Despite the title, only 11 pages are devoted to the origin of meteorites (Ch. 19), and only the author's modification of Mason's theory is discussed. His obvious preference for a single parent body leads to a good deal of special pleading, here and elsewhere.

Meteorite craters (Ch. 20) receive 22 pages. While a meteoritic origin has been suggested for many geographical features on very slender evidence, the author goes to the other extreme: Wolf Creek and Cañon Diablo are 'the only two well-established examples of mega-impacts besides the Henbury craters' (p. 267), though elsewhere the meteoritic origin of the Wabar craters is admitted; the nickel–iron spherules so plentiful at Cañon Diablo and in the Wabar glass are not mentioned. All other explosion-type craters are regarded as 'crypto-volcanic'.

Two chapters (39 pp.) are devoted to tektites—their distribution and properties and the various theories of their origin; but space could have been saved by leaving out the impossible theories and keeping only the improbable ones.

Despite its obvious failings this book should be useful as a second text for the university student, calling attention to the too-facile erection of theories on very slight evidence that is all too common in this field. M. H. H.

McConnell (D.). *Apatite: its crystal chemistry, mineralogy, utilization, and geologic and biologic occurrences.* Applied Mineralogy, Volume 5. Vienna and New York (Springer-Verlag), 1973. xvi+111 pp., 17 figs. Price S324 (DM 47; $14.90).

This slim volume brings together in consolidated form a critical summary of the many hundreds of articles that have appeared on apatite during the past thirty years. Many modern technological developments depend on phosphorus-containing compounds for which the basic raw material, phosphate rock or phosphorite, is a sedimentary rock of which the essential mineral component is normally a carbonate fluorapatite. Igneous and metamorphic rocks also may contain concentrations of apatite and one of the more important aspects of a theoretical knowledge of apatite is concerned with its relationship to teeth and bones. The structure, crystal chemistry, and mineralogy of apatite are described authoritatively and discussed in their relation to geological occurrence and use in industry. The author maintains a critical sceptism throughout: thus in discussing the carbonate apatites the $3PO_4 \rightarrow 4CO_3$ substitution is preferred but under the heading 'questionable interpretations', after mention of the possible substitution of CO_3 for 2F, we are told that numerous papers on carbonate apatites are not cited as the conclusions contained therein are incompatible with accepted crystallochemical theory, the experiments were not performed by appropriate methods, and/or alternative interpretations of the data have been completely disregarded without satisfactory explanation. It is pointed out that the inorganic phase of bone should not be called hydroxyapatite; it is a dahllite (if a mineral name is appropriate for something of organic origin) or carbonate hydroxyapatite (*carHap*) if one is attempting to designate both the composition and the structure.

In the final chapter, 'Critique', the author is challengingly outspoken. Although X-ray diffraction techniques have their uses, when the structures being studied show

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, wilkeïte, 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,