

BOOK REVIEWS

Deer, W. A., Howie, R. A. and Zussman, J. *An Introduction to the Rock-Forming Minerals*, 2nd edition. London (Longman Scientific & Technical), 1992. xvi + 696 pp. Price £21.99

This is the eagerly awaited, revised and modernized second edition of what we often call 'the student version of DHZ', Deer, Howie and Zussman's famous reference work on the common minerals, as familiar to petrologists and mineralogists as the Yellow Pages are to the home-owner. This new version certainly looks a lot cheerier than the first edition; with a brightly coloured micrograph on the cover and fashionable designer lettering it reminded me faintly of a mail-order catalogue. Will the inside be radically different, I wondered, or will it all be reassuringly familiar?

The new edition is bigger than the first, and about half as thick again, with nearly 700 pages. Some of this increase is taken up by a large and more readable type-face, but there are considerable changes and extensions to the coverage of most mineral species. To balance these, datolite, rosenbuschite, l avenite, catapleiite and the helvite group have been sacrificed. As before, many of the minerals covered are not, strictly speaking, rock-formers, and some rare but genuinely rock-forming minerals, like naujakasite, are missed. Nevertheless, the coverage is comprehensive and includes the vast majority of minerals petrologists are likely to encounter.

Although more modern in appearance, the general layout within is just like the first edition. There is the familiar drawing of the crystal morphology and optical orientation. The drawings seem to be generally the same, although the lettering has been tidied-up. The *x* crystallographic axis in the drawings of optical orientation of plagioclase, Fig. 161, is still not drawn parallel to the edge between (001) and (010), a modest error which makes a useful teaching aid. Each mineral group is headed, as before, with a list of important optical and physical properties but this has been made clearer by listing the end members of solid solution series separately. A useful addition is a tabulation of cell dimensions, formula units per unit cell and space group. It is a pity that the authors of such an influential text did not bite-the-bullet and relegate the   to history,

along with rods, poles and perches, and unfortunate that the kbar lives on as the unit of pressure. The tables of chemical analyses and formulae, so valuable for probe users who have found that the subject of their endeavours was not the phase they thought it was, remain all properly referenced. Sections on distinguishing features and paragenesis are present as before. There is some increase in the number of references at the end of each section, with the inclusion of review articles where appropriate, and the source of figures is given in the captions.

Rather than read the whole book (I hope that readers would not expect the reviewer to do this) it seemed more useful to concentrate on certain important groups and highlight the changes. I chose olivine, pyroxene and feldspar, together with cordierite as an example of a less common but interesting mineral. Olivine takes up 3 more pages in the new work, but tephroite is no longer listed as a separate mineral. The text has been largely rewritten, and more detail is given: for example, instead of a bald statement that composition can be obtained from X-ray diffraction measurements, we now have an equation for the relationship between d_{130} and composition. Although Bragg and Brown's classic 1926 drawing of the structure remains, a more modern polyhedral treatment, due to Hazen (1976), also appears. There are many more phase diagrams—Bowen and Schairer's (1935) diagram for the join $\text{SiO}_2\text{--MgO}$ at 1 atm, the sole phase diagram in the 1966 version, is replaced by a polybaric diagram for the forsterite–enstatite–silica part of the join, from Chen and Presnall (1975) and there are new diagrams too, for the olivine–spinel reaction up to high pressures, the dry hydrous melting of forsterite, and the low-temperature reaction olivine + water = chrysotile + brucite. The paragenesis section, while covering the same ground, is completely rewritten. There are more references (7), including one published in 1989, and the reference list is clearly designed to cover a range of geological settings for olivine.

