

BOOK REVIEWS

AN INTRODUCTION TO CRYSTAL CHEMISTRY, by R. C. EVANS, 2nd Edition. Cambridge University Press, Cambridge, England, xii+410 pp., \$9.50, 1964.

When this work first appeared in 1939, the field of crystal chemistry was just coming into maturity after periods of childhood and adolescence following its birth in 1912. Through the magic influence of *X*-ray diffraction, the study of chemistry was now extended into the solid state, the domain of crystal chemistry, thus opening up vast new horizons for chemical understanding, especially in inorganic chemistry. Evans' book at that time offered a first-class summary of the basic principles of crystal chemistry, drawing personally on the profound contributions of such pioneers as J. D. Bernal and Dorothy Crowfoot, and rightly became almost a classic work in the field. Now, 25 years later, the first revision has finally appeared. Since no seriously competitive works have been published in the intervening time, the revision is eagerly welcomed. In this time, the influence of crystal chemistry, because of its very fundamental nature, has grown fantastically. Unfortunately, the revision of the famous *Crystal Chemistry*, as it reflects this growth, is somewhat of a disappointment.

The physical size of the volume has been increased by only about 11 percent. The work is still divided into two parts—"General Principles of Crystal Architecture" and "Systematic Crystal Chemistry"—and all of the increase in size is in the first part. The greatest part of the influence of crystal chemistry of the solid state, the chemistry of the solid state, is the penetrating understanding it gives of *structure*, that is, the geometric aspects of atomic arrangements in solid phases. Developments in molecular orbital and band theory, which have been given the most additional space in this revision, is almost of secondary importance. In the last 25 years, structural understanding has laid the foundation of breakthroughs in advances of knowledge and technology in areas that were still mysterious or completely unknown at the time of the first edition. In spite of this, many of these areas, although of primary importance in terms of crystal chemistry, have been only slightly touched on, or even completely ignored. It appears that the author has deliberately sought only to correct the material of the second part as given in the original edition, while introducing a minimum of new material.

Some of the most glaring omissions are the following: the relation of chemical structure to magnetic properties, especially ferromagnetics; the profound influence of crystal chemistry on the development of ferroelectrics; the brilliant crystal chemical explanation of closely-spaced, "non-stoichiometric" phases such as occur in most transition-metal oxide systems; the aggregation principles that lead to complex intermetallic phases; the relation between polytypism, spiral dislocations and crystal growth; the profound role of the hydrogen bond in biological structures. To ignore these topics does not do justice to the accomplishments of crystal chemistry.

Two other objections may be made. First, for a book which is based so fundamentally on molecular and crystal structure, a chapter on the methods of structure analysis, their powers and limitations, would seem to be almost a prerequisite. They are only mentioned very briefly in the historical introduction. Second, in spite of the author's expressed consciousness of the importance of well-drawn illustrations, those in this book are of average to poor quality in terms of effectiveness, and are wholly lacking in artistry. The illustration on p. 172 fails completely, for example, to convey the extremely important spinel structure—not an easy problem, to be sure, but well worth some effort. And I feel compelled to point out that the figure depicting the Keggin structure of metatungstic acid on p. 231, copied from another well-known book, is a fallacious monstrosity (why is this in a book on crystal chemistry, anyway?).

There has long been an unsatisfied need for a textbook on crystal chemistry that adequately embraces the greatly expanded modern scope of this field. In limiting his revision to the updating of his original material, Evans' book is regrettably far from adequate, and the need is still unsatisfied. Meanwhile, the best that teachers of crystal chemistry like myself can do is to use this book as a background and fill in the gaps from his own resources.

HOWARD T. EVANS, JR.

SILICATE SCIENCE, Volume I—SILICATE STRUCTURES, by WILHELM EITEL, Academic Press, New York—London, 1964, xii+666 pages, $6\frac{1}{4} \times 9\frac{1}{2}$ inches. Price \$24.00, by subscription \$21.00.

This is the first volume of a projected five-volume work. The entire work is considered to be a revision of the author's "The Physical Chemistry of the Silicates," a volume of 1592 pages that appeared in 1954 and was reviewed with unstinting praise by Earl Ingerson (*Am. Mineral.* 39, 1032-1034, 1954). His review included a brief account of the career of the author and of his earlier books that had been published in Germany.

