BOOK REVIEWS

Hemley, R.J. (Ed.). *Ultrahigh Pressure Mineralogy: Physics and Chemistry of the Earth's Deep Interior*. Washington (Mineralogical Society of America, Reviews in Mineralogy, Vol. **37**), 1998. xvi + 671 pp. US\$32.00 (MSA Members US\$24.00). ISBN 0-939950-48-0.

This is another in the 'Reviews in Mineralogy' series published by the Mineralogical Society of America, and joins a highly successful set of specialist subject volumes that have an established reputation as excellent reference texts in pedagogic style covering many aspects of the mineral sciences. This volume contains 19 chapters running to 671 pages.

Traditional mineralogy has been extended: the book adopts its title on the premise that all regions of the Earth – surface to inner core – are accessible, in principle at least, experimentally. Rapid advances in techniques for generating high pressures coupled with new probes of the high-pressure state are the driving force for this expansion of mineralogy downwards in the Earth. The implicit subject here is the advances in static high-pressure techniques – shock-wave studies that can reach higher P and T are only briefly covered. In a volume of this size it would have been difficult perhaps to add another chapter.

The preface contains a concise overview, linking the chapters and provides some useful links to related literature. The chapters are contributed by forefront workers in the mineral geochemical and geophysics community – the latter have the feel of a special session of the American Geophysical Union.

The book contains well-illustrated, summary information in fields from metamorphic petrology to core physics that is highly suitable for a course and text on the modern solid-Earth Sciences. Chapter 1 (H-k. Mao, R.J. Hemley) sets the scene by summarizing the development of high-pressure methods and technology including the diamond-anvil cell, piston-cylinder and multi-anvil apparatus. High temperatures and synchrotron sources are discussed concluding with a table summary of available techniques and applications that increases in length impressively on every occasion an overview of this kind has been written. The book could well appeal independently to two types of reader – assuming that individuals will buy for different pressure regions in the Earth. More traditional crust-upper-mantle systems are described in Chapters 2–4. Chapter 2 covers high-pressure minerals and metamorphism (J.G. Liou, R.Y. Zhang, W.G. Ernst, D. Rumble III, S. Maruyama), Chapter 3 covers upper mantle minerals and phase relations dominated by water near convergent (subducting) plate boundaries (B.O. Mysen, P. Ulmer, J. Konzett, M.W. Schmidt), and Chapter 4 (W.F. McDonough, R.L. Rudnick) covers upper-mantle mineralogy as a whole with a discussion of sources and natural samples. Liou *et al.* include much new work from the Sulu-Dabie terrain, east-central China.

Chapter 5 (C.B. Agee) begins the move toward the subject area defined by mineral physics and planetary physics describing concisely seismically-observed phase transitions and model stoichiometries within the deep upper mantle and transition zone, and provides the link with chapters 6 (C.R. Bina), 7 (R. Jeanloz, Q. Williams), 8 (L. Stixrude and J.M. Brown) on the lower mantle, core-mantle boundary and Earth's core, respectively. Bina describes mineralogical interpretations for seismological and electrical conductivity observations.

The middle portion of the book addresses the familiar subjects of crystal chemistry (Chapter 9, C.T. Prewitt and R.T. Downs) including only a brief discussion of dense hydrous phases, thermodynamics (Chapter 10, A. Navrotsky), and element partitioning (Chapter 11, Y. Fei, with a main section on Mg-Fe^{2+} partitioning in high-pressure transition-zone and lower mantle phases) providing the groundwork in mineral physics for the third quarter of the book. The emphasis shifts toward the physical properties of minerals measured at elevated pressure: high-pressure melting (Ch. 12, G. Shen, D.L. Heinz); viscosity (Ch. 13, D.B. Dingwell, containing in addition a short discussion of glasses); equations of state (Ch. 14, T.S. Duffy, Y. Wang); elasticity (Ch. 15, R.C. Liebermann and B. Li); and rheology (Ch. 16, D.J. Weidner).

