nine hundred plus pages, and is a mine of information presented in a clear and interesting style. Illustrations and tables are abundant and clear. It is highly recommended to everyone with an interest in exploration geochemistry.

Beus A. A. and Grigorian S. V. (1977). *Geochemical Exploration Methods for Mineral Deposits*.

P. J. MOORE

MacKenzie (W. S.) and Guilford (C.). *Atlas of rock-forming minerals in thin section*. London (Longman), 1980. vi+98 pp., 228 colour photographs. Price £6.95.

Here is the excellent pedagogical innovation of a set of annotated superb high quality colour photographs of thin sections of minerals as seen under a petrological microscope in plane polarized light and under crossed polars. It is intended to illustrate and supplement *An introduction to the Rock-forming Minerals* by W. A. Deer, R. A. Howie, and J. Zussman. The photographs are so good that they really will help the average student and the volume undoubtedly fulfils its primary purpose as a laboratory manual. Most illustrations of minerals in thin sections, whether in journals or books, are so atrocious that no one who did not already know the appearance of a mineral could rely on the picture to identify the same mineral in another thin section. These photographs are excellent.

However, the book has the mark of a first edition and a number of improvements can easily be

suggested. (1) Cross-referencing could be introduced so that when a mineral also occurs in another illustration this could be drawn to the reader's attention. Thus nearly half the view depicting anthophyllite shows typical cordierite but no reference is made to this under cordierite. (2) Much more emphasis should be given to diagnostic or special features. Thus to a student colourless (or even slightly pleochroic) andalusite and orthopyroxene are readily confused; both have two cleavages apparently at right angles, both have low birefringence, straight extinction, and they have similar forms. Why not point out that the length-fast and length-slow nature of side sections is diagnostic? Muscovite and talc are effectively indistinguishable by a student. Why not point this out? Although the possible confusion of lamellar-twinned cordierite with plagioclase is pointed out, the fact that the lamellar twinning in cordierite rarely extends across the whole grain is not mentioned although two photographs clearly show this. (3) About two-thirds of the pages could have accommodated double the number of views with only slight re-arrangement of the layout and with the variety to be found in minerals this would give better value to the student. To be fair, several minerals are allocated more than one page, melilite for instance with five views is particularly well done. Despite four views of cordierite, none contains a sector twinned specimen and aragonite is not included in the book. (4) The decision not to show straight extinction pleochroic minerals parallel or perpendicular to the polarizer (because such crystals will be in extinction under crossed polars) is often unfortunate because the maximum diagnostic colour and its direction are not always clear, e.g. the normal deep absorption of tourmaline in the 'vertical' position distinguishes it from most other common coloured minerals but to explain this involves the authors in a long explanation which will not be readily followed by elementary students. Perhaps some grains could have been shown in varying positions from 'horizontal' to 'vertical'—a section of radiating tourmaline for instance?

Other points that came to my attention were the lack of baryte, gypsum or anhydrite (surely commoner than yoderite or astrophyllite, which is not shown in the usual needle-shaped crystals but in irregular shapeless crystals with two nearly identical views in plane polarized light?). I thought the sapphirine lacked its commonest violet-blue colour, orthite frequently has a very low birefringence due to metamict decay, the apatite was rather poor and the rutile distinctly atypical and lacking its diagnostic golden-brown colour.

However, I suspect that the writers did not find

it easy to obtain every thin section as they would have wished and the above points are suggestions for possible improvements. The book is strongly recommended for student use and is good value at a modest price.

B. E. LEAKE

Augustithis (S. S.). *Atlas of the Textural Patterns of Basic and Ultrabasic Rocks and their Genetic Significance*. Berlin (W. de Gruyter), 1979. x + 107 pp., 733 photographs, 47 figs. Price DM 255.

The title of this book suggests that it is a comprehensive treatment of the petrographic features of basic and ultrabasic rocks. On the contrary, it consists of thirty-four chapters (1–5 pages long) on more or less unrelated topics, followed by 264 pages of illustrations, mainly photomicrographs. Many of the chapters are centred on a single, often obscure, example, which is frequently drawn from works by the author or Drescher-Kaden, and ignores better known examples. Among the worst instances of this are Chapter 2 (Metasomatic Transformations of Marbles), which discusses only an example from Trivena, and Chapter 5 (Eclogites and Eclogites) which is a very narrow and unbalanced account illustrated by thirty-eight photographs, of which thirty-seven are of 'eclogites' from Galicia. Indeed, the lack of omphacite (no clinopyroxene is mentioned in the text) and the spessartinic nature of the garnet casts doubt on the validity of these as examples of eclogite. The bias in the selection of examples, however, pales into insignificance compared to that in the interpretations of the rocks; in short, the author seems to have set out to prove that as many basic and ultrabasic rocks as possible are of non-magmatic origin. Inevitably, such a biased viewpoint leads to suggestions which are totally unacceptable to most petrologists.

The philosophy behind the book seems to be summed up by the statement in the Preface that 'the recognition of textural patterns is... genetically more important than... mineralogical or chemical criteria...'. The folly of this approach is exposed time and again in the text: for example, in Chapter 4 what are obviously (igneous) dykes of hornblende in the Seriphos granite are interpreted as metamorphosed vein-form xenoliths of country rock while in Chapter 11 features from undoubtedly magmatic lamprophyre dykes are described as 'blastogenic textural patterns'.

Several chapters are wholly or partly devoted to the hypothesis that the plutonic gabbros, norites, troctolites, etc. (Chapters 7, 8, 9), including those of layered complexes (Chapters 14, 15, 16) such as