thickness variations in profile section. It does not consider fault-related folding kink band style folding, polyphase fold patterns and the representation of foliations and schistosites on maps and sections. Chapter 6 comes somewhat late in the book and deals with unconformities. Chapter 7 deals with landforms but contains little on structural control of landforms. Chapter 8 deals with ocean-floor geology often ignored in other books. Chapters 9 and 10 are a detailed case history of the geometrical and geological interpretation and synthesis of BGS sheets 39° west and 39° east in the Midland Valleys of Scotland. These are well-argued analyses that conclude by comparing this area with modern-day environments. However, in general terms, the analysis of maps to produce cross-sections is not well covered, with little attention paid to the projection of data down plunge and the construction of true profile cross-sections and the construction of perspective and block diagrams. Some consideration is given to considering the compatibility of cross-sections but not to the modern concepts of balancing and restoring cross-sections.

In summary, whilst this book aims to guide a student through the processes of interpreting a geological map, it has a number of serious drawbacks that limit its usefulness. The areas dealing with structures and cross-sections are limited and do not deal with modern concepts of structural geology. I believe that these features (discussed above) can and should be introduced to students at an early stage. The maps analysed in detail are largely of similar style—i.e. BGS maps, and the methodology developed in the book largely relates to this. In other countries where maps may often just show the outcrops, this style of analysis may not be suitable.

K. R. McCLAY

Roberts, J. L. *The Macmillan Field Guide to Geological Structures*. London (Macmillan Press Ltd), 1989. 250 pp. Price £12.95.

This 14 × 18.5 cm hardcover field guide contains 254 illustrations (almost all of them high-quality colour photographs) of geological structures in the field. The features covered include sedimentary structure, igneous and metamorphic rocks, unconformities, tectonic structures (faults, folds, veins, joints, boudinage, shear zones and metamorphic fabrics), fold relationships, and structures in basement rocks. Each section consists of a brief descriptive introduction followed by colour photographs illustrating the structures as seen in the field. The photographs are usually three to a page, each with a detailed caption and usually with a detailed field locality. Descriptive notes are on the facing page to the photographs. The superb quality of the colour photographs and that of the reproduction means that the features are very clearly illustrated. The book is completed by a brief appendix on guidelines for structural fieldwork, an appendix of field localities for the photographs, a glossary, selected references and an index.

John Roberts is to be congratulated on this superb compendium of small and mesoscale structures in the field. The majority of the examples are from the British Isles with the localities fully documented. The descriptive text is in places limited and does not include a full discussion of how various structures form. There is a lack of examples of large-scale structural features, e.g. faults and folds and their topographical expression, but this is a minor criticism. For the professional geologist this field guide is an enviable collection of photographs illustrating the beauty of structures in the field. For the serious student of geology the book provides classic text book examples of most of the structures that one would encounter in the outcrop. For the amateur this book provides an excellent compendium that enables identification and recognition structures seen in the field. The quality of the photographs and the reproduction will mean that most geologists will want to have this book.

K. R. McCLAY

Karato, S.-I. and Toriumi, M., eds. *Rheology of Solids and of the Earth*. Oxford (Oxford University Press), 1989. 440 pp. Price £60.00.

This text, edited by Shun-Ichiro Karato and Mitsuhiro Toriumi, is a translation of the original Japanese version of this book which was published by Tokai University Press in 1986. The text is a collection of review papers that were originally given at a symposium 'Plastic flow and microstructural development in solids: from crystals to Earth' which was held in Tokyo in November 1985. This English version of the book contains an additional paper by Mervyn Paterson on the role of water in quartz deformation.

The quality of the translation of the original papers is excellent, and the text is well organized. It is divided into four parts: Defects and plastic deformation in metals and oxides; Defects and plastic deformation in minerals; Deformation microstructures; Flow in the Earth.

