in Edinburgh, *Mineralogical Magazine*, vol 58A, 1009 pages). As such, and despite the undoubted quality of the state-of-the-art papers included within it, this volume may have a remarkably short shelf life. P. J. TRELOAR

Heaney, P. J., Prewitt, C. T. and Gibbs, G. V., eds. *Silica: Physical Behavior, Geochemistry and Materials Applications*. Washington, D.C. (Mineralogical Society of America: Reviews in Mineralogy, Vol. 29). 1994, xviii + 906 pp. ISBN 0 939950 35 9. Price $28.00.

This volume in the *Reviews in Mineralogy* series deals with silica, a phase which many mineralogists and petrologists might be inclined to dismiss as being fairly simple; if so, they will assuredly find this book quite an eye-opener. In the contributions to this work, chapters 1 to 3 describe the crystal structures and phase transitions of silica and its 'stuffed' derivatives; chapters 4 to 8 bridge the relationship between the microstructural character of real silica minerals and the behaviour of silica in the geological environment; chapters 9 to 13 treat the basic physical properties of the phases of silica; and chapers 14 to 16 detail the uses of silica for industrial purposes.

Low-pressure silica polymorphs (quartz, tridymite, cristobalite) all experience displacive transformations that involve structural contraction with decreasing temperature, and in the first chapter P. J. Heaney outlines research over the past 30 years that has sought out the mechanisms that control these transitions. In chapter 2, by R. J.Hemley *et al.*, the behaviour of crystalline and amorphous silica under conditions of high temperature and pressure is reviewed. In chapter 3, D. C. Palmer reviews phases which comprise a silica framework topology with (alkali or alkaline earth) cations 'stuffed' into the framework cavities, with appropriate substitution of framework cations to ensure charge balance (e.g. β-eucryptite, $LiAlSiO_4$, as the Li-stuffed derivative of β-quartz, and nepheline as the stuffed derivative of tridymite).

As a framework silicate with strong Si–O bonds, quartz may be expected to be strong and refractory, but although this is true for dry quartz deformed under anhydrous conditions, under the relatively low-temperature conditions of the Earth's crust, hydrogen species at the surfaces and interior of quartz serve to interrupt the strong Si–O–Si network and assist processes of inelastic deformation ranging from crack growth to solution transfer and dislocation creep. The understanding of deformation features in quartz is further addressed by H.-R. Wenk in chapter 5, with a detailed consideration of preferred orientation in deformed quartzites. Chapters 6 and 7 break new ground with a study by H. Graetsch of the structural characteristics of opaline and microcrystalline minerals (chalcedony, quartzine, moganite and both microcrystalline and non-crystalline opal) and a review by L. P. Knauth of the petrogenesis of chert; both of these chapters will be essential reading for sedimentologists. Chapter 8 by P. M. Dove and J. D. Rimstedt continues this trend with consideration of the mineral–water geochemistry of the silica polymorphs, and in chapter 9 the thermochemistry of both crystalline and amorphous silica is outlined by A. Navrotsky, who points out that the wealth of polymorphism in the silica phases reflects the low energetic cost of changing the angles linking SiO_4 tetrahedra to produce a variety of crystalline and amorphous framework structures.

The next three chapters deal respectively with the elusive Si–O bond (G. V. Gibbs *et al.*), first-principles theory of crystalline SiO_2 (R. E. Cohen), ranging from potential models to self-consistent electronic structure methods, for bonding, structure, equations of state, thermodynamics and phase transitions, and a review (G. Dolino and M. Vallade) of the lattice dynamical behaviour of anhydrous silica, taking into account recent *ab initio* models which give a rather complete description of crystal structure and vibrational properties.

Chapter 13, by G. R. Rossman, gives a useful and up-to-date review of the coloured varieties of the silica minerals, including the amethyst, citrine, smoky and prasiolite varieties as well as those varieties which are mixtures of quartz and other phases (chrysoprase and jasper, prase, heliotrope, agate). The problem of iron substitution in quartz is considered in detail, and the diffraction effects responsible for the spectral purity of the colour of precious opal are discussed. It has been recognized that rose quartz usually occurs as massive vein deposits and only rarely as euhedral single crystals, but it is interesting to note that the latter variety is indeed different in containing 118 P atoms/10^6 Si and essentially no Ti; a synthetic P-bearing hydrothermal rose quartz is also reported.

The three remaining chapters also provide much food for thought. Chapter 14 by G. H. Beall on the industrial applications of silica as single crystals, in polycrystalline glass-ceramics and as ultrapure glass, outlines the use of the latter two materials in fibres, films and 'soot'; crystalline silica and its stuffed derivatives have a wide spectrum of thermal expansion behaviour from highly positive to negative, and the dimensional stability of silica fibres is important in the concept of an information superhighway. Silica zeolites and clathrasils are described in chapter 15 by J. B. Higgins, and the final chapter, by D. F. Goldsmith, is concerned with the health effects of exposure to silica dust.

The references are given in full at the end of each chapter, but unfortunately there is no index (though the detailed contents list is helpful). Altogether, this work not only maintains the high standards of this *Reviews in Mineralogy* series, but also brings a fresh up-to-date approach to this important and ubiquitous mineral phase. The price makes it an essential purchase for even the most impoverished of academic libraries. R. A. HOWIE

Fleischer, M. and Mandarino, J. A. *Glossary of Mineral Species 1995*. Tucson (Mineralogical Record Inc.), 1995. vi + 280 pp. ISBN 1062 3531. Price $18.00 (+ $2.00 post).

This latest (seventh) edition includes some 200 new minerals whose details have been published since the sixth edition (1991), bringing the total number of mineral species to around 3600. In this new edition, the section listing the individual species in the various mineral groups now includes the chemical formula for each species. The other change in style involves the elimination of separate entries for polytypes, each now being given under the appropriate mineral name.

As always, it is good to see a new edition of this standard reference work. The inclusion of formulae in the listing of species in each major mineral group should be a useful adjunct in helping to appreciate the species boundaries – though the amphibole and zeolite groups, with respectively 66 and 51 entries, remain complex and challenging, and new species in these groups continue to be discovered even since this listing. As before, the Glossary is produced in a ring binding allowing it to open flat. The price makes this essential work eminently affordable.

R. A. HOWIE