Principles of Isotope Geology), that provide a more accessible introduction to a variety of aspects of stable isotope geochemistry.

The preface to this book states that the previous (third) edition "has been totally re-written on the basis of the literature which has appeared since 1987". It is therefore a little disappointing that fewer than 39% of the citations refer to post-1986 papers (Fig. 1). Nevertheless, this 39 or so percent represents the incorporation of significant new work whilst the style and layout have remained effectively unchanged.

A book of 168 pages that encompasses such a wide range of isotopic studies cannot provide a comprehensive survey of isotope geoscience (nor does Hoefs claim to do so). The book therefore has a distinct bias toward the traditional fields of isotopic study. There is nothing on the use of stable isotopes as pollution tracers in the surficial environment (e.g. coupling C and Cl isotopes to trace pollution plumes in groundwater), nor is there anything relevant to archaeological studies (e.g. sourcing artefacts with isotopes). Surprisingly, there is nothing on the rapidly developing field of strontium isotope stratigraphy.

Sometimes, credit is not given where it is due; for example, by citing the "interesting observation made by Shemesh *et al.* (1983) .... that the $\delta^{18}O$-values of phosphorites decrease with increasing geological age", the author overlooks the fact that this observation was put forth as clearly as could be by Longinelli and Nutti in 1968. Some figures are outdated; for example, "Fig. 65. Composite of $\delta^{18}O$-fluctuations in the foraminiferal species *G. sacculifer* from Caribbean cores (Emiliani, 1978)" might more usefully have been a reproduction of the (slightly) more modern SPECMAP $\delta^{18}O$ record.

Despite these caveats, the book clearly remains a useful source of information on stable isotope geoscience, and should be on the shelf of any science library. The third edition of this book was cited 158 times, so clearly it was useful to many.

J.M. MCARTHUR

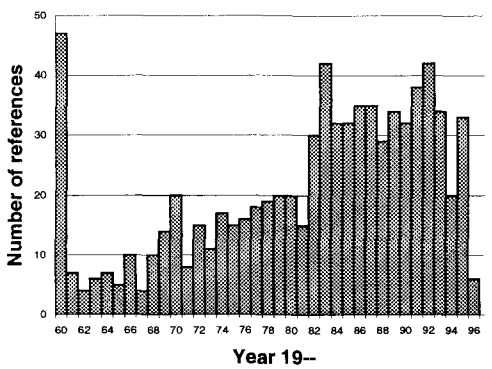

FIG. 1. References by year.

Cornell, R.M. and Schwertmann, U. *The Iron Oxides: Structure, Properties Reactions Occurrence and Uses*. Weinheim and New York (VCH Verlagsgeseiischaft mbH). 1996, xxxi + 573 pp. Price DM 328.00. ISBN 3-527-28576-8.

This book provides an authoritative and detailed account of the structure, properties, reactions, occurrence and uses of the fine-grained iron oxides such as are produced by synthetic and industrial processes. Chapters describe the crystal structure, cation substitution, crystal morphology and size of the common iron oxides and hydroxides. Here crystal size is usually in the micron or sub-micron range and this is particularly relevant to the chapter on surface area and porosity. The chapters on the electronic, electrical and magnetic properties include applications for magnetic tapes and describe the semiconductor properties. Methods of characterization are listed from IR, Raman, UV and Mössbauer spectroscopy to magnetic methods and diffraction techniques including XRD. Microscopy appears low in this list followed by thermal methods such as TG and DTA. Subsequent chapters deal with the thermodynamics, solubility, surface chemistry and adsorption characteristics. The chapter on dissolution covers a range of dissolution reactions and mechanisms and their effects on particular iron oxides and hydroxides. The dissolution effects of biological and other reduction reactions in natural environments are covered in nearly two pages and relate to the effects in soils. The formation of the iron oxides is discussed with reference to synthetic systems and hydrolysis reactions and the flavour of this can be judged from the section on mechanisms of formation which opens "In unhydrolysed or slightly hydrolysed solutions in which only monomeric and dimeric Fe^{111} species are present....". The chapter on transformations is detailed and informative but lacks any application of this knowledge to natural systems. A chapter on rocks and ores appears rather suddenly and magmatic and metamorphic rocks and ores are described briefly. Apparently magnetite is "ubiquitous in rocks" and "intrusive rocks, which cool down at a lower rate, contain crystals (of titanomagnetite and ilmenite) up to 100 μm." We also learn that "An enormous amount of literature about titanomagnetites and other magnetic minerals exists because these minerals are the main carriers of rockmagnetism (sic) and therefore form the basis of the field of palaeomagnetism." Sedimentary and

recent geological environments are given greater coverage since this is where natural pigments can be found. Soils are highly rated as "a unique environment for iron oxide formation in terrestrial ecosystems." The formation of iron oxides by organisms merits a short chapter as do the products of iron metal corrosion. Chapters on the applications and synthesis of the iron oxides conclude the book. The descriptions of the methods of synthesis of individual minerals are particularly detailed and informative.

