BOOK REVIEWS

Holness, M. B. (Ed.) *Deformation-enhanced Fluid Transport in the Earth's Crust and Mantle.* Mineralogical Society Series 8. Chapman & Hall, 1997, xiv + 333 pp. £69.00. ISBN 0-412-752905.

This book would be more appropriately titled 'Deformation-enhanced fluid and magma transport'.. because about half the book deals with magma movement. Although semantically correct, in that magma is a fluid, many will not expect magma to be included.

The contents of the book are well summarised by the chapter titles, thus: (1) The permeability of non-deforming rock; (2) Experimental investigation of the rheology of partially molten peridotite at upper mantle pressures and temperatures; (3) Melt distribution in partially molten peridotites: implications for permeability and melt migration in the upper mantle; (4) The influence of deformation on the extraction of crustal melts: a consideration of the role of melt-assisted granular flow; (5) The role of deformation in the movement of granite melt; views from the laboratory and the field; (6) Ascent mechanisms of granitic magmas: causes and consequences; (7) Ascent and emplacement of granitic plutonic complexes in subduction-related extensional environments; (8) Lithological, structural and deformation controls on fluid flow during regional metamorphism; (9) The geochemistry of volatile fluid flow in shear zones; (10) Segregation veins: evidence for the deformation and dewatering of a low-grade metapelite; (11) Fluid flow in fractured rocks at shallow levels in the Earth's crust: an overview. There is a place and subject index.

The book summarises the present state of knowledge in this important field but does not add much in the way of new insights, theories or even field examples; too many of the ideas have already been published and the only universal agreement that emerges from almost all the conclusions is the complexity of the whole process of fluid and magma movement during deformation and the multiplicity of caveats necessary for any of the proposed models. There is much written on theoretical considerations and experimental studies but many chapters contain scant or even no natural examples with which to constrain theoretical musings. Both Graham, *et al*, who use the SW Scottish Highlands as an illustrative case study of the controls on fluid flow during regional metamorphism, and A.M. McCaig, who considers the geochemistry of volatile fluid flow in shear zones, give useful tables summarising a wealth of information about particular instances already published. Only S.L. Brantley *et al.* specifically consider fluid expression from subduction zones – one of the most important situations where massive fluid flow occurs with veins being kept open by hydraulic pressure while high-pressure minerals grow into 'free-space'. However, they consider hydrofracturing with localised fluid sources only without channelised flow of external fluid and use SW Alaska as their field area.Those interested in granite emplacement are well served with consideration of segregation and melt extraction and Clemens *et al.* convincingly demonstrate the non-viability of diapirism as a mechanism of granitic emplacement and re-iterate the dyke ascent model.

Overall then, this book is an excellent summary of what is currently known about the role of deformation in initiating and assisting the movement of fluids and magmas but is very much an interim statement rather than a comprehensive integrated thesis. B. E. LEAKE

Banfield, J. H. and Nealson, K. H. (Eds.) *Geomicrobiology: Interactions between Microbes and Minerals.* Washington, (Mineralogical Society of America: Reviews in Mineralogy Vol 35), 1997, 448 pp. Price $32.00, ISBN 0-939950-43-X.

As stated throughout this book, and described in various chapters, geomicrobiological research has made major discoveries in the last few years which have profound implications. Many of these relate to microbial mineral interactions and we are now becoming aware of the global significance of these interactions and the probable role that they have played in the evolution of our planet. This is coupled with discoveries of microbial populations deep within the Earth's crust and of inorganically driven anaerobic ecosystems, completely inde-

pendent of photosynthetically fixed organic carbon. All of which elegantly demonstrates the intimate coupling between biosphere and geosphere, which has thrown the previously disparate disciplines of microbiology and geology together and has vindicated the early disciples of geomicrobiology.

Some of these aspects are described in this book, but not all, and in that sense the book doesn't cover Geomicrobiology, but a sub set concerned with microbe:mineral interactions. Yet, there is more than just microbes and minerals. In the first two chapters there is a concise introduction to bacteria, their activity and diversity and, importantly, what's new in each. There are detailed chapters on the crystal structure, geochemistry, formation, and dissolution/weathering/corrosion of minerals and metals, which provide intriguing details of minerals as a potential microbial habitat: providing a substrate, energy source, nutrients and sometimes protection and a 'home', often within a biofilm. The biomineral 'home' becomes exquisite with the exoskeletons of calcium carbonate secreting algae and silica secreting diatoms and we are treated to a description of the fine cellular control of these elegant structures, only to find out that for calcium carbonate producers it might just be a clever way of maximising carbon dioxide concentrations which are limiting photosynthesis. But why are these delicate structures species specific if this is true?

Another chapter describes biomineralization of magnetic iron minerals and magnetotactic bacteria, and how these bacteria use magnetotaxis in combination with aerotaxis to find their optimum position in oxic:anoxic interfaces which occur in a range of environments. Seemingly there may be even finer control based on the composition of the magnetic mineral, with magnetite containing bacteria preferring microaerophilic (low oxygen) conditions, whilst those with greigite prefer the deeper sulphide-containing layers. These bacteria also demonstrate the exquisite control biology can have on mineral formation as they produce magnetic particles with optimum size to give maximum magnetism per magnetosome.

In contrast, for other bacteria biomineralization may be an inescapable and rather undesirable consequence of their activity, strongly influenced by the reactive chemical groups on their cell surface. As 'over their lifetime, bacteria must collect an increasing burden of minerals on their surfaces'. On death these minerals continue to grow, mineralizing and preserving the bacteria, which probably explains how the morphology of 'soft bodied' bacteria survive to provide one of our main clues for the origin of life.

The importance of microbe:mineral interaction in the origin of life is an aspect in several chapters. This is effectively complemented by the final chapter which describes the interplay between biosphere and geosphere in developing the Earth's environment since its formation some 4.5 billion years ago as seen through the evolving global carbon cycle and carbon isotopes.

There is too little space available to summarise all the chapters but I hope that the above provides a flavour of the riches in this book. It is not, however, a text book to be read from start to finish, and although the first two chapters provide an introduction to bacteria a non-microbiologist would benefit from consulting a more general microbiology text book either before reading or alongside these chapters. However, the first two chapters are important reading to enable the most to be obtained from the other chapters. These chapters cover specialist areas and can be read independently. All of these go into considerable depth and often reflect either a microbiological or mineralogical bias, hence they can be challenging to the non-specialist. If the area of geomicrobiology is going to continue to make important advances researchers need to understand both component disciplines and this book represents an important initiative in this direction. This is the type of book you need to dip into often and it will be an extremely valuable resource. It is unfortunate that there is not an index as this would have made accessing the resource more efficient, however, it is often what you stumble across that in the end proves to be most valuable and there is a lot to encounter in this book.

R. J. PARKES

Birch, W. D. and Henry, D. A. *Gem Minerals of Victoria*. Melbourne (Mineralogical Society of Victoria: Special Publication No. 4), 1997, 121 pp. ISBN 0 959 4573 3 X. Price A$29.95 (plus A$14.00 economy air post).

Although the State of Victoria is not the richest state in Australia for gemstones, nevertheless it contains a considerable range of collectable gems. The aim of this well illustrated book is not to be a locality guidebook (though each of the more