The final quarter of the book deals with the physics of the deep Earth and physical techniques:

Vibrational properties (P. Gillet, R.J. Hemley, P.F. McMillan), electronic and magnetic properties (R.J. Hemley, H-k. Mao, R.E. Cohen), and theoretical techniques (L. Stixrude, R.E. Cohen, R.J. Hemley). Chapter 12 on high-pressure melting is a particularly good review of a rapidly changing and technically difficult field and Chapter 18 emphasizes the important changes in bonding that can change mineral properties. The final theoretical chapter touches on the increasing contribution of first-principles and *ab initio* methods to our understanding of the deep Earth. Clearly experiment, as represented by most of the book, and computation fit very well together, a taste of things to come.

Examining each chapter, there is not one that fails to impress, either through the use of examples, or for the care taken to condense much development into an effective, affordable tutorial style. Some contain evidently summary information in a rapidly changing area. The book makes a good attempt at keeping mineralogy current, but perhaps the most obvious conclusion is explicit in the subtitle – that physics and chemistry have a major role to play in our understanding of bulk Earth and planetary processes.

A. JEPHCOAT

Adams, A.E. and MacKenzie, W.S. *A Colour Atlas of Carbonate Sediments and Rocks under the Microscope*. London (Manson Publishing), 1998, 180 pp. Price (hardback) £48.00 (ISBN 0-470-29622-4); paperback £24.95 (ISBN 0-470-23749-X)

This is the latest contribution in an outstanding series of colour atlases illustrating and describing rocks and minerals. It deals entirely and fairly comprehensively with the illustration of the minerals, detrital and biogenic components, sedimentary and diagenetic textures and structures found in limestones and in dolomites. As with the previous titles in this series the quality of colour illustration is of the highest standard. The images are sharp, and the colour reproduction is excellent.

The petrography of carbonate rocks is often regarded as an art that is learnt through extensive experience. No amount of measuring of optic axes, birefringence and refractive indices or isotope geochemistry and X-ray diffractometry will enable you to identify, for example, recrystallized fragments of dasyclad algae that may provide you with the vital clues for your palaeoenvironmental interpretation. However, a very well illustrated colour atlas is still one of the best ways to learn these skills as part of a course in carbonate petrography.

This 180 page book firstly deals with the myriad of different skeletal and non-skeletal grain types that typify carbonate rocks (182 photomicrographs). The text in the next section gives a brief overview of diagenesis (including dolomites and evaporite replacements) and is accompanied by 109 photomicrographs most of which benefit from sections with blue resin impregnation and Alizarin Red S and potassium ferricyanide staining. The book finishes with three short sections on porosity (15 images), limestone classification (5 images) and cathodoluminescence (7 paired photomicrographs). With this coverage and quality of illustration the book is clearly going to be of great value to students, teachers and professional geologists who need a reference guidebook on carbonate rocks.

In detail, I have some criticisms of the atlas: the main one is that each illustration only has the most basic title (stained or non-stained), PPL or XP, stratigraphic and geographic location and the scale) and I would prefer to see the blank space next to each micrograph used to describe and interpret specific features within each image and for these to be identified on each micrograph by an arrow or letter. As I see it, and as I see my students using this book, it is driven by the quality of the illustrations, and not by the text, therefore the images need annotating so that the main features can be quickly understood. This would also give the opportunity of commenting on particular depositional textures or structures illustrated in a slide which otherwise is being used to illustrate a particular bioclast.

I found the limestone classification section rather weak and with some surprising errors which I hope can be redressed in future editions: Figs 313 and 314 are clearly packstones and not, as mentioned in the text, 'grainstones' as they have grain-supported textures and muddy matrices. Figures 61 and 69 are cited as being good examples of 'bioclastic wackestones' but 61 is clearly a packstone as is confirmed in the accompanying text which describes the stacked shells and many might argue that areas of 69 are in fact grain-supported, not matrix-supported and a better example could have been found. Figure 37 is cited as being a good example of a grainstone but the illustration clearly shows a