It is typical of this book that optical microscopy appears after spectroscopic and diffraction methods and is dismissed with the single sentence "Optical microscopy of various types is applied to mineralogical samples". After that opening sentence the section on microscopy lists TEM and SEM in slightly more detail. There is a tendency to mention a topic but to provide little information of substance. This set of values reflects the interest of the authors in the fine-grained iron oxides where optical microscopy has less application. The authors cover no aspect of examination in transmitted or reflected light nor the growth and alteration textures which are so informative in revealing the genesis of the naturally occurring and coarser-grained iron oxides. This limitation of the book should have been made more apparent in the title; a title such as "The Fine-grained Iron Oxides" or "Synthetic Iron Oxides and Natural Pigments" would be more appropriate and explicit. By omission and by some strange choices of emphasis this book misrepresents the occurrence and genesis of the important natural iron oxides. In similar style this book makes it sound as though the Munsell system was established primarily to describe soil colours. There is an inconsistent use of units so that 'mg g^{-1}' and the equivalent 'g kg^{-1}' are used randomly, 'mg kg^{-1}' expresses trace concentration and 'g g^{-1}' is used for major elements but seems not to have been understood since (p. 423) laterite appears to contain up to 154 g g^{-1} Fe!

It would not be appropriate to recommend this book as a primary text on iron oxides to those interested in the natural iron oxide minerals, although there is much extremely valuable detail for those prepared to restore the balance. As a text on the iron oxides for industrial producers and those interested in synthesizing iron oxides and hydroxides this book will undoubtedly form their standard reference.

J.F.W. BOWLES

O'Keefe M. and Hyde B.G. *Crystal Structures, Vol. 1, Patterns and Symmetry*. Washington, D.C. (Mineralogical Society of America Monograph), 1996. xvi + 453 pp. Price, hardback, $36. ISBN 0-939950-40-5.

This book is addressed to "serious students of solid state chemistry and related sciences (e.g. mineralogy, materials science and solid state physics)", and assumes that these are not "professional crystallographers"4; indeed it assumes that they do not wish to become professional crystallographers, and it does not seek to provide any information about methods for determining the structures with which it deals. The latter two thirds of the book are taken up by three chapters devoted respectively to systematic discussions of crystal structures in terms of polyhedral stackings, sphere packings, and 3-dimensional nets. However, these approaches are by no means kept artificially separated, and it is a great virtue of the book that it shows how much can be revealed not only by different approaches to the same structure, but also by comparing apparently very different structures that have an underlying relationship. The structures are profusely illustrated with well-drawn diagrams, and are usually described by giving explicitly the coordinates of the special and general space group positions that are occupied. As a preparation for this the first third of the book provides a thorough exposition of point group and space group symmetry in two and three dimensions, and also of lattice geometry.

The authors' enthusiasm for their subject is very apparent, especially in the 'notes' at the end of each chapter and in the appendices that "are 'notes' that became too long for inclusion in individual chapters". These may well lead the reader on to advanced topics beyond the general theme. A quirk of the book arises from the fact that it seems to assume that its readers never encounter crystals as objects in the real world; so point group symmetry is treated in the abstract without reference to crystal morphology, and lattice planes and zone axes do not appear until Chapter 4 (after the chapters on symmetry). The main potential value of the book for mineralogists would be to lead them to compare mineral structures with one another and with structures of other kinds, and to consider them from different points of view. New insights are most likely to be gained from the relatively minor cross references to a particular mineral, and it is therefore unfortunate that the index frequently fails to lead one to these. Perhaps the promised second volume will rectify this situation. Each chapter is followed by a series of excellent and challenging exercises, but it is a pity that answers are not generally provided. The benefit of exercises to the student is much reduced if he does not know whether his solutions are correct.

Misprints and errors are commendably rare, and seem to be virtually confined to the section on layer silicates. The worst is that a description of the chlorite structure is said to be that of vermiculite. Bentonite and Fuller's earth are not the names of