

apparent that some have only been mapped and investigated on a reconnaissance scale.

This well-produced volume is a tribute to the enormous amount of effort and coordination that must have been put into it by the four authors. Considering the variety of data sources, an admirable consistency of presentation has been achieved. In the case of maps, some attempt has been made to standardize ornament and the ornament is displayed in boxes on the map rather than, as on most Russian maps, explained in captions.

This book will inevitably alert the geological world outside the former USSR to the numerous exciting petrological problems in the Russian alkaline complexes and carbonatites; as such, it has the potential to be a stimulus for cooperation between Russian petrologists and their colleagues outside Russia. For this reason it is regrettable that the high cost of the book will deter most individual buyers. However, I can recommend it for purchase by institution libraries.

J. B. DAWSON

Griffen, D. T. *Silicate Crystal Chemistry*. New York and Oxford (Oxford University Press), 1992. x + 442 pp., 263 figs. Price hardback £45.00. ISBN 0-19-504442-8.

The author's intention in writing this book was to produce a one-semester graduate textbook in crystal chemistry. Its aim is to illustrate the principles that are important in modern crystal chemistry through a discussion of the eight mineral groups: the silica polymorphs, feldspars, micas, pyroxenes, amphiboles and non-classical biopyriboles, the aluminium silicate polymorphs, olivines, and garnets. This discussion comprises Part I of the book; the four chapters in Part II are concerned with crystal symmetry, instrumental methods, atomic bonding and phase diagrams. The book ends with a summary of crystallographic data for minerals in the groups covered in Part I.

Polymorphism and the characteristics of phase transitions are introduced in the first chapter on silica polymorphs and the α - β quartz transformation is used to illustrate the concepts of domains and incommensurate phases. The chapter ends with brief accounts of stuffed derivatives and bonding. Each of the chapters on the large mineral groups commences with an account of the general chemistry and ideal crystal structure. The manner in which the structure is modified to accommodate changes in temperature and composition allows discussion of various phenomena: polymorphism, site preference, cation and anion ordering, polytypism, exsolution and microstructure. Emphasis is placed on the use of relatively easily measured quantities, such as cell

parameters and refractive indices, to estimate the chemical composition and, in some cases, the structural state of a mineral. The author occasionally slips in an extraneous topic: the geophysical importance of the near-forsterite to spinel transformation is to be found in the olivine chapter and a discussion of mullite is included in the chapter on aluminium silicate polymorphs. The discussion of the crystal chemistry of garnets would be enhanced by the inclusion of synthetic garnets. Each chapter ends with a list of papers referred to in the chapter; readers are recommended to perform their own literature searches for additional material.

More than a third of the pages of the book are devoted to Part II which is entitled 'Supporting Concepts'. The reader is warned in the introduction to the book that the account is not comprehensive and it appears to reflect the author's interests. For instance, crystallographic point groups and space groups are treated in depth but no mention is made of the reciprocal lattice. Moreover the general equivalent positions of a space group are derived by cumbersome matrix methods suitable for computer programs rather than simple graphical methods that take just a few minutes to do by hand. This chapter also contains some errors and rather infelicitous phrases that might well confuse someone unfamiliar with the subject. Brief accounts of X-ray powder diffraction (including a clear account of least-squares procedures), electron micro-probe analysis, X-ray fluorescence spectrometry, Mössbauer and nuclear magnetic resonance spectroscopy, and electron microscopy include a theoretical overview. The chapter on atomic bonding models is uneven; there is a fairly detailed but simple account of ligand field theory but the brief section on molecular orbital theory gives wave functions for the hydrogen-like atom and an indication of how solutions of the molecular Schrödinger equation may be found. The last chapter on phase diagrams is the most satisfactory in this part; a student reading it carefully could achieve a good understanding of phase equilibria. An outline of the experimental and theoretical approach to phase stability prefaces a clear account of binary phase diagrams. The chapter ends with a discussion of the kinetics of phase transformations.

There are few errors in the book and it is well illustrated with clear diagrams. However, the text would be easier to follow if some of the many figures that show coordination polyhedra were replaced by plans showing the heights of atoms above the plane of projection. The directions of the crystallographic axes are often described in the caption; arrows indicating their direction on the diagram itself would be easier to follow. Smaller diagrams, printed on the page on which the relevant text is printed would

make reading easier. In one case the figure is to be found six pages on.

