polycrystals. Chapter 15 by A. Hever *et al.* describes the slip systems in uranium dioxide and Chapter 16 (C. Hennig-Michaeli and J.-J. Couderc) describes dislocation rections in experimentally deformed chalcopyrite singel crystals.

In summary this book is a mixture of reviews of the state of knowledge on micro-deformation processes in non-metallic materials together with new data. It is well presented, well edited and indexed. The volume contains a wealth of information and up-to-date references that will be invaluable to the reader. To those unfamiliar with the fields of brittle micro-mechanics this volume will be a useful high-level introduction. The chapters on plastic deformation processes also provide a valuable review of the current theories and level of knowledge. At £65 it is perhaps a little expensive for individual libraries but is a must for all departmental and University/College libraries. It is highly recommended for any Earth scientist who needs to understand deformation processes in the lithosphere.

K. R. McClay

Mason, R. *Petrology of the Metamorphic Rocks* (2nd edn.). London (Unwin Hyman), 1990. x + 230 pp. Price £35.00 hardback; £14.95 paperback.

The First Edition (1978) of Roger Mason's textbook on metamorphic petrology was presented as the third volume in the series published by Allen & Unwin covering the main classes of rocks—igneous, sedimentary and metamorphic. This pretence was never convincing and has been dropped in the present edition. Mason's approach is entirely different from those adopted in earlier texts. Instead of a systematic classificatory framework, metamorphism and metamorphic rocks are presented through a series of case histories drawn from the author's own research experience in Britain, Ireland, other parts of Europe, Turkey, the United States and China.

This original approach has been retained in the Second Edition, although the subject matter has been updated and rearranged so that it is now more overtly related to the plate tectonic environments in which the different types of metamorphic rocks have been formed.

After introductory chapters dealing with the definition of terms, schemes of classification, methods of study and the chemical and thermodynamic aspects of metamorphism, the main body of the text covers the einvironments of contact metamorphism related to intrusion, dynamic metamorphism in thrusts and shear zones, metamorphism on the ocean floor and in zones of subduction and collision of tectonic plates. An account is given of high-grade granulite facies terrains, found in the stable continental cratons, and of metamorphisms of mantle materials seen in ophiolite complexes and mantle xenoliths, brought up in kimberlite pipes and basaltic lava flows. The final chapter introduces 'extra-terrestrial metamorphism', as seen in meteorite impact craters on earth, represented by the Nordlinger Ries crater in Southern Germany, and the Moon rocks brought back from the Apollo missions. The text is well illustrated by clear line drawings of maps, graphs and thin sections of metamorphic rocks.

The book originated as a Second Year University course in metamorphic petrology and it certainly provides a valuable and stimulating introduction to metamorphism for students at this level. It will also provide a readable and useful update in current methods and concepts in metamorphic petrology for teachers and professional geologists. The personal and anecdotal approach in spite of a Glossary of terms and an Index, will limit its value as a standard course textbook, as the author has not attempted to provide a comprehensive coverage of the whole range of metamorphism and metamorphic rocks.

A. J. Barber

Poirier, J.-P. *Introduction to the Physics of the Earth's Interior*. Cambridge (Cambridge University Press), 1991. Price: hardback £40.00, paperback £17.50.

This is an excellent soft-bound book, packed with essential mathematical models and physical explanations for current research through mineral physics and geophysics, to determine the structure, composition and temperature of the deep Earth. In the first two chapters, the book presents a succinct review of the fundamentals of thermodynamics of solids, and elastic moduli. The next chapter provides a fairly rigorous review of the fundamentals of lattice vibrations, including, for example, recent observations on Gruneisen parameters. The next two chapter explain the origins and applications of the equations of state for solids at high temperatures and pressures, and examine the thermodynamics and theoretical models of melting with, for example, specific application to our current understanding of the Earth's core. Dynamic processes in the Earth, including mechanisms of diffusion and viscosities of solids and liquids are linked with the principles of electrical and thermal conduction in a longer chapter 6, under the title of transport properties. Finally in Chapter 7, the three major types of

