

significant departures from the ideal, as is apparently true for carbonate apatites, the method loses much of its capability: 'there are limitations to the extent of structural information that can be attained by study of a triclinic crystal if one begins with the erroneous premise that the crystal is hexagonal'. It is considered that there is a lack of reliability in most of the interpretations based on infra-red data, and that these are incompatible with data obtained by other methods capable of more straightforward interpretation. Very proper objection is taken to attempts to calculate a 'solubility product' for an aqueous system that is not at equilibrium. The challenge of interrelating the precipitation of dahllite to the vital processes of vertebrates will make little progress as long as the carbonate ion—both in solution and in the solid—is disregarded.

In a useful appendix, data are summarized for apatites and related substances, including brushite, chlorapatite, dahllite, ellestadite, fluorapatite, francolite, hydroxyapatite, monetite, morinite, strontiapatite, whitlockite, wilkeite, and voelckerite.

Although the dental and biological aspects of the carbonate apatites are of considerable interest, this reviewer would not wish to give the impression that they dominate the book. This is indubitably the most important modern text on apatites of all types, summarizing as it does all work on this group since the summary given by Hausen (1929) at a time before the structure had been determined and before reliable values for fluorine content were available. There is a complete chapter on the igneous and metamorphic occurrences but it is obvious that there is still a scarcity of data on apatites occurring as accessory minerals in a wide range of rock types, most specimens studied having been from veins, pegmatites, and segregations. It is an essential book for all scientific libraries, but at a price of well over 5p per page, although thin it is expensive.

R. A. HOWIE

WEDEPOHL (K. H.), editor. *Handbook of Geochemistry*, Volume II/3. Berlin, Heidelberg, and New York (Springer-Verlag), 1972. iv+845 pp., 161 figs. Loose-leaf binder: Price DM 258, U.S. \$81.80 (subscription price DM 206.40, U.S. \$65.50).

This further substantial contribution to the *Handbook* provides a complete, or substantially complete, treatment of a further nine elements (N, F, Zn, Ga, Se, In, Te, Ba, Tl) together with separate chapter sections for Si and chapter sections A (Crystal Chemistry) for sixteen elements in addition. Taking together the three parts of Volume II so far issued, fifty-two elements have now received almost complete coverage. One or more sections have appeared for a further fifteen elements, while nothing has yet been issued for the rare gases, the halogens, nor for Co, Ni, Zr, Nb, Mo, Hf, and Ta. One further part of Volume II, expected during the next year or so, should complete the whole work.

The layout of the *Handbook* will by now be familiar to most geochemists, and the general remarks made in reviewing Volume II/1 (*Min. Mag.* **38**, 533-4) hold good for the present part. As before, while the style of treatment varies from element to element and from author to author, the over-all standard is high, and when the work is complete a formidable body of quantitative information and fundamental ideas will be accessible to geochemists with the greatest of ease. In the present instalment,

the reviewer found the chapters on N, Zn, and Ba, and the newly available section on the crystal chemistry of silicon particularly lucid and informative.

Again, the quality of typography and production is good, and obvious errors few. The price of this instalment, like its forerunners, is high. The work is essential for any chemical, geochemical, or geological library, but rather few private subscribers will feel able to afford it.

E. A. VINCENT

STANTON (R. L.). *Ore petrology*. London and New York (McGraw-Hill Book Co.), 1972. xviii+713 pp., 242 figs. Price £9.35.

This book, as the title implies, is concerned with the study of ores as rocks—rather than as exotic entities derived from extraneous sources and superimposed on geological situations to which they bear little or no genetic relationship. There are two parts: in part one principles are dealt with in not unreasonable detail (pp. 7–302), and the remainder of the work is concerned with the nature, mode of occurrence, and origin of the principal ore types. The development of ore-genesis theory has been slow, haphazard, and repetitious, and the popularity of various well-known theories has waxed and waned substantially as a matter of fashion. This is attributed in part at least to a lack of co-ordination in research between field and laboratory. Whereas in silicate petrology studies based on field observations, petrography, and mineral chemistry have advanced together and each technique has received continuous help from the others, with ore research this has not generally been the case. The author's approach to the theories and principles of ore formation illustrate the main philosophy of this work: thus ores are considered as rocks and, provided the relevant conditions for the stability of ore minerals are observed, it is shown that they may have formed in all the ways that 'ordinary' rocks have formed. The ores themselves are treated as natural polycrystalline aggregates, conforming with the principles of phase equilibria and geochemistry.

The first part presents a great deal of basic information, ranging from banding in minerals, through a classification of ore minerals, the diagrammatic representation of phase equilibria, the behaviour of ore minerals in aqueous systems, and the fractionation of sulphur isotopes. In the concluding sections of part one the features and behaviour of ores are approached from the point of view of modern 'materials science', with chapters on growth and growth structures in open space and in polycrystalline aggregates, and on structures due to deformation and annealing.

In part two the ores are grouped under broad petrological headings but any immediate genetic connotation is avoided. In each association, e.g. ores in mafic and ultramafic igneous rocks, descriptions of the geological setting and of typical examples of the association are followed by a discussion of views on the genesis of the ores in relation to experimental and analytical data. Associations considered include ores of felsic igneous rocks, iron and manganese concentrations of sedimentary affiliation, stratiform sulphides of marine and marine-volcanic rocks, stratabound ores of sedimentary affiliation, ore veins, and ore deposits of metamorphic affiliation. This section ends with a chapter on ore type and the tectonic cycle, in which an account is given