Part I of the book is a valuable textbook on crystal chemistry; Part II is more likely to prove of interest to lecturers seeking different approaches to basic concepts.

C. H. MCKIE

Clauer, N. and Chaudhuri, S. *Clays in Crustal Environments: Isotope Dating and Tracing* Berlin, Heidelberg and New York (Springer-Verlag), 1995. xii + 359 pp.. Price DM. 148.00. ISBN 3 540 58151 0

In this book the low-temperature isotope geochemistry of clay minerals in various environments of the uppermost crust of the Earth is considered. Weathering profiles, transport and deposition, and the diagenetic and metamorphic fate of a rock are discussed. The main focus of the book is on dating and tracing clay minerals, because these are questions relevant to everybody investigating them — whether that is for their use as stratigraphic or tectonic markers, or as climatic, fluid, or physico-chemical tracers.

The six chapters are structured like individual articles. Chapter 1 (Introduction) gives a very brief overview of the structure and classification of clay minerals, and of the principles and methods of isotope geochemistry. Furthermore, and very importantly, problems with methods themselves (e.g. Ar-diffusion), and the effects of various treatments necessary for separation and preparation of the clays for isotopic analyses are highlighted.

Chapter 2 (Continental Weathering) deals with (mainly Sr-) isotopic changes and physicochemical conditions of both silicate minerals and ambient fluids during weathering processes. These conditions have a considerable effect (isotopic inheritance) on the pedogenic clays; a model is presented for the derivation of those. The importance and the effects of the presence of micro-environments in soils is clearly shown.

Chapter 3 (Young Continental and Oceanic Sediments) discusses the changes in Sr-, Nd-, Ar- and stable isotopic signatures of suspended and dissolved loads of rivers from the drainage basin to their deposition, alteration, and burial in the ocean. The problem of differentiating between detrital terrigenous and authigenic oceanic minerals such as glauconites, palagonites, smectites, and celadonites, and of the mode of their formation, is emphasized.

Chapter 4 (Sedimentary Rocks) includes two aspects. Firstly, the difficulties (e.g. detrital isotopic memory) of dating timing and duration of deposition by Rb—Sr, and K—Ar methods are discussed. The second part is on the timing and the physicochemical

conditions of both formation and evolution of diagenetic clay minerals in shales and sandstones. It revolves about illitization of smectites and its most influencing factors. The timing, and the thermal and physicochemical evolution of clay authigenesis in hydrocarbon reservoirs is considered, and also the role of pore-fluids and water-rock interactions with respect to the O- and H-isotopic composition of diagenetic clays. The disputes of mass-transfer and open/closed-system behaviour in sedimentary basins are discussed.

In Chapter 5 (Mica-type Minerals in Low-temperature Metamorphic Rocks), the authors point out that the onset of various types of metamorphism causes more coherent isotopic relationships between the various rock-components than those found in sediments. Although permeability and size-fractions of the clay particles affect the degree of isotopic memories, and isotopic records of recrystallized minerals depend on the original chemistry, they may be useful in describing dynamics of tectonism and the timing of (hydro-) thermal events.

Chapter 6 is entitled 'Frontiers in Clay Isotope Geochemistry', and is basically a review of the previous chapters. It shows what the current state of isotope geochemistry of clay minerals is, what is known and what is still unclear, what needs to be better established, and what needs to be done in order to achieve these better insights into stable isotope geochemistry.

As this book is not supposed to be a textbook, it does not contain much background or basic information. However, the inclusion of some more references, in particular in the Introduction, would have improved its value for less advanced isotope geochemists. A more detailed and subdivided index would have made it more useful as a reference book. What made it difficult to read on occasions are the abundant, strongly condensed excerpts from refereed papers. Often, their results could have better been displayed in a table rather than being listed in the text (e.g. p. 268). The figure captions often lack sufficient description and explanation of the symbols, lines, or numbers in order to be able to easily and quickly understand the diagram (e.g. Figs. 1.3, 2.1, 5.17). Spelling mistakes are rare (*Lenan* — *Leman*, *gauconites* — *glauconites*), and the identity of referred authors might not always be their real one (*Longstaffe FK* — *Longstaffe FJ*).

The book gives a very good overview of the studies published to date on the subjects of discussion. Discrepancies between the studies are pointed out, substantiating the importance of careful and appropriate sample separation and preparation, confirming the ambiguity of interpreting low-temperature isotope data, and corroborating the need for a better understanding of the controlling