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

to systems such as the plagioclase feldspars and spinels.

The basic ideas behind thermodynamics, which determine most aspects of mineral behaviour, are clearly presented, with discussions of entropy, phase equilibria and Landau theory. The nature of solid solutions is outlined, the processes of exsolution, spinodal decomposition and ordering are reviewed. Finally kinetics are introduced, and the book ends with some excellently presented case studies of transformation processes, including discussions of the incommensurate behaviour in quartz, unmixing in the pyroxene system, and other geologically and materials-relevant processes.

In short, this book is a tour de force, illustrating clearly the major advances which have taken place in our understanding of the complex behaviour of minerals and related phases. It could only have been written by a scientist who has an extensive and clear understanding of modern mineralogy. Andrew Putnis is to be congratulated on writing an outstanding book, which will not be surpassed for many years to come. Buy, read and enjoy this splendid book!

G. D. PRICE

Gribble, C. D. and Hall, A. J. *Optical Mineralogy: Principles and Practice*. London (UCL Press Ltd.), 1992. Price £50.00 (£17.95 paperback).

This book is a revised and extended successor to *A practical introduction to optical mineralogy* (by the same authors) published by George Allen and Unwin (1985; 249 pp). The latest book retains much the same style, content and organisation as its predecessor, from which it has inherited most of the illustrations. The book aims to provide an introduction to the theory and practice of the examination of rock-forming minerals under the microscope, including both transmitted- and reflected-light techniques, and is comprehensive enough to satisfy the requirements of most undergraduate geology courses.

The separation of the theory of both transmitted- and reflected-light optics (Chapters 4 and 5) from the first chapter on microscope techniques allows a simple 'recipe book'-type approach to mineral study, without encumbering the student with the need to initially wade through theoretical considerations. This arrangement, however, is not in practice entirely user-friendly, since there is a number of references in Chapter 1 to Figures and colour Plates (4 pages) positioned much later in the book.

The descriptions of silicate and non-silicate minerals (Chapters 2 and 3) are presented in broad alphabetical order with related minerals kept together in groups. While the silicate mineral diagrams show optical orientations and give information such as cleavage and 2V, they do not indicate well the characteristic mineral forms, as presented for many of the non-silicates, and only a few selected silicates are illustrated by photomicrographs. The misidentification of a granophyric intergrowth of quartz and feldspar in a photomicrograph as a myrmekitic texture appears to be an isolated error, but could cause some minor confusion. Diagrams giving comparative extinction angles (e.g. for pyroxenes) are very useful.

Transmitted-light theory is dealt with in a straightforward manner, although the explanation of interference in crystals and the origin of interference colours may not be easy for students to assimilate. While crystal symmetry is very briefly dealt with in relation to reflectance of opaque minerals, no outline is given of the distribution of crystallographic axes in the individual crystal systems, which is an omission that students beginning the subject may find a disadvantage. The reflected-light theory provides a useful background to the study of opaque minerals, including reflectance measurement and observation of anisotropy.

Understanding the ways in which light interacts with minerals in the polarising microscope, and becoming competent in microscope techniques are aspects of geology courses that students frequently find very difficult. This textbook offers a sound, traditional approach to *both* transmitted- and reflected-light microscopy, *and* incorporates much useful reference data on the common minerals all in one relatively affordable volume, which is to be commended. It does not, however, seize the opportunity to adopt a markedly fresh approach to the presentation of the subject at student level.

R. KANARIS-SOTIRIOU

McBirney, A. *Igneous Petrology Second Edition*, (Jones and Bartlett Publishers Inc.), 1992. xii + 508 pp. Price $52.50

These are exciting times in Igneous Petrology. The number of new approaches and techniques continues to increase, and there is a welcome trend towards much better integration of contributions from different subject areas. Radiogenic isotope analyses are now only rarely presented in isolation from major and trace element data on the same rocks; laboratory and computer models provide much needed constraints on the physical