Many topics are dealt with in more detail than the reviewer would consider necessary for a geology student but it is a very useful reference work for the student who is particularly interested in optical properties of crystalline materials and certainly this book should be in any Geology Department library. W. S. MACKENZIE

WOOLFSON (M. M.). *An Introduction to X-ray Crystallography*. London and New York (Cambridge University Press), 1970. ix+380 pp. Price £4·25.

There are now a fair number of textbooks that deal in one way or another with the subject of X-ray crystallography, and among them this new one plays a distinctive and valuable role. The selection and treatment of subject matter shows it to be aimed very directly at those who are interested in crystal structure determination. The latter subject is treated in considerable detail, while other topics are developed, usually concisely, just to the extent to which they might be needed to lead on to, or to assist, structure determination.

Compared with other books on the determination of crystal structures, Woolfson's approach is more actively didactic: it starts at a more elementary level, and includes more 'background' material (e.g. some crystal optics and crystal physics). The style of writing and method of attack are consistent with an attempt to teach by example. This is shown not only in the inclusion of problems and answers with each chapter, but also in the text, where principles and methods are discussed and very frequently illustrated by examples. The examples in the text are well chosen, usually dealing with more simple special cases in order to illustrate more general and therefore more formidable-looking theorems.

The above features of the book lead me to view it as a practical manual rather than a definitive work, and I believe that this is what the author desired. The topics covered are indicated by the following headings for the nine, roughly equal length, chapters: 'The geometry of the crystalline state', 'The scattering of X-rays', 'Diffraction from a crystal', 'The Fourier transform', 'The experimental collection of diffraction data', 'The factors affecting X-ray intensities', 'The determination of space groups', 'The determination of crystal structures', 'Accuracy and refinement processes'.

The book is concluded with a useful list of references and a bibliography, a short list of physical constants, and two short tables, one of scattering factors and one of absorption coefficients for certain radiations. The latter tables are for twelve different atoms including H, C, N, O, but not Si or Mg. Here and elsewhere is an indication that the author's own experience has been more with organic compounds, although most of the book is equally valid for those determining inorganic and mineral structures.

The technical production of the book is good except for some figures where three-dimensional effects do not show too clearly, and some photographs where the contrast is not good and detail is lost. Minor errors are not very plentiful, and only two are worth mentioning. On p. 6, the effect of a vertical mirror plane in the stereogram in

fig. 1.5 (*b*) ii is incorrect, and on p. 8, a printing error labels a diagram with crystal class as $\bar{5}$!

In the treatment of enantiomorphism, the essential idea that enantiomorphic structures have mirror images *that are not superimposable* is not expressed explicitly; hence the dubious statement 'a centrosymmetric structure is its own enantiomorph'.

Since the book is intended for structure determinations rather than general X-ray work, its treatment of powder methods is very sparse and in some respects misleading, as for example in the rather inadequate sketch and description of a powder camera, and in the statement that only the counter moves in a powder diffractometer.

While there are minor criticisms of minor aspects of the book, there is no doubt that it achieves its major aim very effectively. It will be very useful to students of any aspect of the solid state who are interested in the determination of crystal structures.

J. ZUSSMAN

WILSON (A. J. C.). *Elements of X-ray Crystallography*. Reading, Massachusetts (Addison-Wesley), 1970. ix+256 pp., 64 figs. Price $14.75.

In a most unusual order of presentation, this book follows an introductory section on X-rays with chapters on powder cameras and powder diffractometers before discussing the symmetry of crystals and the reciprocal lattice in a chapter preceding those on single-crystal cameras and diffractometers. The author justifies this experimentation with a more normal logical presentation on the ground that the student is helped by an early encounter with experimental methods and that the powder photograph is the simplest type of diffraction pattern to understand. Whatever the general truth of this assertion, one feels the case is not well made in a text where by the third chapter the student is immersed in aberrations and line profiles in powder diffractometry before even the most elementary symmetry concepts have been mentioned. It might be improved if there was more balance in the depth of presentation, a recurrent criticism for the remaining four chapters on the intensity of X-ray diffraction, elementary statistical properties of X-ray intensities, the determination of crystal structure, and diffraction by imperfect crystals; for an introductory text the dependence on reference to original literature (between 250 and 300 papers in the bibliography) appears excessive, though more generalized suggestions for further reading (and questions) are provided at the end of each chapter.

Professor Wilson admits that this book is the outcome of lectures to physicists, and viewed in this context it may have some appeal. For chemists, metallurgists, and all those others whose work leads them into contact with the crystalline state and X-ray diffraction it provides a much less satisfactory introduction than many of the other books in this field, though it could make interesting supplementary reading for certain topics less extensively treated elsewhere. Any mineralogist, in particular, will find it difficult to be sympathetic to an approach in which, for example, the author, after damning with faint praise the methods of microscopic optics, suggests that crystal fragments should be oriented on single-crystal cameras by trial and error methods!

P. GAY