the stability of tourmaline, are both considered in detail, with reference to experimental products as well as natural systems. Dingwell, Pichavant and Holtz review experimental data concerning the behaviour of boron within granitic melts, providing information about its influence on the physical properties (such as viscosity and density) and chemical properties of granitic melts, mostly from studies of synthetic systems.

Two very substantial reviews follow. Grew reviews the occurrence of around 15 borosilicates (excluding tourmaline) in metamorphic environments. He gives optical properties, chemical analyses and details of occurrences, including associated mineral assemblages. Estimates for the stability limits ($P-T$) for kornerupine, dumortierite and grandidierite are given, together with consideration of the extent and impact of B substitution in other silicates. Henry and Dutrow provide a long chapter on tourmaline in metamorphic environments, detailing the common tourmaline species and their solid solutions, and giving substantial compositional data (including trace elements). Sources of data are well tabulated.

Slack's chapter on tourmaline in hydrothermal environments starts with the field description of typical associations which may be varied in type (as in granites), veins as in volcanic and metamorphic rocks, stratabound or as tourmalinites. Key major element compositional data are presented, together with isotope data.

Moving on to more general geochemical topics, Leeman and Sisson review the geochemistry of boron and how that impinges on crustal and magmatic processes. This chapter includes a summary of data for B in standard rock reference materials, and looks at the global distribution and fluxes of boron. There is a brief overview of the analytical methods used to determine boron in rocks. Palmer and Swihart discuss boron isotope geochemistry, from fractionation through to examples of occurrences for which data are available, and their interpretation. Both chapters bear on cosmochemistry, and provide an introduction to Shaw's comparison of the behaviour of boron in lunar and terrestrial systems. The absence of water on the Moon has most influence; there, boron behaves entirely as an incompatible element, in marked contrast to its behaviour on Earth.

The book finishes with five chapters on instrumental methods of investigating boron in geological materials. McGee and Anovitz focus on electron microprobe methods, working on the basis that any probe worth its salt (nowadays) will be able to determine boron directly. The chapter provides valuable insights into the problems which are specific to the determination of boron. Hervig provides an account of use the of the ion probe, comparing the use of different instruments around the world, with good tabulation of data sources. Nuclear methods (particle induced gamma emission, prompt gamma neutron activation, fast neutron activation) are described in detail by Robertson and Dyar, and EELS methods are described by Garvie and Buseck. Finally, application of mass spectrometry in the investigation of boron is reviewed by Swihart.

As far as production is concerned, the book suffers from poor printing quality, with blurring of the type face in some places, and an abundance of fine print which is not easy to read. A missing figure is supplied for a scissors and paste insertion into the right place.

This is, overall, a book with something for everyone with an interest in boron and its minerals. Those interested in boron deposits associated with volcanic rocks, such as the Turkish calcium borate mineral deposits, might well be disappointed, and there is no special attention paid to the aqueous geochemistry of boron. The editors are well aware of the book's limitations, and it could well have become unmanageably large. As it is, it is difficult to take in all that the book has to offer without settling down to use it, with students, over a period of time. I have no doubt that this will be one of the most useful Reviews in Mineralogy; it is unlikely that any attempt will be made to provide such an extensive summary of the geochemistry, mineralogy and petrology of boron for many years to come. D.A.C. MANNING

Deer, W.A., Howie, R.A. and Zussman, J. *Rock-Forming Minerals*, Vol. 2B, *Double-Chain Silicates* (2nd Edition). London (The Geological Society). 1997, xii + 764 pp. Price £99 (US$165), Geol. Soc. and Min. Soc. members £50 (US$83). ISBN 1-897799-77-2.

Here is the long awaited DHZ volume 2B on amphiboles, 764 pages packed with information, 400 figures over 500 chemical analyses of amphiboles, nearly 3000 references — the calcic amphiboles alone have 63 closely packed pages of references, amounting to almost 1700 items — indeed a summary of almost everything known about amphiboles up to 1996, and at a bargain price.

The format follows that now well established: an opening page for each mineral group with a summarized chemical formula, the optical and physical properties, the space group and cell size

information and a sketch of an idealized crystal; then subsequent pages deal with the structure, chemistry, experimental syntheses, breakdown and stability of the mineral under widely varying P, T, p_{H_2O}, f_{O_2}, etc. conditions, optical and physical properties, distinguishing features and paragenesis. Particularly valuable are the extended and perceptive summaries of the parageneses and the extensive listing of the chemical analyses of the minerals concerned. A most attractive and exceptionally durable outside to the book displays lilac glaucophane in thin section. There is no loose, separate jacket to become dilapidated with the considerable use this book will receive from mineralogists and petrologists.

