

BOOK REVIEWS

CRYSTALLOGRAPHY, A PROGRAMMED COURSE IN THREE DIMENSIONS BY
BRUCE CHALMERS, JAMES G. HOLLAND, KENNETH A. JACKSON, AND R. BRADY WILLIAMSON.
Appleton-Century-Crofts, New York. 1966. \$18.35.

The materials in this new kit include nine booklets, some materials with which to construct simple packing models, stereo-viewer, two booklets with explanatory information, X-ray photographs, etc. The nine programmed booklets cover the topics of Packing, The Packing of Spheres of Different Sizes, Unit Cells and Space Lattices, Miller Indices, The Seven Crystal Systems, The Fourteen Bravais Lattices, Introduction to X-ray Diffraction, Laue Patterns, and Powder Patterns. Each of the booklets leads the student through the elementary phases of these topics, through a process of definition of concepts, followed by a series of questions and problems designed to reinforce each point. In general, concepts and questions are accompanied by diagrams, stereo views, or where possible, directions for the construction of simple ball models. For example, in Book I, the concepts of one- and two-dimensional arrays of spheres are developed and expanded to that of packing in three dimensions. With both diagrams and constructed sphere models, the student is familiarized with the general nature, symmetry, coordinations, vacancies and other features of simple cubic, body-centered cubic, simple hexagonal, face-centered cubic and hexagonal close-packed packing of spheres. In the booklet on Miller Indices, the notation for lines and planes is developed and reinforced with a large number of illustrations, stereo views, and questions (which are answered on the page following the question). The booklets are designed so that some may be used independently of the others, although the first three contain the basic core material. It is suggested that "the basic parts of the program can take the place of three to four weeks of lectures."

The program has several very desirable features, most of which are concerned with the student involvement and participation in the program, which is lacking in many university lecture equivalents. The variety of diagrams and stereo views, the construction of models, and the integration of the question and answer sequences directly into each section act to provide the student with a much firmer and lasting understanding of the topics considered than would be possible in a lecture course and in many mineralogy courses, where the bulk of the laboratory is concerned with morphological crystallography, which is hardly mentioned in this program. The emphasis of the program is on the nature of crystal structures, nomenclature, and with elementary X-ray diffraction.

The program is biased toward a metallurgical viewpoint, however, as shown by the fact that the first basic book considers the packing of spheres for five metal-oriented structures, and one book is concerned with the Laue method for the orientation of single crystals. Mineralogists should prefer a more general theoretical approach to crystal structure relations. That is, virtually all ideas are stated as fact to be learned, accepted and understood in a sequence which leaves little flexibility. For example, Bragg's law could certainly be derived in a single panel. The general lack of a derivational approach using symmetry as the defining medium leaves much to be desired. For example, the definition of the tetragonal system stating that "The tetragonal differs from the cubic in that it has one unit cell parameter unequal to the others and, therefore, has different symmetry," leaves much to be desired. Similarly, the question "In terms of symmetry, what characterizes the triclinic system?" is given the answer "no symmetry (it lacks symmetry)."

The system, then, has several advantages and disadvantages. In terms of mineralogically oriented courses the latter can be largely overcome by using the very fine examples and

problems and diagrams selectively as supplemental material to lectures. Used selectively in this manner, portions of the program should be most useful to mineralogists.

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METHODS OF X-RAY SPECTROSCOPIC RESEARCH. M. A. BLOKHIN, translated from the Russian by F. L. CURZON and edited by M. A. S. ROSS. Pergamon Press, London, England, 1965, 448 p., 164 figures, \$15.00.

This book, originally published in Russian by Fitmatgiz, Moscow, is virtually free of problems attending translation. Twenty-two pages of the book are devoted to both text and supplemental references. The most recent reference, however, is dated 1961 and much of the exciting work of the past six years dealing with the soft and ultra-soft X-ray region is missing.

The major part of the book, 306 pages, covers five chapters dealing with excitation, subsidiary apparatus, measurement of intensity and resolution of X rays and the treatment of experimental data. The next three chapters (74 pages) cover qualitative and quantitative analysis. The final chapter of 16 pages deals with absorption analysis. The subjects discussed are treated comprehensively, with extensive mathematical treatment and illustration of equipment design. An unusually long discussion of photographic theory (33 pages) will appear puzzling to the reader as this method of recording X-ray intensities has not been in use for many years. The practicing X-ray analyst interested in quantitative applications will find the book to be of limited use. It will, however, serve as an excellent reference for physicists and engineers concerned with the design and construction of X-ray spectrometers and subsidiary apparatus.

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GEOCHEMISCHE TABELLEN by H. J. ROSLER AND H. LANGE. VEB Deutscher Verlag für Grundstoffindustrie, Leipzig, Germany (DDR). 328 pages, 112 figures, 169 tables.

This slim volume is crammed with an extensive selection of modern data of geochemistry. Background material includes weights and natural abundances of atomic species, five different sets of ionic radii, a qualitative table (but no values) of polarizability of ions, and for a long list of inorganic compounds: density, solubility products (whose?) and thermodynamic data (Rossini's).

