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BOOK REVIEWS

MINERAL DEPOSITS WITHIN THE EUROPEAN COMMUNITY. Edited by J. Boissonnas and P. Omenetto. Special Publication No. 6 of the Society for Geology Applied to Mineral Deposits. Springer-Verlag, Berlin, 1988. xxiii + 558 pages, 221 figures. $130.00.

This book is a very mixed bag of 29 individual papers divided into three groups: Part I, Tungsten, Tin, Molybdenum, Tantalum (13 papers, 248 pages); Part II, Chromite and Platinum-Group Elements (4 papers, 72 pages); and Part III, Base Metals, Phosphates, Placer Minerals (12 papers, 232 pages). Among this potpourri are topics as widely diverse as fluid inclusions as a guide to tungsten deposits, niobium-tantalum mineralization in Greenland, chromite deposits in Greece, Cyprus, Oman, and New Caledonia, lithogeochemistry application to base-metal exploration, hydrocarbon gases and mineralization, phosphate stratiform deposits in Belgium, and much, much more. What the book lacks is any sense of a unifying theme. It is a collection of articles more suited for publication in the appropriate journals. As such, it is unlikely to appeal to the individual scientist, and the price makes it a poor investment for any but the richest or most specialized libraries.

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INTERNATIONAL TABLES FOR CRYSTALLOGRAPHY, VOLUME A. SPACE-GROUP SYMMETRY. SECOND, REVISED EDITION. Edited by Theo Hahn. Published for the International Union of Crystallography by D. Reidel Publishing Company, Dordrecht, Boston, Lancaster, Tokyo, 1987. 878 pages. $140.00.

The first edition of this complete revision of the old *International Tables for X-ray Crystallography* was published in 1983 and reviewed in *American Mineralogist,* 69, p. 816. The first edition superseded the direct-space symmetry tables portion of Volume I of the previous series and was a vastly expanded version, both in layout (23 × 30 cm page) and length. The size and weight of this volume make it somewhat inconvenient to use or transport, so I was very pleased to see that a Brief Teaching Edition was published in May 1985.

The Second, Revised Edition contains a number of minor, mostly cosmetic, changes and additions, plus the significant addition of a discussion and tables of space-group normalizers. The minor changes include corrections of a number of relatively minor errors, addition of footnotes to enhance clarity of discussion and explanation sections, addition and updating of references, and revision and expansion of the subject index. New symmetry diagrams have been prepared for the two-dimensional space groups and the trigonal three-dimensional space groups, but the principal innovation here is to reverse the placement of symmetry-element and general-position diagrams to enhance consistency.

The significant addition to the Second, Revised Edition is the incorporation of two sections, totaling approximately 16 pages on normalizers of space groups by E. Koch and W. Fischer (Marburg) and H. Wondratschek (Karlsruhe). Normalizers are mathematical operators used to determine automorphism groups of space groups and to determine permissible translations in direct methods of crystal-structure determinations. These operators may also be useful in discussion of subgroup-supergroup relations. Whereas normalizers have been known to mathematicians since the last century, their application to crystallography appears to be a developing field rather than the well-established formalisms presented in the other sections of this volume. As such it is difficult to estimate how useful this discussion will become to mineralogists; however, the use of space-group normalizers may find expanding application in defining complex subgroup-supergroup relations encountered in recent studies of high-temperature superconductors.

In light of the cost and probable limited application of the significant additions to the Second, Revised Edition over the First Edition of this volume, it is not anticipated that most mineralogical crystallographers will seek to replace their copies of the First Edition. However, those wrestling with describing complex subgroup relations and those interested in advanced group theory and direct methods of crystal-structure determinations may wish to utilize the Second, Revised Edition as a standard reference on the topic of normalizers.

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OCCURRENCE, PROPERTIES AND UTILIZATION OF NATURAL ZEOLITES. Edited by D. Kallo and H. S. Sherry. Akademiai Kiado, Budapest, 1988. 858 pages. $69.00.

