BOOK REVIEWS

Reed, S. J. B. *Electron Microprobe Analysis and Scanning Electron Microscopy in Geology.* Cambridge University Press, 1996, xiv + 201 pp. ISBN 0 521 48350 6 (paperback) £17.95 (US$29.95), hardback ISBN 0 521 48280 1 £50.00 (US$80.00).

This is an excellent book with an unusually extended scope that is highly recommended for all involved in electron microprobe and scanning electron microscope analysis. The book contains ten chapters encompassing: (1) An introduction to micro-beam techniques, including a brief summary of non-electron excited techniques, including PIXE, XRF, ion and laser microprobe methods (6 pp); (2) Theoretical aspects of electron excitation and X-ray production (14 pp); (3) Design details of electron-optical instrumentation (22 pp); (4) The design and operation of ED and WD X-ray spectrometers (22 pp); (5) The performance and capabilities of the scanning electron microscope with particular emphasis on recording topographic and compositional images, a chapter that is particularly well illustrated with black and white photomicrographs (31 pp);(6) Element mapping (15 pp);(7) Qualitative X-ray analysis and the interpretation of X-ray spectra (17 pp); (8) Quantitative X-ray analysis, including matrix correction procedures, light element analysis and a useful discussion of special cases including tilted and thin specimens, broad-beam and whole rock analysis, and the analysis of particles and fluid inclusions (32 pp); (9) Accuracy of X-ray analysis and factors such as surface roughness, porosity, beam damage, edge effects, the Fe valence problem that affect the interpretation of results (15 pp); (10) Specimen preparation (15 pp) and references cited (11 pp).

Given the wide experience and extensive knowledge of the author, it goes without saying that this work is authoritative. However, there are several noteworthy features of this book. One is the way the treatment of the electron microprobe and scanning electron microscope are integrated, the second is the way in which theoretical aspects of instrumentation is integrated with practical applications. A third is the clarity of the text, illustrated by many line diagrams, spectral scans, black and white photomicrographs and a smaller number of colour plates. And finally the price of the paperback edition offers very good value for money. This book is aimed at geological postgraduate and postdoctoral researchers, those working in industrial laboratories as well as a basic text for those attending SEM and EMPA courses. As well as being highly recommended to all these users, established researchers will find value in the integrated approach followed in this book. In summary, a hit that is heading for the best seller list for this category of publication. P.J. POTTS

Dickin, A. P. *Radiogenic Isotope Geology.* Cambridge, New York and Melbourne (Cambridge University Press), 1995. xvi + 452 pp. Price £65.00 (Hardback). ISBN 0 521 43151 4.

The aim of this book is "to concisely review the field of radiogenic isotope geology in order to give readers an overview of the subject and to allow them to critically assess the past and future literature". The approach is historical in that the literature reviewed deals with original concepts and new analytical strategies, covers 'classical' contributions, and includes numerous case histories some of which have involved alternative and contradictory data interpretations.

Chapter 1 (14 pages) briefly introduces nucleosynthesis, radioactive decay mechanisms, and the basic decay equations while the second chapter (24 pp) covers chemical and physical techniques (specialized analytical strategies are also included in later chapters) and also has a clear discussion of the statistical approach to assessing 'errorchrons' versus isochrons. Chapters 3 (30 pp), 4 (35 pp) and 5 (29 pp) deal successively with Rb–Sr, Sm–Nd, and Pb-isotope dating, with fairly predictable early sections being followed by particularly useful treatments of crustal and seawater evolution. Chapters 6 and 7 deal with the applications of Sr, Nd, and Pb isotopes in studying the geochemistry and petrogenesis of oceanic volcanics (40 pp) and continental crust (29 pp); the latter contains a useful discussion on magma-crustal interactions but, surprisingly, the basic mixing equation is not given. The extension of such isotope 'tracer' work by application of Re–Os isotope studies is covered in Chapter 8 (22 pp) while recent work on the Lu–Hf, La–Ce, La–Ba and K–Ca systems is covered in Chapter 9 (20 pp). The next chapter (32 pp) covers K–Ar and Ar–Ar dating and includes the recent applications of laser ablation microprobe studies to the ^{40}Ar–^{39}Ar method. Chapter 10 (28 pp) follows on by covering the application of the inert gases (He, Ar, Xe and Ne) as isotopic tracers, in particular to studies involving the degassing of the Earth.