A section on *Geochemical Migration* is mainly concerned with the system of crystal energetics that began with A. E. Fersman's *EK* values, was further developed by A. A. Saukov, A. F. Kapustinski, K. Doerffel, and E. Sádeczky-Kardoss, but which has received little attention in eastern Europe or America. Stabilities in aqueous solution, including only a small sampling of Eh-pH diagrams, are taken from a survey by Tischendorf and Ungethüm, although the books of both Pourbaix and Garrels are also listed as references.

A section on methods for geochemistry leads off with a useful table comparing the range of applicability, advantages and disadvantages of various methods of mineral concentration, with references. The methods of analysis are necessarily restricted to short statements and reference to textbooks or survey articles. However, the data for elemental content in standards G-1 and W-1 does not go beyond the 1963 compilation of Fleischer and Stevens. Similarly, most of the abundances of elements in meteorites are taken from the 1957 compilations of Heide. For the earth's crust you can take your choice of six compilations, old and new. Consideration of the distribution of elements in particular rock types is much more detailed, with numerous examples from recent literature (to which Dr. Lange has

himself made many contributions). The book concludes with an extensive section on application of geochemistry.

The intent of Rossler and Lange was a compilation useful to students and to geologists who should be applying geochemistry to their problems. This is no Fleischer (or even Clarke) *Data of Geochemistry*, rather it is a combination of an outline of modern geochemistry and a secondary compilation of tables. As such it should be very useful for the audience for which it was intended. Even practicing geochemists, who probably know where to find most of the data that is in the tables, may find the bibliographies (including one on the geochemistry of individual elements) very useful. Either group can use the book without more than a passing acquaintance with German.

Although obviously included for local use, a list of geochemical periodicals and the holdings of them in libraries of the DDR provides an interesting insight into facilities for research. Many of the less important periodicals from outside that country, especially from the USSR, are available in only one of its libraries, the Deutsche Staatsbibliothek in Berlin. *Geokhimiia* is more recently available in two other libraries, but in all cases only in the Geochemical Society's translation. More or less complete sets of *The American Mineralogist* are available both there and at Freiberg, but to see the *Proceedings of the National Conference on Clays and Clay Minerals*, you have to go across Berlin to the Deutsche Akademie der Wissenschaften.

I picked up this volume in a bookstore in Kiev, but it should be available through any importer.

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THERMOANALYTICAL METHODS OF INVESTIGATION BY PAUL D. GARN.
Academic Press, New York, 1965, xvi+606 pages. \$19.50.

Differential thermal analysis as an analytical and determinative technique has been moving forward in its applications into diverse disciplines at a very rapid rate. Its use has spread from the study of clays to all kinds of phase identification, both inorganic and organic, and at temperatures from considerably below zero to those in excess of 1600°C. This book by Professor Garn is an attempt to stop and take stock of the advances in the design and construction of differential thermal analysis (DTA) and thermogravimetric analysis (TGA) and related equipment, and to advise those investigators interested in building their own apparatus.

Although the title of this book is a very broad one, most emphasis is placed on DTA and TGA although other techniques are treated briefly including calorimetry and dilatometry.

The book is introduced by a brief chapter on "Changes in State of Heating"; this is followed by chapters on DTA, operational parameters, apparatus for DTA, evaluation of DTA curves, kinetics, atmosphere control, and special techniques. Next follows two chapters on TGA, and TGA apparatus and then a chapter dealing with simultaneous DTA and TGA. The remaining chapters cover other techniques, miscellaneous topics; analysis of gaseous decomposition products; recording, control, and power equipment; miscellaneous apparatus and information; apparatus design and three appendices.

The chief emphasis of the book is on design and instrumentation and Professor Garn has explored many corners of this field. The reader will find an extensive review of the papers dealing with these specialties and an evaluation of their contents. Professor Garn's numerous contributions form an integral portion of the text. There is much in this book that is not treated elsewhere in detail. Chapter XV: Recording, Control and Power Equipment; Chapter XVI: Miscellaneous Apparatus and Information and Chapter XVII: Apparatus Design are particularly interesting.

The style of this book does not make for easy reading. It is at times argumentative and at times it borders on the ostentatious. The author apparently does not hold the early basic studies in high regard.

Thus no mention is given either in the index or in the references to the original work of Le Chatelier (1887) who laid the foundation for DTA. Neither is any reference given to the papers by Norton (1939) of the Massachusetts Institute of Technology and Hendricks, Alexander and Nelson (1939) of the U. S. Department of Agriculture. These papers were responsible for the renewed popularity of the method in the United States and the use of the instrumental design proposed by their authors set the style for this renaissance. The work of the staff of the Geophysical Laboratory, Carnegie Institution of Washington, in the field of thermal analysis is likewise almost entirely ignored. One hunts in vain for references to Day, Allen, Kracek, Fenner, H. S. Roberts and above all to Walter P. White.

This reviewer does recommend the book to all researchers using DTA who are interested in design and instrumentation and in a commentary on theory. Its price, \$19.50, is rather high and will limit its distribution.

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