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BOOK REVIEWS

GEM TESTING. 8th ed. By B. W. Anderson. Van Nostrand Reinhold Company, New York, 1971. 384 pages. $19.50.

This book is meant to be a manual for jewellers and gem dealers. As such it covers topics ranging from the handling and housing of gemstones (including three plates showing how to fold a "stone paper") to the use of the polarizing microscope and absorption spectroscope. The treatment of these topics is lucid and totally practical. About 200 pages are devoted to the identification of diamond, ruby, sapphire, emerald, aquamarine, alexandrite, zircon, topaz, quartz, chalcedony, opal, garnet, tourmaline, peridot, spinel, jade, turquoise, lapis lazuli, and other less important gems. Pearls, amber, tortoiseshell, coral and "jet" are also treated in detail. The most interesting and perhaps unique feature of this manual is the intensive treatment given to man-made stones, including details of the methods of treating synthetics to simulate natural gems. The book jacket claims that the text is "completely up to date," but with the continuing rapid advances in mineral technology, the reader is advised not to rely entirely on *Gem Testing* for his information about synthetic and "faked" gemstones.

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ORE PETROLOGY. By R. L. Stanton. McGraw-Hill Book Company, New York, 1972. 713 pages. $19.50.

The ambitious first 300 pages were primarily intended to introduce seniors, or naive graduate students, to various aspects of structures, stabilities, and textures of ore minerals. However, there is questionable utility in a 14 page condensation of the theory of phase diagrams, or a summary of ore minerals classification, structures, and microscopic properties in 33 pages. Other topics treated equally cavalierly are isotopic fractionation, and Eh–pH, phase, and fugacity diagrams. Furthermore, some of the phase diagrams do not reflect the major advances in this area of the last five years. For example, the contributions of Cabri and Morimoto and their associates to the Cu–Fe–S system are ignored. Also, Kullerud deserves broad recognition for his pioneering in the study of phase relations or ore minerals, as concluded by Stanton, but appreciation of his contributions is hardly increased by republishing two of his earlier diagrams (Figs. 5–24 and 5–25) long since shown to be seriously incorrect.

A major virtue of the first part of this book is a unique, fairly comprehensive exposition of factors controlling ore textures including: bonding, diffusion, crystal growth, deformation, and annealing. The author's several imaginative papers, developing experimental studies of ore textures, are the principal bases for this discussion. Two other aspects of the kinetics of the solid state that could well have been developed here are mechanisms of exsolution, particularly the results of Yund and his students (for example, Yund and McCallister, 1970, *Chem. Geol.* **6,** 5–30), and of phase transitions (Krüger, 1964, *Chemistry of Imperfect Crystals,* North–Holland).

The second part, of about 400 pages, is a milestone among textbooks. It is the first serious attempt to classify, describe, and evaluate the genesis of metallic ore deposits based on the quantitative concepts developed through the last decade. Explanations draw freely on aqueous and phase equilibria, and isotopic and trace element data. Stanton's largely new classification doesn't even mention many classical terms sacred to economic geologists—such as mesothermal, xenothermal, leptothermal—an aged and foggy terminology long ready for a well deserved demise. Instead he uses eight principal categories with up to five types within each. As would be expected in a new classification, some problems arise. "Stratabound ores of sedimentary affiliation" is a somewhat forced grouping including Mississippi Valley-Type, Colorado Plateau-Type, and Witwatersrand-Type.

By choice he includes no explanation of lateritic or supergene processes nor any discussion of pegmatitic or non-metallic ores. Alteration is given little emphasis, being "covered" in about three pages. The summaries of ores in igneous rocks would have been improved by including data from the symposium "Magmatic Ore Deposits" (*Econ. Geol. Mon.* **4,** ed. by H. D. B. Wilson, 1969), instead of merely listing it as suggested reading. In the description of telluride ores, omitted is any reference to the principal discussion of these ores—by Kelly and Goddard ("Telluride Ores by Boulder County, Colorado," *G.S.A. Mem.* **109,** 1969); consequently phase relations for the ternary system, Au–Ag–Te, are absent here although vitally important to interpretation of these ores.

Among the chapters on the various types, only that on ores of metamorphic affiliation is weak. Contact metamorphic deposits are described in seven pages and scarn mineralogy is barely mentioned; the question of criticality of transporting fluids is unexplored but its state (gas?) is implied to be *pneumatolytic.* (Such archaic nomenclature is virtually absent elsewhere.) The category of "Regional Metamorphism" is redundant with other classes of his scheme so that descriptions of some deposits are found both here and elsewhere and are repetitive.

The text is lucid, well edited, clearly illustrated, and has both name and subject indices, totalling twenty pages. It is obviously superior to other textbooks available for an elementary course on metallic ore deposits, and should replace those currently available at this level. However, mineralogists will find the discussions of ore mineralogy much too condensed to be useful in typical mineralogy courses.