This volume is the proceedings of the Second International Conference on the Occurrence, Properties, and Utilization of Natural Zeolites held in Budapest, Hungary, August 12–16, 1985. The invited and contributed papers are arranged into nine general subject areas: Geology and Mineralogy, Crystal Chemistry and Physical Properties, Applications in General, Ion-exchange, Water Purification, Adsorption, Catalysis, Agricultural Applications, and Miscellaneous. In general each section is headed by a review paper followed by papers describing specific original studies of natural zeolites.

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In the first section on geology and mineralogy, there is a competent review paper on natural zeolite occurrences by J. R. Boles, a good review of application of zeolite mineralogy to petroleum exploration by A. Iijima, and several papers providing descriptions of natural zeolite occurrences in Alaska, Japan, Czechoslovakia, Yugoslavia, Bulgaria, Italy, and Turkey.

In the second section, devoted to synthesis and stability, there is a lengthy review of thermochemistry of various natural zeolites by E.E. Senderov in which the author concludes that most natural zeolites are thermodynamically metastable relative to quartz and feldspars. This review is followed by several papers describing synthesis-reaction experiments to produce various zeolites from natural starting materials.

In the third section, which is devoted to crystal chemistry and physical properties, there is a disappointingly brief review of structural classification of zeolites by W. M. Meier followed by an interesting and potentially very useful and widely cited review and synthesis of ordering of tetrahedral cations in natural zeolite structures by G. Gottardi and A. Alberti. This is followed by several papers reporting studies using a variety of spectroscopic methods to determine cation ordering, vibrational dynamics, dehydration, and cation-exchange phenomena in several natural zeolites. No new crystallographic data were reported.

In the section titled Applications in General, the reader is treated to an eclectic, illustrated review of commercial and some noncommercial applications of natural zeolites in the U.S. and western Europe by Fred Mumpton, a review of corresponding applications in East-block countries by G. V. Tsitsishvili, and a review of the same in Japan by H. Minato.

The Ion-Exchange section contains mostly papers describing specific studies of ion-exchange experiments in clinoptilolite and ferrierite. The section devoted to Water Purification also contains papers describing specific application experiments and pilot-plant operations using natural zeolites, mostly clinoptilolite, for treatment of sewage and other waste waters for removal of ammonia and other cations.

The section on Adsorption has papers describing studies of the effect of various exchangeable cations on dehydration and adsorpton of various volatile molecules in some natural zeolites. The section on Catalysis has papers describing industrial catalysts developed from natural zeolites, particularly mordenite and clinoptilolite. In the section devoted to Agricultural Applications, there are several papers describing the role of zeolites in soil formation, as well as several describing applications to wheat, hogs, and cattle. The Miscellaneous section contains papers describing zeolite applications to solar-energy storage, solar refrigeration, and cement chemistry. The final paper concerns possible carcinogenic effects of erionite, mordenite, and synthetic zeolites.

On the whole, the volume is a valuable resource on natural zeolites. To this reviewer, the most valuable papers containing data or syntheses that are not readily available elsewhere are those by Gottardi and Alberti, Senderov, Bish, Boles, and Iijima.

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ERRATUM

Thermodynamic studies of zeolites: Heulandite by G. K. Johnson, H. E. Flotow, P.A.G. O'Hare, and W. S. Wise (v. 70, p. 1065–1071). In Table 5, ΔH for Reaction 11 should be $-(1096.16 \pm 0.15)$ kJ/mol. As a result, ΔH_f^0 and ΔG_f^0 of heulandite at 298.15 K should be $-(10594.6 \pm 10.2)$ and $-(9779.1 \pm 10.2)$ kJ/mol, respectively, and each entry for $\Delta H_f^0(T)$ and $\Delta G_f^0(T)$ in Table 7 should be more negative by 103.5 kJ/mol.