The first section contains six papers dealing with a range of topics including dislocation motion, grain boundary behaviour, diffusion and creep in various metals and oxides. The treatments are

thorough and supported by detailed bibliographies. The six reviews, although describing aspects of the rheology of materials that do not occur naturally, will be of broad interest to those interested in mineral rheology as the deformation mechanisms described also occur in nature and the materials can be regarded as good analogues for various minerals. Because each paper is a review, the topic is clearly introduced and important aspects of the appropriate science described. The editors appear to have done an excellent job in integrating the different contributions.

The high standards set in the first section of the book continue into the second, where detailed reviews of water weakening of quartz, pressure solution, deformation of olivine, and rheology of ice are presented. Each paper is clearly introduced and each subject is well reviewed, again with excellent bibliographic support.

The third section of the book moves away from the behaviour of individual crystals to consider the microstructures that result when collections of grains deform together. The reviews start with a treatment of preferred orientation and progress into discussions of plastic anisotropy, preferred orientation in mantle materials, recrystallization of metals, and the experimental generation of shear zones in quartz aggregates. The review papers in this section of the text provide a link between the crystal physics presented in sections 1 and 2 and the behaviour of rocks deforming plastically within the Earth, which is presented in section 4.

The fourth section of the text has a more 'geological' feel to it, with discussion of field examples. The papers review the microstructures of regional metamorphic rocks, shear zones and mylonites, and the evidence for plastic flow and structure development in the mantle. An experimental study of the generation of shear zones in halite is reported and these data are used to explore the nature of seismicity in the shear zones at subducting plate boundaries.

This text, therefore, takes the reader from specific descriptions of the deformation mechanisms mobilized in single crystals of minerals, ceramic compounds and metals, through the deformation of mineral aggregates to the rheology of rocks within the Earth. The book is well presented, the equations are clear, and the quality of the line drawings and plates is good. The text will find its readership amongst those interested in deformation mechanisms, texture development in rocks, and rheology of the ductile regions of the lower crust and upper mantle. I found the book easy to read and informative.

Finally, it is important to note that although this text follows a symposium which took place in 1985, and is a translation of a book published in 1986, the contributors have updated their papers so that the literature includes reference to papers published up to 1987. The work reported is therefore fairly current.

M. E. JONES

Gill, R. C. O. *Chemical Fundamentals of Geology*. London and Boston (Unwin Hyman), 1989. xii + 292 pp. Price £14.95 (paper).

Recent advances in the Earth and Environmental Sciences have made it even more necessary than before for students to have an understanding of how chemical and physical principles control or influence natural processes. This book is intended to provide Earth Science students who lack a formal training in Chemistry with an appreciation of fundamental chemical principles. It is also intended to serve as a revision text for students who have previously been exposed to such material.

The first four chapters are concerned with processes and introduce the concepts of thermodynamics, equilibrium, kinetics, and aqueous fluid chemistry. In these chapters, topics covered include Gibbs' Phase Rule, simple phase equilibria, activation energy, diffusion, radioactive decay, blocking temperatures, fluid inclusions and Eh–pH diagrams. The next four chapters discuss the properties of the atom, using a simple wave mechanics approach to explain electron energy levels, leading on to the structure of the periodic tables, the different types of chemical bonds, and structures of rock-forming minerals. Topics discussed include atomic spectra, the electron microprobe, calculation of mineral formulae, and crystal growth. The last two chapters deal with the distributions of 'geologically important' elements in the Earth and the Solar System. Contents include discussion of incompatible trace elements, K–Ar dating, organic C compounds, oxygen isotopes and buffers, transition elements and colour in minerals, nuclear fusion and fission, and chemical evolution of the Earth and Solar System. Appendices include a glossary and sections on 'Mathematics revision' and 'Simple solution chemistry'. Also present are a table of atomic numbers (but surprisingly no atomic weights), a periodic table, and a very useful, comprehensive index.

The chemical principles are on the whole very clearly explained with many geological and environmental examples helping to emphasize their importance. Some more challenging concepts are