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THE CRYSTALLINE STATE: AN INTRODUCTION. By Peter Gay. Hafner Publishing Company, Inc., New York, 1972. ix + 348 pages. $14.95.

This book is designed as a beginning undergraduate textbook basically treating the repetitive nature of the constituents of crystalline matter. One might infer from the title that many of the principles of crystal chemistry are explored. This is not so. The text emphasizes elementary crystallography in a non-rigorous, but stimulating manner. Applications are stressed throughout, to give the student an appreciation of the power of the tools of crystallography and to encourage him to dig deeper into the subject.

The book may be subdivided into four sections. The first one, on geometrical crystallography, covers at some length (eight chapters) and in some depth topics such as two-dimensional patterns, stereographic projections, crystal classes and systems, axial systems and indexing, morphological crystallography, as well as three-dimensional lattice types and space groups. The second part (three chapters) introduces the subject of X-ray crystallography in more depth than do most elementary texts that are not exclusively devoted to X-ray crystallography. Topics in this section include X-ray generation; X-ray diffraction geometry; powder methods; single crystal Laue, rotation, and oscillation methods; and space group determination. The approach excludes the concept of the reciprocal lattice, but perhaps overcomes this weakness by its stressing of applications. The third section briefly (one chapter) presents symmetry dependence of physical properties. Tensor notation is not developed in an essentially qualitative discussion of optical and other common physical properties of crystals. The final section (one chapter) discusses the nature of crystal imperfections. Considering the depth of presentation of material in the other three sections, that of crystal imperfections is very brief, but does cover subjects like point and line defects, Burger's vectors, and stacking faults. Included in the text is a four-part appendix, which could easily have been incorporated into the main body and which contains further discussions of stereographic and gnomonic projections, calculations of the stereogram, crystal growth, and twinning.

The diagrams and figures of the text are mostly clear and instructive, but a few are overly cluttered. Most figure captions are too brief and force the reader back and forth from diagram to text for understanding. A strong point of the book is the selected biblography, current and germane, at the close of each chapter. Most chapters also have a number of problems which help the student concentrate on the more important concepts covered. Answers are given at the end of the book.

Overall, the book meets the requirements of a student text for a one semester introductory course on the geometrical nature of the crystalline state. Its few shortcomings are perhaps unavoidable because of the nature of the subject matter and the attempted introductory level of presentation.

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THE CHEMISTRY AND PHYSICS OF CLAYS AND OTHER CERAMIC MATERIALS. 4th ed., rev. By Rex W. Grimshaw. Wiley-Interscience, New York, 1971. 1024 pages, $38.50.

The fourth edition of this book retains the logical layout of the third, describing the mineralogy, chemistry, and physics of raw ceramic materials. Clays are the major subject covered in the book, but some space is given to other naturally occurring and artificially produced siliceous and non-siliceous substances. The book has been updated largely by addition of paragraphs describing relevant recent research work, which adds to the comprehensive discussion; the bibliography also has been enlarged substantially to cover up to 1970.

The book is so broad, comprehensive, and interdisciplinary in scope that many students of geology, clay mineralogy, mineralogy, geochemistry, petrology and even structural geology would extract information and refresh themselves through reading some sections in the book. The author starts with a chapter which summarizes the historical development of ceramics and general geology of clays and other ceramic materials. The second part forms the largest section of the book (Chapters 2–10, 640 pages), and is concerned with fundamentals of mineralogy (crystallography, crystal chemistry, and determinative mineralogy), influence of water, thermodynamics of the solid state, and chemical kinetics as relates to the studies of raw ceramic materials. It is impossible here to say more than that the coverage is very concise, but thorough. Mathematical equations, research data, and illustrations are drawn from the most current literature. This part would be of most benefit to students other than those of ceramic industry (*e.g.*, mineralogists, clay mineralogists, and geochemists) on some basic principles of solid-state geology. The final part (Chapters 11–14) deals with applications of current knowledge to practical ceramic problems. These include chemical and physical changes in "heterogeneous" ceramic materials when subjected to elevated temperature as well as ordinary temperature, and changes in other related properties such as strength, and thermal and electrical conductivities. Reading the book is a stimulating and joyful experience.

Presentation of the subject matter is soundly factual and emphasizes mathematical treatment. Most new analytical techniques are introduced adequately, except SEM, which was not mentioned, even though SEM is recognized and is widely used by mineralogists, particularly by clay mineralogists. The appendix (12 pages)—optical properties, DTA, and X-ray analysis of minerals associated with ceramic materials—would be most useful and provide firsthand references to anyone who analyzes clays, or other minerals. It should be noted, however, that the effect of organic acids on attack of clays and similar materials, although mentioned on page 699, has not been elaborated to cover the current basic knowledge of such effects.

Nevertheless, this is a comprehensive, broad-brush book which covers an enormous range of subject matter. A mineralogist, particularly a clay mineralogist, would find it an excellent reference book. The book is expensive, but it should be in all geological and mineralogical libraries.

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