The treatment of pyroxenes had gone up from 36 to 60 pages. It starts as before, with an introductory section. The nomenclature adopted for quadrilateral pyroxenes is the widely ignored 'official' one of Morimoto (1988) which leads to calcium-rich clinopyroxenes from ultrabasic rocks

to ferrosyenites all being called augite. This may be structurally sound but it does not provide a useful naming system for petrologists, and I shall continue to use the Poldervaart and Hess terms from the first edition. DHZ appear to agree tacitly with this because in the main treatment of clinopyroxenes 'augite-ferroaugite' appears as a heading, although they seem to omit to tell the reader where the limits of the subdivision lie. The Morimoto scheme for assigning captions to sites is given, but there is no discussion of the best way to deal with the common practical problem of incomplete analyses where $\text{Fe}^{2+}/\text{Fe}^{3+}$ is not obtained [see p. 681—Ed.]. Eighteen analyses of pyroxenes are given, many different to those in the first edition.

The more detailed sub-sections on pyroxene are divided essentially as before, except that omphacite gets a separate section which includes a summary of Carpenter's (1980) phase equilibrium relationships between jadeite and augite. As in the treatment of olivine, there is considerably more use of phase diagrams, and these are up-to-date. Lindsley's (1983) phase diagrams for quadrilateral pyroxenes are given, but not in a form which makes them easily usable as a geothermometer. A simplified version of the two-pyroxene thermometer is given, due to Saxena (1968 and 1986), which contains no way of testing whether a two-pyroxene pair is actually in equilibrium. There are several bits of material relevant to two-pyroxene thermometry divided rather randomly between the orthopyroxene and diopside-hedenbergite sections and it would have been better to have treated this in the introduction or in one or other section. The custom of using literature diagrams rather than diagrams purpose-designed for teaching, leads to some missed chances and some oddities: why, for example, are the two sections of the pyroxene solvus forming Fig. 66 printed as *mirror images*, with different temperature scales and without any attempt to draw attention to the petrologically important fact that the crest of the pyroxene solvus moves to much lower temperature as Fe increases? As it has always been, DHZ is pre-eminently a mineral data book, rather than a book designed for teaching mineralogical principles at undergraduate level.

Feldspar receives 65 pages and differs a little in style from the rest of the work because the authors have not had their own extended volume on which to base the 'student' treatment. Although a good deal of basic material from the first edition has been retained, they have relied on Smith and Brown's (1988) '*Feldspar Minerals*' and on a 1989 Min. Mag. review by Brown and the

writer for much of the updating. Use of the latter had led to a curious inconsistency of treatment with the rest of the book, because our review was concerned both with phase equilibria and phase *behaviour* in alkali feldspars. Thus the concepts of coherent and strain-free solvi are introduced here, and the student could be led to believe that the different types of exsolution are unique to feldspars—they get no mention in the pyroxene section, for example. Having embarked on this course of action, I'm not sure that the authors provide explanations that students will find easy to follow. On p. 403, for example, the strain-free solvus is said to be 'appropriate for an ideal match of crystal structures across the two-phase interfaces'. If anything, it is the mismatch of the structure that is perfect, and the critical factor is the completely discontinuous character of the interface. There is also, in the following paragraph, a confusing statement that 'alkali feldspars quenched from temperatures above the high albite-monalbite inversion will be monoclinic and those quenched from lower temperatures will be triclinic'. In fact alkali feldspars more albitic than about $\text{Ab}_{63}\text{Or}_{37}$ will be triclinic at room temperature whatever their thermal history—monoclinic albite-rich feldspars are non-querchable. I feel that the authors have been less than clear in their treatment of alkali feldspars because they have continued Tuttle and Bowen's early concept of discrete 'high', 'intermediate' and 'low' temperature solid solution series whereas the modern view is of a continuum. They thus equate cryptoperthite with rapid cooling and framework disorder when in fact fully ordered low albite-low microcline cryptoperthites have been described from very slowly cooled rocks. The presence or absence of aqueous fluids in the appropriate temperature range is the most important factor controlling the structure and microtexture of feldspars in rocks and although the authors treat this in the paragenesis section (p. 427) it has not been connected effectively to the earlier phase equilibrium section. The Fuhrman and Lindsley (1988) two-feldspar thermometer is treated in the form of solvus isotherms (enough to give minimum crystallisation temperatures only) and would have been more useful and comprehensible had some examples of two-feldspar tie-lines been given. Nevertheless, despite these minor shortcomings, there is no doubt that the DHZ treatment of feldspar is well up to date compared with most of the competition at an undergraduate level. A number of exsolution textures are illustrated in a central section of half-tone plates, together with micrographs of some other minerals and a two-colour projection of the feldspar structure.