Earth models, seismological, compositional and thermal, are elegantly explained and brought right up to date with an authoritative summary of the literature. The book (264 pages) includes approximately 470 references and an appendix for the PREM (seismic) model for the mantle and core. It is well illustrated, and indexed with some 250 items. The book is well produced, and the text virtually error-free, through one important boob on page 97 has inverted the important concept of liquidus and solidus. The book provides an extremely useful introduction and handy references to researchers working in the earth sciences, physics and materials science. It will provide an almost essential upgrade to a number of undergraduate courses, including the more traditional geology and geophysics. It is very highly recommended.

A. P. JONES

Ganguly, J. (Ed.) *Difffusion, Atomic Ordering and Mass Transport* (Advances in Physical Geochemistry, Volume 8). Berlin, Heidelberg and New York (Springer-Verlag), 1990. xiii + 567 pp. Price DM 290.00.

The latest volume in this well-established series brings together thirteen review-style articles which are connected by the general theme of atomic migration and diffusion. This is a very broad field and is tackled here on a variety of scales from the atomic to the geological outcrop, using both theoretical and experimental methods. The relationship between the chapters may therefore seem somewhat tenuous, and it is unlikely that many readers will be familiar with more than a few of the topics presented here. However, each chapter is representative of a particular approach to some diffusion-related problem, and the list of the 22 contributors confirms that the leading practitioners in the field are displaying their wares (see M.A. 91M/4233-4245).

The book is loosely grouped into themes which reflect the scale of the process discussed. The first three chapters deal with mainly theoretical approaches to the microscopic interactions which control atomic transport and ordering. Kubicki and Lasaga outline the role of molecular dynamics computer simulations in determining diffusion in silicate melts; Ross presents a summary of Ising models and their application to cation ordering in a number of mineral systems, and Downs discusses how electron density is determined from X-ray diffraction data and then applied to computer models of crystal structures.

Chapters 4–10 deal with volume diffusion in various mineral systems, principally from an experimental point of view. Chakraborty and Ganguly review compositional zoning and cation diffusion in garnets, and the implications to geothermo-barometry and geochronology; Morioka and Nagasawa summarize ionic diffusion experiments in olivine; Jaoul, Sautter and Abel describe the nuclear microanalysis techniques for measuring diffusion profiles. Volume diffusion is known to be affected by various factors: Goldsmith emphasises the effect of pressure on Al, Si diffusion and oxygen isotope exchange, Graham and Elphick describe the role of hydrogen in enhancing oxygen diffusion, while Kramer and Seifert discuss experiments designed to measure the effect of strain. In Chapter 10 Parsons and Brown summarise and add to their body of work describing the mechanisms and kinetics of exsolution in alkali feldspars.

Moving to grain boundaries introduces larger scale problems with more immediate applications to petrological processes, Joesten presents a very useful summary of grain-boundary diffusion with a discussion of how the available data can be applied to mass transport in metamorphic rocks. In Chapter 12 Lesher and Walker discuss the role of thermal gradients in diffusional mass transport in magmas (the Soret effect), and in the final chapter Lichtner presents in 100 pages, a detailed account of quasi-stationary state approximations to fluid/rock interactions and their application to a number of geological processes.

There is much of interest in this volume and the themes discussed are central to our understanding of geological processes. The chapters are all written to a high standard and the editor has done a good job in ensuring a uniformity of presentation and style. Bringing together these chapters provides a good impression of the range of activities at the frontiers of the subject, and practising research workers will find the book a useful source of information as well as providing a fairly high-level introduction to fields beyond their specific expertise. The book should certainly by available in institutional libraries wherever serious research and teaching are carried out.

A. PUTNIS

Mazor, E. *Applied Chemical and Isotopic Groundwater Hydrology*. Milton Keynes (Open University Press), 1990. x + 274 pp. Price £37.50.

This book emphasises the physical and chemical properties of water and their variations with time. Its strength lies in its use of numerous examples and case histories to show how the chemical information coded into water during its passage