

BOOK REVIEWS

Clark, A. M., *Hey's Mineral Index: Mineral Species, Varieties and Synonyms*. London (Chapman and Hall and The Natural History Museum), 1993, x + 852 pp. Price £50.00.

Here it is at last: the long-awaited third edition of a book which originally appeared in 1950. Since then advances in technology have contributed greatly to the regular discovery of new minerals, the number of accepted species now being around 3500. Other popular listings such as Fleischer's *Glossary of Mineral Species* or the *Mineral Reference Manual* by Nickel and Nichols already provide lists of accepted species but the great strength and importance of *Hey's Mineral Index* lies in its exhaustive listing of synonyms and varietal names, together with an authoritative commentary.

There are two main changes since the previous editions. One is in the considerable expansion of the alphabetical listing of mineral names, now occupying 782 pages; this section is now placed first. If the mineral belongs to a broader group of related minerals, the name adopted for the group is given after the formula. Reference is made to the original description, where known, of the named mineral; where earlier descriptions of the same material, but without the current name, are available, these are also given. For old names and many synonyms, reference is made to the earliest citation seen. If the spelling originally used for the mineral name differs from that currently used, the original version is shown in parentheses after the reference; cyrillic characters are given for the mineral originally described in Russian. To distinguish between polymorphic mineral forms, the crystal system, unit cell dimensions and formula unit contents (*Z*) are given; where the unit cell data are from the *Powder Diffraction File*, the relevant file number is quoted. The type locality is then given, followed by the origin of the mineral name and by any chemical redefinitions of the species. Each entry concludes, where appropriate, with a list of synonyms applied to the species and a list of names with a varietal status, which may include habit, colour or chemical varieties. I have outlined this arrangement within the alphabetical listing in some detail as it is here, in my view, that the strength and usefulness of this work mainly lies.

The section on chemical classification is much reduced in this new edition and is restricted to the recognised species. The groups used are generally the same as in the previous editions but within each category a complete rearrangement has taken place to incorporate the many hundreds of new species described in recent years. The extensive cross-referencing of chemical constituents in the two earlier editions has now been dropped to save space. A further departure from previous editions is that the pronunciation guide is no longer included.

The second main change readers will immediately note lies in the great increase in size—and weight. The page size is approximately twice that of the previous editions and the thickness (852 pages) is also much greater. This overall expansion may mean that the book is less easily shelved or stored close at hand than the earlier versions; it is essentially a book not just for the library but should be conveniently available for the personal use of all mineralogists and petrologists.

The expansion and rearrangement of the alphabetical index section will be widely welcomed and the inclusion therein of the unit cell data is an additional bonus. This volume is indeed a gem; it turns the scales at some 9500 carats, however, and tends to be a trifle unwieldy. The price for once is eminently sensible for a book that will be in continuing demand.

R. A. HOWIE

Price, G. D. and Ross, N. L. (eds.) *The Stability of Minerals*. The Mineralogical Society Series Vol. 3 (Chapman and Hall), 1993. x + 368 pp. Price £75.00.

The latest addition to the Mineralogical Society Series is rather optimistic in its scope, professing to address the 'fundamental factors that underlie our understanding of all aspects of mineral behaviour and crystal chemistry'. This would require a somewhat more elaborate treatment than is presented here (a collection of nine chapters by different authors, focusing on specific areas of mineral energetics) but nevertheless, the book is interesting and informative. The chapters are based on papers presented at the Mineralogical Society's 1989 Winter Conference at University College, London. The long gestation period is

apparently due to the demise of the original publishers, and Chapman and Hall are to be commended for rescuing the series.

The book begins with an introduction to the factors affecting mineral stability. If the reader is not deterred by the grandiloquent prose of the opening pages, the remaining chapter presents a lucid and wide-ranging synopsis of mineral energetics, with an indication as to how these ideas are expounded in the following chapters.

The next two chapters examine the energetics of interatomic bonding, from a solid-state chemistry perspective. F. C. Hawthorne provides a helpful discussion of bond-valence theory, viewed as a very simple adaptation of molecular orbital theory—a scheme which is taken up in somewhat more detail in the following chapter by J. K. Burdett. Hawthorne's simple elaboration of complex crystal chemical formalisms is much to be admired, and he provides some useful mineralogical examples.

The next two authors adopt a 'Mineral Physics' approach. First, N. L. Ross describes the contribution of lattice vibrations to thermodynamic stability. This is of course well-trodden ground, but Ross endows her treatment with a geological perspective, emphasising how the frustratingly-complex lattice dynamics of most rock-forming minerals can be conveniently reduced to more manageable proportions using the Debye or Kieffer models and successfully applied to the prediction of mineral stabilities. Next, M. A. Carpenter presents an introduction to the macroscopic theory of structural phase transitions. Relations between structural, thermodynamic and physical properties are derived for various types of phase transition induced by changing temperature, pressure or composition. Armed with 'Landau Theory', Carpenter clarifies the myriad complexities of coupled phase transitions in feldspars, pyroxenes and calcite, and the theory is extended to cover fluctuations and kinetics.

The last four chapters are somewhat more specialist in nature. J. D. C. McConnell discusses the stability of modulated structures, using a group-theoretical approach to analyse quartz and K-feldspar. R. O. Sack describes thermodynamic mixing properties for solid solutions, taking the tetrahedrite-tennantite fahlores as an example. M. Engi assesses the use of thermodynamic data for prediction of phase stabilities, and the error propagation techniques commonly used; a review of various thermodynamic databases is also given. Finally, B. Velde examines various factors controlling the stability of clays in geological environments.

Overall, this is an excellent volume, well-written and pitched at an appropriate level for advanced students and post-graduates. Unfortunately the high price will put it beyond the range of most individuals; inevitably a comparison has to be drawn with the Mineralogical Society of America's *Reviews in Mineralogy* series, which offers great value-for-money. The real strength of *The Stability of Minerals*, however, is that in a single volume it provides a convenient and wide-ranging summary of current developments in mineral energetics, from crystal chemistry to petrological applications. As such, it is to be warmly recommended for all Earth Sciences libraries.

D. C. PALMER

Putnis, A. *Introduction to Mineral Sciences*. Cambridge (Cambridge University Press), 1992. xxii + 457 pp. Price £22.95 (paperback); £60.00 (hardback).

Putnis adopts a materials science approach to the study of minerals, and in this excellent book focuses on the behaviour of minerals in relation to geological processes, rather than using the traditional systematic treatment of the subject. The approach taken is more qualitative than quantitative, but the complex concepts of materials behaviour are explained clearly and are extremely well illustrated.

The introductory chapters deal with the basic concepts of crystallography and symmetry. The ideas behind crystalline anisotropy are clearly explained, and the basis of the optical, elastic and related tensorial properties of minerals is presented. There follows an extensive chapter on diffraction and imaging techniques, including the reciprocal lattice, powder and single crystal X-ray diffraction, electron diffraction and imaging. A final methodology chapter on spectroscopy comprehensively covers the concepts involved with nuclear magnetic resonance spectroscopy, electron spin resonance spectroscopy, vibrational spectroscopy and inelastic neutron scattering, optical spectroscopy, X-ray spectroscopy and the Mössbauer effect.

The bulk of the book, however, is devoted to discussion of the nature and behaviour of minerals. This ranges from the discussion of the basic principles of crystal architecture (viz. close packing, polyhedral packing, etc), through to the discussion of the structural features of major rock-forming phases such as olivines, pyroxenes, and framework silicates. The concept of defects and the role that they play in mineral behaviour is introduced, and illustrated by specific references