

modern books on mineralogy lies in the manner in which the minerals have been grouped: The classification used in this book is based on geochemical-crystallochemical principles and not just crystal chemistry.' The book contains more than 2000 different mineral names and is well up to date with new minerals described up to the middle of 1966. To cover all these minerals in 470 pages (the systematic mineralogy) means that the information on certain minerals has to be somewhat limited; to take only one example the olivine series is treated in one page of text with one page of diagrams. Except as a fairly complete catalogue to minerals the reviewer wonders if such limited data on a very common mineral is what is required by the student of mineralogy.

The inclusion of data on the strongest lines in the X-ray diffraction patterns is a welcome innovation in a mineralogy text and in some cases d.t.a. patterns are given where appropriate, e.g. zeolites, serpentine minerals, and numerous sulphates.

For one who is accustomed to consider refractive index as the most fundamental of the physical properties which can be measured in a transparent mineral, the treatment accorded to this property leaves much to be desired. In the case of the common rock-forming silicates such as the orthopyroxenes or the plagioclase feldspars, the diagrams relating chemical composition to RI are too small to be useful in determining composition in these series. On the other hand diagrams showing the common forms developed and tables of interfacial angles are given for enstatite and it is felt that this treatment is rather out of date. Diagrams, of the type that a few generations of students have used in Winchell's textbook, showing the different values of extinction angles exhibited by amphiboles are drawn in this book; while these undoubtedly offer some comfort to a student faced with the problem of determining the name of a mineral that he considers is an amphibole, they may actually mislead him into thinking that he has actually determined the name of the mineral.

The book from which the translation was made was first published in Sofia in 1957 but this English edition is revised up to 1966. It therefore includes data on such minerals as deerite, howieite, zussmanite, dellaite, rustumite, yoderite, etc., but these data are limited to a chemical formula and a few of the strongest X-ray lines. The bibliography is of necessity limited because of the large number of minerals mentioned and therefore no references are given in the text. There are three appendices—the periodic table, a list of atomic and ionic radii and electronegativity of elements, and the 230 space groups.

The publication is of a very high standard with excellent diagrams and illustrations and is produced on a very high quality paper. The price is correspondingly high and well out of the range a British student would expect to pay for a textbook.

W. S. MACKENZIE

WYCKOFF (R. W. G.). *Crystal Structures*. 2nd edition, vol. 4. *Miscellaneous Inorganic Compounds, Silicates, and Basic Structural Information*. Chichester and New York (Wiley: Interscience), 1968. 566 pp. Price 235s.

This is the fifth volume to appear (vol. 5 already published) in the second edition of

*Crystal Structures*, replacing by revised and updated chapters, in bound volumes, the loose-leaf first edition. Although some minerals are dealt with in other volumes, volume 4 contains the highest proportion of minerals. The book has three chapters, two containing descriptions of structures and the third explaining and illustrating structural crystalchemical concepts.

The first chapter, 'Miscellaneous Inorganic Structures', occupies 156 pages describing over 150 structures, about 20 of which are of minerals. There is deliberately no system in their presentation, since compounds dealt with here are with a few exceptions those which do not fall clearly into the categories of other volumes, and they have very little relationship to one another. Among the minerals included are some complex borates, tantalates, sulphides, and vanadates.

The greater part of the book is taken up by the second chapter, which deals in 328 pages with silicates, most of which are minerals. Here there is systematization into four sections on what are called discrete-ion, chain-type, layer-type, and network-type silicates.

For each structure described there are given wherever possible, cell parameters, space groups, atomic coordinates, usually at least one projection drawing, and a 'packing' drawing. Some important bond lengths and angles are given, and often the cell parameters of isostructural compounds are listed (e.g. 10 synthetic melilites).