The next two chapters show how secular disequilibrium between the short-lived isotopes of the uranium decay series can be applied to dating young sediments (25 pp) and to the elucidation of the timescales of mantle melting and magma chamber evolution (29 pp). In Chapter 14 (36 pp), work on the cosmogenic nuclides ^{14}C, ^{10}Be, ^{36}Cl, ^{129}Xe and ^{26}Al is reviewed with wide-ranging examples including environmental geoscience appplications. Extinct radionuclides (^{129}I, ^{244}Pu, ^{26}Al, ^{107}Pd, ^{53}Mn, ^{60}Fe, ^{247}Cm, ^{41}Ca) are briefly dealt with in Chapter 15 in the context of the primaeval nature and early development of the solar system. The final chapter (23 pp) covers the experimental techniques of fission-track dating with applications chosen from tectonic uplift and subsidence rate studies.

Overall, the book is clearly written and contains abundant information with numerous clear figures. The treatment of analytical strategies gives a useful insight for the non-specialist, while the approach of providing wide-ranging case histories gives a clear picture of the importance of isotope geochemistry in Earth Sciences research areas varying from processes of Earth formation to mantle–crust–hydrosphere–atmosphere evolution and, more recently, to topics of environmental interest. Researchers and advanced undergraduate students alike will find it a useful compendium of information which, together with texts such as Faure's *Principles of Isotope Geology*, provide a comprehensive coverage of the systematics and applications of isotope geochemistry in geosciences research. C.M.B. HENDERSON

Coleman, R. G. and Wang, X. (eds) *Ultrahigh Pressure Metamorphism*. Cambridge Topics in Petrology, CUP, 1995, ISBN 0 521 43214 6, x + 528 pp. Price £55.00, US$79.95.

The expression UHPM (Ultrahigh Pressure Metamorphism) was born about 10 years ago and is now widely used, though not always in precisely the same sense. The editors of this book use UHPM to mean "a metamorphic process that occurs at pressure greater than $\sim$28 kbar (the minimum pressure required for the formation of coesite at $\sim$700°C)". This is essentially equivalent to the 'coesite-eclogite (sub)facies' defined as those parageneses corresponding to the $P-T$ stability field of coesite, in contrast to the 'quartz-eclogite (sub)facies' applicable at lower pressure, as introduced by the present author in 1985.

Stable coesite is obviously a diagnostic mineral for UHPM in rocks containing free SiO_2, but above some 300°C stable diamond is also a diagnostic mineral in rocks containing free C, but here graphite can also be stable with coesite in the lower pressure part of the UHPM $P-T$ field. Of course several other single minerals can be stable only under UHPM conditions, as is the case of innumerable specific combinations of minerals such that one can justifiably contemplate UHPM conditions without any trace of coesite or diamond. Nevertheless these two minerals carry a certain aureole of glamour which incites petrologists to eagerly hunt for them. Since their grain sizes are normally microscopic — indeed one often writes about microcoesite or microdiamond — they fortunately present no interest to the gemmological trade or to amateurs so that there is little risk of important scientific occurrences being destroyed for commercial reasons except when they occur in particularly beautiful eclogites.

The editors, who include a highly-respected forefather of 'modern' research into eclogites in the early 1960s and a representative of the new school of better-equipped younger researchers, created this high-standard multi-author book in order to provide in one volume an overview of recent knowledge about UHPM. In effect this topic has become a new discipline in the Earth Sciences since such high pressures in previous crustal rocks were not conceived in the 'classic' 1960s vintage texts on metamorphism, for example those of Barth, Miyashiro, Turner, Winkler, and Pitcher and Flinn. The authors chose, for detailed description in one chapter each, the four areas for which most data are available and which correspond historically to the first-known definite UHPM areas: W. Italy (Chap. 7 by R. Compagnoni, T. Hirajima and C. Chopin), S.W. Norway (Chap. 9 by D.C. Smith), E. China (Chap. 10 by X. Wang, R. Zhang and J.G. Liou) and N. Kazakhstan (Chap. 12 by V.S. Shatsky, N.V. Sobolev and M.A. Vavilov). Subsequently-reported localities of definite or deduced UHPM such as Kirghizstan, Poland, Togo and the German/Czech border receive only scant attention, which is regrettable. Even if there is insufficient data available here to produce one review chapter per locality, it would have been useful if someone had been invited to present a combined review of these 'other' localities.

Garnet can occur stably in peridotites at pressures several kilobars lower than those necessary for stable coesite. However, in many world-wide occurrences of peridotite massifs enclosed within crustal rocks,