The first changes in the cordierite section which struck me were that 'nH₂O' is now part of the molecular formula, and that the optic axial plane is now parallel to (010) whereas in 1966 it was parallel to (100). No explanation for this mysterious transposition is offered: demonstrators pinned to the wall by puzzled students will find that there is an explanation, of sorts, in Vol 1B of the multi-volume DHZ. Although cordierite is placed in the book with ring silicates, the authors point out that it is really a framework silicate, as its optical properties, imply. The new structure drawing (from Cohen *et al.*, 1977) is much easier to understand than the one given in the first edition. As for many mineral species new analyses are given, with one carried forward from the earlier edition, and the drawings of complex twinning are much clearer. The section on chemistry is considerably expanded, with a *P-T* diagram for KMAH and several more reactions involving cordierite discussed. Like most other sections there are more references, and these have in some cases a review character.

The book has three appendices. The first two are from the first edition: examples of how chemical formulae can be calculated from mineral analyses, and a table of molecular weights. A new appendix explains how molecular percentages of end member components in solid solutions can be calculated from chemical analyses. A final addition, inside the back cover, is a coloured Michel-Levy birefringence chart.

The new edition represents an almost complete rewrite of its predecessor. Connections with the first edition are little more than a ghost stratigraphy and the authors have done a magnificent job of revising and updating all the important minerals. While it is possible to quibble about details there is no doubt at all that the new edition maintains the 'student' DHZ as the most authoritative compact mineralogy reference work for undergraduate and postgraduate use. The substantial changes are all improvements, and perhaps the only aspect of modern mineralogy conspicuously absent is any treatment of mineral thermodynamics. The price is realistic and (for once) not so great that students will find it out of reach. For knowledge content and applications this is probably one of the best value Earth Science books around. The authors deserve our heartfelt thanks for the immense amount of work that has gone into producing it and its multi-volume parents. It is certain to be a familiar sight on laboratory benches for many years to come, and deservedly so.

I. PARSONS

Clarke, D. B. *Granitoid rocks*. London (Chapman and Hall), 1992. 283 pp. Price £24.95.

The literature on granitic rocks is now so vast, and the techniques used to study them so varied, that it is difficult even for a specialist to see the wood for the trees. The author of this book has succeeded remarkably well in covering the present state of granitology in such a concise review, or, to use his own analogy, in distilling a batholithic amount of information into a book of aplitic proportions.

His approach has been to take each type or method of investigation—field, mineralogical, geochemical, isotopic—and describe what information it has provided or could provide on the origin of granitic rocks. Every chapter is full of interest, and is supported by a lengthy and up to date bibliography. The first chapter sets out the many ways of classifying granitic rocks and discussed the merits and limitations of the alphabetic (S and I) classification. This is followed by a chapter on field relations which is somewhat less satisfactory than the rest of the book; it does not say enough about the composite nature of granitic intrusions and the difference between plutons and batholiths. There are excellent chapters on mineralogy, geochemistry and experimental petrology which are a mine of information and ideas. There is a welcome discussion on economic geology, which is a useful reminder to igneous petrologists that hydrothermal processes are an integral part of the granite story. Finally there are case studies of some contrasting granitic suites, and a very valuable bibliography.

A great virtue of this book is its consistency of purpose. It is written from beginning to end as a guide to the new researcher, setting out what is known already and what can be achieved. It is not written primarily for undergraduate students, nor is it bogged down in the sort of detail that might be found in a research monograph. It is consistently well written, its brevity and lucidity making a real contribution to the understanding of a complex subject. It comes as close as is possible to providing a complete state-of-the-art review of granite studies. For both new research students and experienced specialists alike this book is excellent value for money.

A. HALL

Mason, B. *Victor Moritz Goldschmidt: Father of Modern Geochemistry*. Geochemical Society Special Publication no. 4, 184 pp 1992.

A fascinating biography of the most influential scientist in the sphere of geochemistry. It chron-