There can be no doubt as to the usefulness of this compilation, which gives good coverage of the most important structure determinations up to 1967. Having said this, one can perhaps feel free also to be somewhat critical. In general terms, the usefulness of this work to mineralogists is probably less now than it was for the first edition. This is because of the publication within recent years of such books as *Silicate Science* by Eitel, *Crystal Structures of Minerals* by Bragg and Claringbull, and other reference books containing information about mineral structures. While none of these provide atomic coordinates for any but the simplest structures, such details, if required, are obtainable in the original papers, most of which are in relatively few mineralogical or crystallographic journals. In addition, there is overlap with the functions of *Structure Reports*, which, although far less up to date, does give very complete accounts of structures.

Wyckoff gives estimates of the accuracy of the various structure determinations where such information is available, and it is rather surprising to see in how many cases it is not. In such cases it would be useful to know what methods were employed for the structure determination, whether it was accomplished by one, two, or three projections, or by three-dimensional techniques. Wyckoff sometimes gives his own indication of the accuracy of some published data by such remarks as '... cannot be drawn as given ...' or '... Si-O distances ranging from 1.50 to 1.90 Å ...'.

On more detailed matters, the mineralogist will find the individual structure descriptions very useful, but the connecting text disturbing in places, perhaps most in the section on layered silicates. One sympathizes with the author when he writes '... their structures or probable structures (have been) described in great and sometimes confusing detail ...'. In the grouping of minerals, and in other ways, there seems to be considerable confusion as to the distinction between micas, brittle micas, chlorites,

kaolinites, and montmorillonites. The network silicates are very well treated, although there is the misleading implication that in the zeolite natrolite (and others) the silicate network is not continuous.

Some omissions are surprising: the serpentine group, for example, is represented only by the work on antigorite by Aruja in 1945 and Ito in 1951, and not by Whittaker's detailed work on chrysotile, or that by Kunze on antigorite. It is reasonable to expect, as Wyckoff states, to find only the structures of minerals that exhibit the simpler, somewhat idealized structures, and not all the variants through stacking and other kinds of disorder. However, halloysite is included, so that one would expect chrysotile, which has been so much more fully investigated, to be at least mentioned.

The last chapter of eighty pages gives a concise and useful treatment of basic structural crystallography, in order to enable the less experienced reader to make better use of the data presented throughout the volumes. The subject index and arrangement of references are both well compiled and easy to use.

Those interested in mineralogy and crystallography will certainly find this volume useful, and will be grateful to Dr. Wyckoff for continuing with the almost superhuman task of keeping pace with new structural determinations. J. ZUSSMAN

HAMILTON (E. I.) and FARQUHAR (R. M.), editors. *Radiometric Dating for Geologists*. London and New York (Wiley: Interscience), 1968. viii+506 pp., 88 figs. Price 147s.

This book consists of nine articles by various authors on some aspect of radiometric dating. For whom is this book intended? The title suggests that it will be an introduction to age-dating methods for the average geologist; a stratigrapher, a mining geologist perhaps! It certainly is not that. The editors state their intentions for this book as a 'volume in which "case histories" are presented, so that the geologist or geophysicist has access to accounts of methods, results of age studies and related topics concerning the significance of some isotope ratios, in as full a geological and geophysical context as possible'. This certainly explains the inclusion of some of the chapters but the book as a whole falls short of this high ideal.

The opening chapter by P. E. Damon on potassium-argon dating should have formed the model for the whole book. The chapter opens with a clear and concise account of the general principles. Numerical examples are used to great advantage, for example what looks like a sterile academic approach in a deterministic model for K/Ar ages turns out to be fruitful when applied to some work on the Alpine fault zone in New Zealand. The rest of the chapter describes the application of K/Ar methods to the Basin Ranges and ends with some geological philosophy.

The correlation of the disturbance of the age dating system with some petrologically recognizable criteria would be a great help in interpreting radiometric ages. The chapter by S. R. Hart *et al.* is a description of an excellently conceived piece of work towards this goal. The effect of the intrusion of the Eldora stock about 55 m.y. ago into gneisses and schists 1200 m.y. and older was studied. The lowering of the ages