BOOK REVIEWS

CRYSTAL SYMMETRY AND PHYSICAL PROPERTIES. S. BHAGAVANTAM. Academic Press Inc., New York, 1966, x+230 p., $9.50.

CRYSTAL SYMMETRY AND PHYSICAL PROPERTIES by S. Bhagavantam is a major addition to the growing array of textbooks on crystal physics. Much of the material is derived from papers by Dr. Bhagavantam and his collaborators, previously published in journals, now brought together to give a connected account of their studies of the application of group theoretical methods to the solution of problems in crystal physics, particularly those involving the effect of symmetry on the physical properties of single crystals.

Chapters on linear transformations, tensors, matrices, and groups are essentially self-contained. Other chapters cover crystallographic groups, symmetry and physical properties, the group theoretical method, and the classification of physical properties. Strain, stress, and elasticity, including third-order effects, comprise chapters 9 through 12. Chapters 13 through 16 are devoted to thermal expansion, electrical, magnetic, and optical properties. In Chapter 17 transport phenomena are covered. The last chapter of the book describes some selected illustrations of single-crystal properties. As is to be expected from the author, group theory is given a prominent position in the text.

The treatment emphasizes the 90 crystallographic magnetic point groups. Brief mention is made of the Shubnikov and magnetic space groups, though the general derivation is not given.

In the very readable section on symmetry and physical properties, consideration is given to second- and higher-order effects; properties up to sixth rank are included. The nontensor properties are not considered in the book since the study of such properties is not amenable to the methods developed in the text.

The general emphasis of the book is on phenomenological theory. While a few experimental data are included, no pretense is made of covering, even in a general way, experimental procedures. Little mention is made of the fact that a number of the properties considered can be measured only with great difficulty, and that experimental confirmation of the general cases can easily defeat the most skilled and patient experimenter.

The general style of writing is pleasantly informal, though the treatment of the subject matter tends to be quite concise. The work is perhaps not the best choice for a beginning course in crystal physics, at least for mineralogists, though it is highly recommended as supplementary reading for such a course. Advanced students and workers in physical crystallography would do well to have it in their personal libraries. It contains much that is not to be found in the standard English language textbooks on the subject.

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SILICATE SCIENCE, Volume IV—HYDROTHERMAL SILICATE SYSTEMS. WILHELM EITEL. Academic Press, New York–London, 1966, xiv+617 p., $24.00.

The appearance of volume IV completes the publication of this impressive five-volume series. The other volumes have been reviewed on these pages (*Amer. Mineral.* 50, 524–525 and 1134 (1965), 52, 301 and 302 (1967)). The present volume is dedicated to the memory of Pentti Eskola and George W. Morey. It is divided into two sections: (A) Silicate systems with volatiles (408 pages), and (B) Dehydration behavior of silicate hydrates: zeolites and related materials (130 pages).

As stated in the preface to this volume, "In no field presented in the other volumes of this treatise have the advances of investigations been so revolutionary as in that of hydrothermal synthesis." While these advances are thoroughly reviewed much material from the geological-petrological literature has also been woven into the discussion. This leads, for

instance, to the inclusion of sections on *Problems of splitization* and *Investigations of the chemical weathering process.*

In the review of the first volume it was noted that references to topotaxy and syntaxy were lacking. In the present volume several cases to topotaxy are discussed under the heading "dehydrogenation behavior of silicate hydrates" but the three references to "topotactic" in the subject index are only to footnotes in the appendix. In the attempt to make the work truly comprehensive even preliminary reports have been taken into account and over twenty items in the appendix are based on the program of the 1965 GSA meeting. Discriminating coverage of such a mass of material is nearly impossible and so a few things, such as the statements regarding gastunite on page 356, have been rather uncritically included.

The series SILICATE SCIENCE is of first rate importance and ought to be available in every library used by mineralogists and petrologists.

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PROCEEDINGS OF THE SEVENTH CONFERENCE ON THE SILICATE INDUSTRY (SILICONF, 1963). Ferenc Tamás (Ed.) Akadémiai Kiadó. (Hungarian Academy of Sciences), Budapest, 1965, 672 p., 286 figs, 106 tables, $15.00.

