BOOK REVIEWS

SOSMAN (R. B.). *The phases of silica.* New Brunswick (Rutgers University Press), 1965, x+388 pp. Price: $10.00.

Nearly forty years ago the author published the well-known monograph on 'The Properties of Silica'. In the intervening years knowledge of this important, ubiquitous substance has continued to grow; some measure of this growth is indicated by the increase in the number of recognizable, distinct phases of pure silica from seven to twenty-two. It is therefore not surprising that when Professor Sosman came to revise his original work he found that it would now be advisable to publish it in two volumes. The present book concerns itself with the description of the phases of silica and their inter-relations; the second volume will deal with the properties of silica in all its forms and their inter-relations.

'The Phases of Silica' is based on the first fourteen chapters of the original monograph, so that the form is essentially preserved; naturally the contents of the chapters have been revised in the light of modern literature, with the occasional interjection of unpublished work known to the author. A slightly disappointing fifteenth chapter on the SiO_2–H_2O system is added, though it must be recognized that the presentation of more than an outline of this field and its ramifications would have led to a disproportionate emphasis in a book of this kind. Each of the other fourteen chapters attempts to give a coherent picture of some aspect of the silica phases, and usually starts from a brief description of the relevant fundamental principles; for example, the chapter on the symmetry modifications of silica begins with a short discussion of symmetry classes in general before turning to that of the silica phases. This approach may be justified by considering the wide range of disciplines from which potential readers may be drawn.

In general, the text is well-presented in a characteristic and expansive style; it is well supplemented by detailed references for each chapter and many text figures. Professor Sosman has performed a valuable service in collecting much data scattered through the literature into this very readable book, which will no doubt in time come to enjoy the same reputation as his original monograph. P. GAY

WYCKOFF (R. W. G.). *Crystal Structures.* Vol. 3. (2nd edn). New York, London, Sydney (Interscience Publishers), 1965, viii+981 pp. illus. Price: £10. 10*s*.

This volume contains three chapters covering inorganic compounds described as $R_x(MX_4)_y$ (ch. VIII), $R_x(M_nX_p)_y$ (ch. ix), and hydrates and ammoniates (ch. x). Chapter viii was in vol. 2 of the first edition. Chapter ix has been completely reorganized to cover both the material that was in chapter ix of the first edition and most, though not all, of the material that was in chapter xi (Miscellaneous Inorganic Compounds). Chapter x retains its identity, but the remaining miscellaneous compounds, and also silicate structures (ch. xii), do not appear in the present volume and are presumably reserved to a later one.

The general comments on vol. 2 (Min. Mag., vol. 35, p. 554) apply also to this volume in regard to format, information provided, improved ease of reference, and extent of rewriting. The quantity of material has been increased relative to the corresponding parts of the first edition by over 100 %, and the references have been brought up to mid 1963.

It is obviously very difficult to produce an entirely satisfactory classification of inorganic compounds in terms of generalized formulae. For the binary compounds in the earlier volumes the difficulty was not too great, even though the meaning of the chapter headings had to be stretched in order to include structurally related compounds either by regarding a simple radical (e.g. hydroxyl) as an atom, or by disregarding the difference between similar atoms (e.g. O and S in rare earth oxysulphides). But in the present volume such extensions have had to be carried so far that the chapter headings give a very inadequate impression of the scope of the contents. The formulation $R_x(MX_4)_y$ does not necessarily imply that the compounds contain MX_4 anions, nor that all the R atoms are of the same element, nor even that they are all ions of the same sign. Thus chapter viii includes such diverse substances as cryolithionite ($Na_3Al_2Li_3F_{12}$), and apatite structures like vanadinite ($Pb_5Cl(VO_4)_3$) and $Ca_9B_2(CO_3)(PO_4)_6$, all under the heading $R_x(MX_4)_y$. There are logical grounds for this of course, but there is little logic in the heading $R_x(M_nX_p)_y$ for chapter ix, and in retaining it the author does his book a dis-service. The introductory paragraph to the chapter describes the sections of it in terms of this formula with successive values of p; yet the sections themselves not only correspond to, but are actually headed by, the more suitable general formulations $R_xM_yX_z$.

There is one criticism to be made of the indexing. Although minerals are cross-referenced under both the mineral name and a chemical name, the chemical name of each substance (and its formula in the formula index) appears but once, in order of only one of the elements that it contains. In many cases this is sufficient, since the key element is the most

electropositive one in accordance with usual chemical practice. But in the case of some of the more complex compounds the order is not at all obvious (e.g. $Cu_2Mg_2(OH)_6CO_3.2H_2O$ and many garnet and apatite structures). Cross-referencing under all the cations would be a considerable improvement.

However, these are small defects in so valuable a compilation of structural information, which is so much more accessible than it was in the first edition. E. J. W. WHITTAKER

GARRELS (R. M.) and CHRIST (C. L.). *Solutions, minerals and equilibria.* New York (Harper and Row), 1965. xiii+450 pp. Price: 108*s*.

Professor Garrels's 'Mineral Equilibria' was published in 1960, and this new text is both a revision and an expansion of the earlier book. The previous restriction to low temperatures and pressures has been removed, and, together with the inclusion of new data, this has led to the text being almost doubled in length, with eleven chapters: seven of these are expanded versions of those which appeared under similar titles in 'Mineral Equilibria'.

The first two chapters aim to present fundamental thermodynamic relationships in such a way as to make them most useful for geological application. The third chapter deals with carbonate equilibria, a subject of great significance over a wide range of studies. This is followed by a new short chapter on complex ions, which gives detailed consideration to the nature of the solute in various natural waters. A short account of the measurement of Eh and pH precedes chapters on partial pressure and Eh–pH diagrams in which the emphasis is placed on the application to geological and geochemical problems. Three new chapters follow: the first, on ion exchange, is concerned mainly with the fundamentals of cation exchange and cation electrodes; a second new chapter examines the effects of temperature and pressure changes on equilibria, whilst the third, headed 'Combination Diagrams', deals with the combinations of parameters that are most suitable for the presentation of data on silicate, carbonate, and sulphate systems of mineralogical importance. The concluding chapter of the book describes the utility of mineral stability diagrams to some geological situations.

The book is written throughout with a directness and clarity of approach that leaves the reader with a much better understanding of the way in which the sophistications and abstractions of chemical thermodynamics are relevant to the practical problems found in mineral associations. For those whose interests extend beyond the material of the