In the words of the general preface this revision is restricted "exclusively to the progress made in the period between 1952 and 1962." The first volume corresponds to chapters I and III of the previous work. It comprises three sections: A. Silicate crystal structures (218 pages), B. Clay minerals; structures (68 pages), C. Silicate dispersoids (328 pages). Most of section C lies outside the fields of interest and competence of ordinary mineralogists. Four separate indexes (authors, subjects, compounds, minerals) cover 52 pages. As in the 1954 work the indexes refer to numbered paragraphs within each section. There are footnotes on nearly every page, 1468 in all, and even material in these is indexed and indicated by asterisk. Citations to the literature are placed in the footnotes and a dozen or more citations may be given in one footnote. Titles are not given with the citations but in many cases there are brief comments that may be much more illuminating than titles.

The discussion of "Special Structures of Silicates" in section A (pages 47 to 189) is a resumé of work on the determination of silicate crystal structures during the ten-year period covered by this book. An acquaintance with the results of earlier work on silicate structures is indispensable for an understanding of what is here reported. The work summarized is mainly on the refinement of crystal structures that have long been known, such as those of andalusite and garnet, or on the determination of the structures of the rarer minerals, e.g., perrierite, seidozerite, lovozerite, tobermorite, bazzite. Some of the work on the rarer minerals has revealed new structure types, for instance the new types of chains in pyroxmangite and xonotlite, which are of importance in systematic consideration of the crystal chemistry of silicates. The figures in this section, and probably in most of the book, have been taken from original sources without change so that they vary greatly in style and quality.

In the main each of the numbered paragraphs corresponds to an abstract. In part these "abstracts" are *indicative* rather than *informative*, but they differ from ordinary abstracts in that the author's vast acquaintance with the literature has enabled him to include many allusions to related matter or hints as to special points of interest or significance. Only in a few cases is there a lack of discernment in the reporting. Two structure determinations of sepiolite which led to somewhat different results are reviewed without indication that one of these must be considered to supercede the other. The subject index includes several references to epitaxis (epitaxy), and a dozen consecutive paragraphs are devoted to it in section A, but the terms topotaxy and syntaxy are not included. In a few places non-silicates are discussed, a long paragraph and three figures from Donnay and Donnay (*Am. Mineral.* 38, 932-963, 1953) being devoted to relations in the bastnaesite group.

There are numerous references to particular sections of the forthcoming volumes so that it is apparent that the remaining parts of the work have been planned in detail. It is almost incredible that one man should be able to cover such diverse fields in such comprehensive fashion. It is fitting to repeat the closing words of Earl Ingerson's 1954 review. "There is no need to recommend this book. It will be automatically required for reference wherever there is interest in silicates, silicate science, or silicate technology."

A. PABST

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MINERALOGY OF THE RARE EARTHS (Mineralogy, genetic types of mineralization, and main features of the geochemistry of the rare-earth elements). E. I. SEMENOV, Akad. Nauk SSSR, Gosud. Geol. Komitet SSSR, Inst. Mineral., Geokhim. i Kristallogkhim, Redkikh Elementov, Izdatl'stvo Akad. Nauk SSSR, Moscow, 1963, 410 pp., 2 rubles, 72 kopecks (about \$3.00) (in Russian).

This volume begins with systematic treatment (to p. 238) of the mineralogy of the minerals containing yttrium and the lanthanide elements, including chemistry, crystallography, physical properties, optics, and occurrences. In addition, structural data, x-ray powder patterns, and DTA curves are included. Determinations of the proportions of lanthanides are given, as well as chemical analyses of the minerals. The remainder of the volume summarizes the crystal chemistry of the minerals (p. 239-277), genetic types of rare earth mineralization (p. 278-334), and the geochemistry of the rare-earths (p. 335-379).

The literature is very thoroughly covered and many previously unpublished determinations are included. The book is highly recommended to anyone who reads Russian and is interested in the mineralogy and geochemistry of these elements. Regrettably, the quality of the paper and of the binding is poor.

MICHAEL FLEISCHER

SPECIAL CERAMICS 1962, P. POPPER (Ed.) London: Academic Press Inc., \$16.00, (1963), 482 pp.