The Seventh Conference on Silicate Industry in Budapest 1963 was jointly organized by the Hungarian Society of Silicate Industry, and the Central Institute of Building Materials Research. The thoroughly international character of this Symposium, however, is evident from the high percentage of participants coming from foreign countries (200 foreign delegates, among 500 representatives in toto) all experts in pure and applied silicate science. This is a most welcome sign of understanding and cooperation of scientists and engineers from all over the world. The organizing activities of the Hungarian Society of Silicate Industry, so impressive in the present valuable volume of the Proceedings, are to be commended for their advancement of research in one of the key industries of all countries. Their contribution is by no means restricted to the chemical technology of ceramics, or to manufacture of glass, or hydraulic binders. Mineralogists and petrologists all over the globe are equally involved in applying these specific methods of modern physical crystallography, and in basic studies related to solid-state reactions, phase equilibria from silicate melts, and the phenomena of recrystallization.

Basic research is represented in the present volume by 29 papers on the physical-chemical fundamental facts of silicate science, in welcome equilibrium with 31 papers directed to specific technological problems. It is worthwhile to consider a list of the 14 introductory principal reports presented by invited speakers: I. Náray-Szabó (Budapest) *Structure and physical properties of glass;* T. Takáts (Budapest) *Thermal investigations in silicate industry* (with strong emphasis given to modern derivatographic methods); R. Roy (Pennsylvania State University): *Metastable and stable dehydration reactions in clays and zeolites;* H. F. W. Taylor (University of Aberdeen, Scotland): *The chemistry of cement hydrations;* M. Déri (University of Veszprém, Hungary): *Recent research in the field of oxide ceramics;* R. Poděl (Bratislava, Č. S. R.): *Modern stoping methods in quarrying;* J. Sövegjártó (Budapest): *Modern pressing machinery in the refractory industry;* A. de Jerphanion (Paris): *The use of natural gas for the firing of porcelain;* G. Bornschein (Dessau, Germany): *Rotary kiln processes in the cement industry;* H. Širhal (Brünn, Č. S. R.): *Trends and developments in the brickmaking industry;* H. Costa (Jena-Burgau, Germany): *Automation in the silicate industries;* F. Nadachowski (Cracow, Poland): *New refractory materials;* J. Albert (Budapest): *Lightweight ceramic building materials;* K. Dolezsai (Budapest): *High-magnesia portland cement.*

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PROCEEDINGS OF THE EIGHTH CONFERENCE ON THE SILICATE INDUSTRY (SILICONF, 1965), FERENC TAMÁS (Ed.) Akadémiai Kiadó (Hungarian Academy of Sciences), Budapest, 1966, 808 p., $19.60.

The Proceedings of the 1965 Conference follows the successful achievement the Seventh Conference (1963), a perfect equilibrium between basic silicate science by physical-chemical and mineralogical investigations, and practical technology of the silicate industry. Again, the impressively international spirit of cooperation of experts from many countries of Europe and elsewhere is manifested by participation of more than 300 representatives of 23 nations. Better than any detailed description, we wish to demonstrate the character of the material discussed during the Conference by naming the speakers of invited introductory reports, with their titles. In the basic science group (28 papers) the principal reports were presented by: J. P. Roberts (Leeds, U. K.): *Microscopic examination of technical silicates;* H. E. Schwiete et al. (Aachen, Germany): *Solid state reactions of silicate systems;* St. Brunauer (Potsdam, N. Y., USA): *Structure of hardened portland cement paste and concrete;* J. Chikán (Vác, Hungary): *Material transport and homogenization in the cement industry.*

Even in the technological discussions the mineralogist will find many actual problems which could be solved by mineralogical-petrographical methods. Organization and publication of the Proceedings is again of high quality, particularly in the numerous illustrations and micrographs. The use of the book is much facilitated by a detailed subject index (the previous volumes had none). Most of the reports, especially those in the basic silicate science division, have very useful bibliographies. The Hungarian Society of Silicate Industry, the guiding scientific-technological principles of which are convincingly described in the Introductory Address of Academician Mór Korach in the VIIth volume, should be warmly congratulated on the success of this truly international platform for expert discussion. The Editor of these Proceedings should also be commended. The forthcoming Ninth Conference [Amer. Mineral. **52,** 306 (1967)] promises mineralogists a most welcome advancement in silicate research.

