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

treated in a series of separate 'boxes' which are cross-referenced with the normal text. In addition to worked examples through the text, most chapters end with a series of problems, the answers to which are given at the end of the book. As might be expected for such a book, some parts are treated too superficially, but overall the information is well balanced and students with little or no chemistry will find it a useful text. Nevertheless, it should be stressed that this is emphatically not a geochemistry textbook and, once students understand the basic principles, it will be necessary for them to consult more-specialised mineralogy, petrology and geochemistry books, many of which are recommended in 'Further reading' lists.

The production of the book is generally good; the figures are particularly well thought-out and clearly drawn and the print is clear with only a few typographical errors. There is one very surprising error on page 80. Due to a miscalculation in the molecular weight of $MgCO_3$ the mole fraction of $CaCO_3$ in dolomite is reported to be 0.514! A minor niggle in this section is that integral approximations are used for atomic weights without comment.

It is always possible with this type of introductory text to criticise particular omissions or oversimplifications but I have refrained from doing this. The author has prepared a comprehensive and very useful introductory chemistry text for Earth Science students and I can strongly recommend it—at £14.95 for the paperback version it is very good value.

C. M. HENDERSON

Brown, P. E., Editor. *The Origin of Granites.* Edinburgh (Trans. Roy. Soc. Edinburgh, vol. 79, parts 2 and 3), 1988. viii + 350 pp. Price £25.00.

In recent years there has been much debate on the genesis of granite. An international symposium entitled 'The Origin of Granites', held in Edinburgh in September 1987, brought together many researchers in this field and prompted much useful discussion. Most of the papers presented at this symposium are published in this Royal Society of Edinburgh volume.

The topics covered by the contributing authors may be grouped into three broad categories, which reflect the main areas that we have to consider in the investigation of granite origin. These are concerned with the nature of the source, the mechanism of production, and the subsequent evolution of the granite magma. Most controversial, perhaps, is the problem of source. The opening paper by Chappell and Stephens deals with the origin of infracrustal granites, with particular reference to the Lachlan and the Caledonian Fold Belts. This serves as a useful reminder, as well as an update of the much-used I-type and S-type granite classification of Chappell and White (1974). Now more descriptively termed infracrustal and supracrustal, the two groups are defined according to the non-weathered (igneous) or weathered (sedimentary) character of their source. Whilst rather dated, this simple classification is appropriate in certain provinces, several of which are described in this volume. For instance, of supracrustal affinity are the leucogranites of the Himalayan collision orogeny (France–Lanord and Le Fort). In contrast, Silver and Chappell discuss the Peninsular Ranges Batholith of California where all granites appear to be infracrustal. Unfortunately, only one paper (Pankhurst *et al.*) is concerned with the more complex (and more common?) situation of supracrustal and infracrustal source mixing. The important role of Sr, Nd and O isotopic techniques in the identification of granite source is adequately discussed, however, there is little mention of Pb isotopic data. An informative paper by Taylor deals more specifically with O isotope systematics, particularly with the role of $^{18}O/^{16}O$ studies in determining the origins of the aqueous fluids involved in producing granitic magmas.

Several of the papers that discuss the cause and method of granite genesis are especially useful in the context of this volume. In all of the contributions concerning infracrustal granites, basalt underplating is suggested as a mechanism that may have been involved in their generation. Of particular relevance, therefore, is the paper by Huppert and Sparks, in which they investigate the thermal role of basalt sill intrusion (a process that may occur during underplating) in the melting of the lower crust. Their experimental and theoretical studies support the effectiveness of this mechanism in the production of large volumes of silicic magmas. An interesting paper by Pichavant and Montel discusses the conditions rather than the means of crustal melting. Most important is the contribution by Miller *et al.* Here we are reminded that a large source region is almost inevitably heterogeneous, and, as such, is likely to pass on some degree of heterogeneity to any granites derived from it. Extent of pluton homogeneity may therefore be an effective indicator of the process of magma segregation and transport.

It is well understood that high-level silicic magma chambers may feed contemporaneous