The flavour is well represented by the hornblende (*sensu lato*) section. This includes all the calcic amphiboles except tremolite, actinolite, ferro-actinolite, kaersutite, ferrokaersutite and joesmithite which are described separately. The section opens with the introduction, 2 pages; structure 4 pages; chemistry 54 pages with 210 analysed amphiboles plus 16 *REE*-analysed amphiboles, partition coefficients and rare-gas controls; experimental syntheses (or inability to synthesize!) 24 pages, including hornblende–tschermakite, edenite, pargasite, magnesiohastingsite and their iron end-members; phase relations in natural rocks 29 pages, dealing with basic igneous rocks, amphibolites, tonalites (widely interpreted), alteration and weathering; co-existing calcic amphiboles and other phases 39 pages which successively considers the association of calcic amphibole with calcic amphibole, Fe–Mg amphibole, biotite, pyroxenes, plagioclase, garnet, chlorite, epidote and liquids; geothermobarometry 13 pages; Ar–Ar geochronology 13 pages; optical and physical properties 22 pages including Mössbauer, infra-red and MAS NMR spectra, natural and experimental deformation; distinguishing features 1 page; paragenesis 121 pages of great interest to petrologists, with igneous rocks being divided into acid, intermediate, basic, ultrabasic, alkaline, volcanic, xenoliths and megacrysts, skarns, pegmatites and veins, coronas and symplectites including oxide and eclogitic coronas, while metamorphic rocks are subdivided into greenschist, lower amphibolite, amphibolite, granulites and eclogite facies with retrogressed eclogites, charnockites, calc-silicate and contact metamorphic rocks being separately considered. The whole section of 367 pages is illustrated with 230 figures; it would by itself constitute a substantial book, and is a magnificent summary of present knowledge about this complex group.

Unfortunately, the authors had almost completed their book as the 1997 amphibole nomenclature was being finalized and published and this has resulted in the precise nomenclature used being neither the IMA-approved 1978 version nor the 1997 version although extensive reference is made to the latter and the 1997 nomenclature diagrams are reproduced There is, however, a muddled statement about prefixes (on p. 13–14) which, contrary to what is stated, are an *essential* part of the mineral name and which denote important compositional variants e.g. the ferro in ferropargasite or both adjectives in potassic-titanorichterite, the last prefix being joined to the root name unless two vowels would adjoin. There is no mention of modifiers (although some are included in the list of prefixes) such as ferrian in ferrian pargasite. Modifiers denote less substantial substitutions, and may be omitted and all have 'ian' or 'oan' endings and are not an essential part of the name. However, the names used in the volume are generally perfectly clear but should not be taken as the 'official' IMA names. For instance, the 'manganoan cummingtonite' from Nsuta, Ghana, described on p. 90 is strictly permanganocummingtonite and all the names in Table 5 are obsolete, so beware!

The book is well produced, clearly illustrated, rather sparsely indexed and inevitably in a book as long and complex as this, there are a few misprints (e.g. p. 656, Fig. 364, $0.5 \leqslant \mathrm{Si} \leqslant 1.5$ should be $6.5 \leqslant \mathrm{Si} \leqslant 7.5$) but they are very few.

Although over 95% of the book is concerned with amphiboles, other double-chain silicates included are biopyriboles (e.g. jimthompsonite), deerite and howeite.

Considering that the previous publisher of the series estimated a selling price of £240 for this volume, the list price of £99 (or £50 for Geol. Soc. Lond. and Mineral. Soc. members) not only represents a bargain price for what could have appeared in three books, but also demonstrates the value of not-for-profit scientific society publications.

This book is unreservedly recommended; there is no other account which even remotely approaches the authoritative and comprehensive summary of the double-chain silicate data and its interpretation. It is excellent value and the three emeriti professors are to be strongly commended for producing an outstanding book, worthy of the prestigious series they originated and have, in the encyclopaedic second editions, maintained at the front of mineralogical knowledge; three incredibly fruitful and hardworking 'retirements'.

B.E. LEAKE