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MINERAL RECOGNITION. IRIS VANDERS AND PAUL F. KERR. John Wiley & Sons, Inc., New York, 1967, xiii+316 p., $11.95.

"This book is intended for the mineral collector, the nonprofessional reader with an interest in minerals, the beginning student of mineral science. . . . It is designed to provide an introductory background in mineralogy as well as a procedure for the rapid recognition of common minerals." So far as the first two categories of readers are concerned, the book may have a moderate success. The casual student need only paste together pages 37–44, which recount some details of orbital theory, energy levels, and bond types, taken directly from the Chemical Bond Approach Project. The remainder is then a well-rounded introduction to mineralogy, with good reviews of crystal chemistry, crystal growth, and symmetry.

A good selection of mineral species is described, arranged in a logical chemical-structural classification. The layout of the descriptions is somewhat confusing: a second-order heading *Summary* begins each description, but the following sections on *Composition, Tests, Crystallization, Associated Minerals, Alteration,* etc., are third-order headings. Then comparisons are made under the second-order heading *Minerals of Similar Appearance,* with the individual compared minerals listed as third-order headings, followed by a third-order heading of *Occurrence.*

An important feature of the book is the set of 49 color plates, each illustrating six minerals. At the price charged, this represents a real breakthrough in mineralogy publishing. For the most part, the plates are good reproductions of museum specimens, many of them

from the U. S. National Museum and the American Museum of Natural History. There is a tendency for the red-through-orange hues to appear as a dirty pink, as in Plate 30B, but most of the photographs are sharp, well arranged, and well chosen. It perhaps goes without saying that color photographs of minerals, particularly of the unusual and beautifully developed examples from museum collections, are not infallible guides for the amateur mineralogist to identify most of the material with which he has to work. However, they will be helpful so long as the reader recognizes that the range of color and form is often much more extensive than can be illustrated in any book.

Meteorites are described in a five-page appendix.

In addition to the variable technical level, the book is spotty in other respects; for example, under hematite, a large fold-out map shows the distribution of economic iron ore deposits around the world. This is good background information, but it is not clear what it has to do with Mineral Recognition, and it is the only such map in the book.

The chapters on *Symmetry* and *Chemical Tests* are abbreviations of the traditional treatments of morphology and blow-pipe analysis, respectively. The book does describe briefly some of the optical and X-ray methods used in mineralogical laboratories, and suggests in some places, as in the clay minerals, that such methods are necessary to many mineral identifications. Even more might be done to give amateur mineralogists a more realistic idea of the limitations of hand specimen identification.

The general chapters are all followed by references to sources, as well as suggestions for further reading. However, the chapter on crystal growth does not mention John Sinkankas' *Mineralogy for Amateurs*, which by some coincidence has a remarkably parallel treatment of this subject, with line drawings very similar to Vanders and Kerr's figures 2–22, 2–24, 2–11, 2–29, and 2–49.

William T. Holser

DER MINERALIENSAMMLER, 2nd Ed., WERNER LIEBER. Ott Verlag, Thun/Switzerland, 1966, 272 p., 73 figs., and 32 plates (10 colored), 27.80 DM.

The first edition of this comprehensive guide for amateur and professional mineral collectors was published in 1963. It was so enthusiastically received by the collectors, mineralogists, and geologists versed in the German language that a second revised and enlarged edition was issued in 1966. This book is based to a large extent on the author's long experience in collecting minerals.

The text includes ten chapters in which the formation, chemical composition, physical and optical properteis, and identification of minerals are authoritatively discussed. The methods useful in the purchase and exchange of minerals and preparing them for display purposes are also given.

Eighty pages are devoted to the listing of important mineral localities not only in Germany, Austria, and Switzerland, but also throughout the world. The location of public mineral collections and official organizations in the German-speaking countries are given. There is a selected bibliography. The text is well illustrated by seventy-three line drawings and thirty-two plates (ten colored).

The author has produced a very useful compendium which can be recommended to all who are interested in collection and display of minerals.

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