This book contains the papers of a 1962 symposium sponsored by the British Ceramic Research Association. Of the 25 papers (including discussions), 13 are devoted to the properties of special ceramics such as oxides, borides, carbides, and graphite. The remaining 12 are devoted to experimental techniques for property evaluation or processing. Except for these general ties, there is no more coherency between the 25 articles than in an annual volume of a technical society. Therefore this volume will not serve as a general reference source for the reader.

Three of the 25 contributions may have specific interest to certain industrial mineralogists. The first is an article on "Refractory Sulfides of Uranium and Thorium," by P. D. Shalek and J. H. Handwerk where attention is given to sintering and resulting microstructures. The second is a contribution by M. G. Harwood on "Anisotropic Conductivity of Rutile," in which he observes variations with time of an electrical current when the voltage gradient is along the *c* direction. The conductivity in the *a* direction remains constant. On the basis of his work, Harwood suggests that a breakdown occurs in "local filamentary paths separated from one another by more highly insulating regions." Crystal growth orientations is not a factor.

The third article of specific interest is one on "Electron Microscopy of Ceramics," by S. N. Ruddlesden. Various examples are given of the use of the electron microscope as a laboratory tool.

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SYMPOSIUM. PROBLEMS OF POSTMAGMATIC ORE DEPOSITION WITH SPECIAL REFERENCE TO THE GEOCHEMISTRY OF ORE VEINS, Vol. 1. Discussion on selected topics before the symposium. 588 pp. Appendix to Vol. I Translations of Papers presented in Russian 219 pp. Geol. Surv. Czechoslovakia, Publ. House Czech. Acad. Sci. Distributed by E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, Germany. 1963 \$8.50 (for both).

These are the papers presented at the Prague Symposium, September 1963, organized by the Geological Survey of Czechoslovakia and the Faculty of Natural Sciences of the Charles University of Prague under the auspices of the Czechoslovak Academy of Sciences and sponsored by the Geochemical Society. The volumes are dedicated to František Pošepný.

The volumes contain 105 papers of international authorship (even China is represented.) Since a complete listing of the papers is here not possible, the following abbreviated table of contents will give a good idea of the scope of the Symposium. Question 1: Problems concerning the origin of primary zoning in ore veins, ore deposits and larger units. Chapter 1: General discussion of zoning. Chapter 2: Problems of polyascendent zoning. Chapter 3: Problems of polyascendent and monoascendent zoning. Chapter 4: Problems of monoascendent zoning. Chapter 5: Evolution of chemical composition of ore-bearing solutions dependent on the same source. Chapter 6: Other problems of zoning. Question 2: Criteria solving the manner of the transport of metals in ore-bearing solutions and comments on the existing views. Question 3: Reasons for or against the distinguishing of a pneumatolytic phase in the classification of postmagmatic processes. Question 4: Criteria for the recognition of metacrysts of minerals. Question 5: Role of selective replacement in hypogene ore deposition.

The two books are an indispensable reference work for all students of economic geology.

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SHORT NOTICES

CONCISE DICTIONARY OF ATOMICS, ed. by ALFRED DELVECCHIO; introduction by Wernher von Braun. Philosophical Library, 15 E. 40th St., N. Y. 262 pp. 1964. \$6.00.

A NEW SYSTEM OF CHEMICAL PHILOSOPHY, by JOHN DALTON; introduction by Alexander Joseph. Philosophical Library, 15 E. 40th St., N. Y. 168 pp. 1964. \$6.00. Reprint of a classic work, the publication of which in 1808, started the chemical revolution of the 19th Century.

THE PRODUCTION AND USES OF NATURAL GRAPHITE. Warren Spring Lab., Dept. Scientific and Industrial Research. Sales Sect., British Info. Services, 845 3d Ave., N. Y. 83 pp. 1964. \$1.10 Paper bound.

ROCKS AND MINERALS OF ONTARIO, by D. F. HEWITT. Ontario Dept. Mines, Geol. Arc. 13, 108 pp., 64 photos, 20 figs. \$1.00. Paper bound. Primarily for the laymen, but a good general summary of the major mineral occurrences and resources.

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