## BOOK REVIEWS

BRAGG (W. L.) and CLARINGBULL (G. F.). *Crystal Structures of Minerals.* London (Bell), 1965. ix+409 pp. Price: 70*s*.

If there is any one book likely to be familiar to readers of this journal it must be the now classic *Atomic Structure of Minerals* (1937) (M.A. **7**–7]. Inasmuch as the book under review is the successor to that one (and, in effect, the second edition) it will be convenient to consider the new book mainly in terms of the old one.

The principal change has been the revision of some of the old structure descriptions and addition of many new ones. The organization, format, style, and nature of the contents, however, are the same as before. The inclusion of new material has increased the size considerably, not only in the number of pages (409 *vs.* 292), but also in the number of words per page (nearly a 40 % increase). The only other significant change is the elimination of Chapter 2, 'The Analysis of Crystals by X-Rays'. The remaining fourteen chapters correspond to those in the first edition.

The passage of nearly thirty years has brought about an interesting change in the relative coverage of the books. The first edition summarized practically all that was known about mineral structures up to the end of 1936. The new edition, in spite of its greatly increased size, can describe only a fraction of all the mineral structures now known. This problem has been partly solved by appending at the end of each appropriate chapter a list of references to structures not discussed in the text. These supplemental references are intended to cover all such structures reported through 1963. Although these references are of great assistance, the reader cannot assume that all mineral structures known up to 1964 are mentioned. In a quick check of the supplemental lists for the first few chapters, I found pre-1964 references in standard sources for at least 10 more halides, 5 more sulphides, and 4 more oxides. The same situation holds for most of the other chapters.

Chapter 1, 'Geometry of Crystal Patterns', retained with little change, develops the idea of space groups and emphasizes its importance in dealing with crystal structures. In view of the fact that this book is intended in part as a standard text in mineralogy, the chapter should have included some illustrative descriptions and explanations of representative structures explicitly in terms of equipoints and atomic position parameters. This elegant and essential method of structure

description is much too important to be left for students to learn about by hit-or-miss methods.

Chapter 2 (old Chapter 3), 'Some Factors Governing the Structures of Minerals' is essentially the same as before and is based on the simplest sort of ionic model. Brief mention is made of the results of crystal field theory in regard to $Cu^{2+}$ and $Mn^{2+}$. A new section has been added, which summarizes in a simple way our knowledge about the distribution of the elements in the earth's crust.

The remaining thirteen chapters, as before, describe and discuss the structures of the more important and interesting minerals. The structures are described in exactly the same way as before. This, in my opinion, is the principal short-coming of the new version—the lack of descriptions explicitly in terms of equipoints and position parameters. The addition of such descriptions to the clear verbal and diagrammatic descriptions already present would have multiplied the pedagogical value and convenience as a reference book several times over. The references for the structures discussed in the text are mostly to the earliest reasonably complete descriptions. Although references to some refinements are given, they are by no means consistently given, nor are they always the latest ones. The value of this book as a reference volume would be greatly enhanced if the literature reference to the most recent description or refinement (prior to 1964) were given for each mineral. This is especially the case in view of the fact that *Structure Reports* generally lag the years covered by six or seven years.

The structures are considered as static, average structures. Almost no mention is made about atomic motions. The structural information presented is, with very few exceptions, restricted to that obtained by X-ray diffraction. Almost no reference to or use of the results of neutron diffraction, electron diffraction, infra-red absorption, nuclear magnetic resonance, or electron spin resonance are made. The structural behaviour of H in minerals in general is essentially ignored. Curiously, also, no mention whatever is made of ice.

Otherwise, the enormous volume of X-ray results for the years between 1936 and 1964 seem to be well covered. The infrequency of misprints and other errors is notable. One surprise, however, is the retention on page 242 of old Fig. 112 (as new Fig. 166)—Warren's famous diagram of the inferred relation between the structures and cleavages of pyroxene and amphibole. It is almost certainly wrong but now that it has been recertified by the highest authority it will continue to be reproduced in all the elementary texts.

Although there is far too much new material for one to be able to summarize even the salient points in this brief account, mention should be made of Chapter 14, 'Framework Silicates: The Feldspars'. This chapter, written by W. H. Taylor, presents in forty-seven pages a clear summary of what is 'currently' (roughly 1964) known about the complicated feldspar structures. Although the chapter was written in 1962, the material is quite up-to-date because the author had access to then unpublished results of a number of co-workers. The chapter is organized into three parts. First is a survey of the main features of the structural scheme of the feldspars. Next is a detailed description of the principal structures of the different temperature forms of the end-component K-, Na-, Ba-, and Ca-feldspars. There is more detail than for the descriptions elsewhere in the book. Data on such things as metal–oxygen bond distances, temperature factors, anisotropic atoms, and ordering are given and discussed. The third part describes and interprets the structures of the two-component alkali feldspar series, plagioclase series, and (K,Ba)-feldspar series. Among other things, the significance of crystal imperfections is at least mentioned. This chapter may well be a signpost to the direction of future editions. Coverage of the whole range of mineral structures by just one or two people within a short enough time is probably too big a job from now on.

The criticisms made here should not be construed as negating the over-riding positive features of the book or as discounting any of the enormous amount of care and labour that went into its production. The book will continue to be indispensable for anyone dealing with minerals. It will again be the first place to turn when one wants an introductory education on mineral structures, some specific information, or to find out what problems still remain to be solved.

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FANG (J. H.) and BLOSS (F. DONALD). *X-Ray Diffraction Tables*. Southern Illinois University Press, 1966. 360 pp. Price: $12.75.

In a pleasant, usable format these tables provide values for $d$, $\sin^2\theta$ (or $Q$) for $2\theta$ angles at intervals of 0·01° for the wavelengths $K\alpha$, $K\alpha_1$, $K\alpha_2$, and $K\beta$ of copper, iron, molybdenum, and chromium radiations, and for $L\alpha_1$ of tungsten. The $d$-values for each radiation are given side by side so that not only can those peaks associated with a $K\alpha_1$ peak be readily identified, but also possible interference from a contaminated tube can be quickly checked. The absence of cobalt radiations will be regretted by some laboratories.

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