BOOK REVIEWS

Cabri, L. and Vaughan, D. J. (Eds) *Modern Approaches to Ore and Environmental Mineralogy*. Ottawa (Mineralogical Association Canada; Short Course Series Volume 27), 1998. viii · 421 pp. Price $48.00.

This book results essentially from a four day short course held in Ottawa in 1998 and given by experienced staff, many of whom are leaders in their own fields. The text and references are therefore up-to-date and authoritative. In the first eleven chapters there is a comprehensive review of modern techniques for studying ore minerals supported by applications relevant to petrogenetic studies, mineral processing and environmental problems. The final two chapters are concerned with the environmental problems caused by sulphide-bearing mine waste. In Chapter 1, Alan Criddle draws attention to the important role of such courses in bridging the gap between a declining graduate knowledge base in mineralogy and the requirements of, for example, the mining and processing industry. I fully share his concern about the future of mineralogy in the UK.

The first and critically important stage in most ore mineral studies is a careful examination of the specimen with a reflected light microscope. As befitting its importance a chapter on ore microscopy and photometry by Alan Criddle comes first and comprises ~20% of the book. In it he provides a comprehensive review of the optical theory and practice pertinent to this technique. Whereas the use of an optical microscope is important in the early stages of studying a sample, Bruce Robinson (Chapter 5) points out that low vacuum SEM may also be very useful at this stage for rapid mineral identification and petrographic studies. Chris Stanley (Chapter 4) reviews the available textbooks for ore microscopy and then discusses the textural interpretation of ore specimens and some applications in mineral processing, archaeology and metallurgy. The preparation of high quality specimen surfaces for advanced studies is clearly vital and Stanley and La Flamme in Chapter 3 discuss the principles and key aspects of the process such as sampling, cutting, impregnation, grinding and polishing.

In Chapter 2, Vaughan and Wright provide an essential grounding in the experimental and theoretical approaches to the study of structure and bonding in minerals with a view to understanding the reactivity of mineral surfaces. The importance of these surface reactions is now widely recognised in ore genesis, mineral processing and environmental studies.

Four chapters are devoted to trace element and isotopic analysis by microbeam techniques. Robinson *et al.* (Chapter 6) show how, by pushing EPMA technology to its limits, it is possible to obtain detection limits for many trace elements of <20 ppm. Cabri and Campbell (Chapter 7) describe the rapidly expanding use of the proton microprobe (PIXE) for quantitative multi-element trace element measurements in ore minerals. Its principal advantages over EPMA being somewhat lower detection levels and an ability to carry out standardless analyses. McMahon and Cabri (Chapter 8) describe the SIMS technique and emphasize its complementarity to EPMA and PDE. The advantages of SIMS are its exceptionally high sensitivity, an ability to measure different isotopes of a given element, and measurement of light elements and *REE*. Analytical principles and details of instrumentation are given and some practical aspects of SIMS analyses are described such as the determination of mass interference, standardisation and direct ion imaging. Richard Stern (Chapter 9) discusses the analyses of a range of radiogenic tracer isotopes, including Pb, Os and Hf, by high resolution SIMS. According to Stern these capabilities, as compared to its better known geochronological applications, are under utilized and may be applied to mineral deposit studies as well as biological and environmental applications.

Chris Hayward (Chapter 10) provides a thorough review of cathodoluminescence in ore and gangue minerals and its application to the minerals industry. The theory, instrumentation and many practical aspects such as sample preparation and damage and also some applications are given. In Chapter 11, Lastra *et al.* discuss image analysis techniques and their applications tomineral processing. They cover instrumentation (optical microscope, SEM, EMP), sample preparation and the discrimination of minerals thereby allowing the determination of mineral quantities, size distribution and textures.

The book concludes with two chapters on enviromnental studies. Jambor and Blowes (Chapter 12) cover sulphide-bearing mine waste. They outline the mineralogy of mine waste and the theory and procedure for establishing its acid generating capacity. The meat of the chapter is concerned with the reactivities of the key minerals in the mine waste environment. Finally, Nesbitt and Jambor (Chapter 13) highlight the role of mafic minerals in neutralizing acid rock drainage and suggest they have significant intermediate to long tenn neutralizing capacity. Base metal sulphide-rich waste from the Waite-Amulet mine, Quebec, is used as an example and mineral-pore water reactions are discussed.

Overall the book provides a valuable introduction for research students and junior professionals and a useful refresher for 'seniors' who find it increasingly difficult to keep up with advances outside their own speciality. However, while recommending the book I would also suggest that those who can attend the next appropriate short course and see this fascinating kit in action.

C. M. RICE

runin, R. F. *Shock Compression of Condensed Materials*. Cambridge (Cambridge University Press), 1998. xi + 165 pp. Price £30.00. ISBN 0-521-58290-3.

Shock studies of condensed matter originated in the USA and former Soviet Union during and shortly after World War II. The original urgency and motivation has obvious links with the rush to catalogue the properties (in particular their equations of state) of the various materials used in the construction of nuclear weapons. The outcome of these early shock experiments in both the former Soviet Union and USA, and their continued application since the early work, is now a fully developed field of high-pressure research that includes not only dynamic laboratory experiments, but underpins more recent static high-pressure techniques with the diamond-anvil cell by providing the link to the primary pressure scale. For those interested in the origin of these fundamental condensed-matter studies, R.F. Trunin has written a compact volume summarizing the beginnings of the work and the results that were achieved in a special period of Soviet scientific achievement. Experiments evolved from high explosive sources to using underground nuclear explosions themselves as sources, generating pressures as high as 10 TPa (10000 GPa, 100 Mbar). The book focuses on the development of methods and their results, with occasional data from similar experiments elsewhere, and provides an introduction to shock-wave theory and Hugoniot states.

His style is concise and combines in the early chapters a brief description of the political motivation with the clear scientific and experimental challenge faced by experimentalists at the Russian Nuclear Centre in Sarov (Arzamas-16), Novgorod region. A large part of the book (Chapters 3 and 4) covers the simple metals: their technological importance determined that they were exhaustively studied. But this also led to the first direct experiments at Earth's core conditions and the data on iron were fundamental to early geophysical papers (with L.V. Al'tshuler) on the properties and phase diagram of iron at high pressure and temperature — problems that have not been fully resolved even today. The text contains numerous historical remarks both in terms of the original ideas of interpretation, and the outcome of the experiments. Many of the data are presented as numerous shock velocity (D)–particle velocity (U) plots.

There are shorter chapters on metal alloys, porous metals and metal hydrides (these materials also referenced in terms of historical significance for planetary interiors) as well as a chapter covering minerals (oxides, halides, sulphides). The response of rock-types to shock waves is also briefly discussed and the book closes with summary information of organic solids and various liquids — and hydrocarbons.

The book contains a useful bibliography tracking numerous references to published work in Soviet journals. In line with the suggestion on the cover, this book will provide a reference for condensed matter physicists, materials scientists, earth scientists and astrophysicist — at least those with an interest in the properties of matter at high density.

A. JEPHCOAT

Paquet, H. and Clauer, N. (Eds) *Soils and Sediments: Mineralogy and Geochemistry*. Berlin, Heidelberg and New York (Springer Verlag), 1997. xx + 369 pp. Price £68.50. ISBN 3-540-61599-7.

Soils and Sediments is a multi-author volume dedicated to the late Georges Millot. Millot was the founder of the leading European school of clay geology based at the University of