amounts of Si, Ca, P and Al are constituents of pitticites but are non-essential. Pitticite is retained as a generic name for amorphous, gel-like, ferric iron arsenate minerals of varying chemical composition.

Yukonite

Yukonite is reported from a second occurrence at the Sterling Hill Mine, Ogdensburg, Sussex County, New Jersey, where it occurs as gel-like, waxy aggregates of brownish color and as dark red, remnant pseudomorphs after koettigite–parasymplesite, associated with ogdensburgite. Microprobe analyses (2) yielded: SiO_2 0.6, 2.2; Al_2O_3 0.8, 1.0; Fe_2O_3 28.8, 28.8; MgO 0.4, 0.6; CaO 10.4, 10.4; MnO 2.1, 2.2; ZnO 3.3, 3.8; As_2O_5 32.1, 39.1; SO_3 0.2, 0.2; H_2O (by difference) 19.7, 12.5; sum = 100.0, 100.0 percent. Pitticite has a weak X-ray powder diffraction pattern with strongest lines 5.60(8), 3.25(10), 2.79(8), 2.52(3), 2.33(3), 2.23(3), 1.63(4b). **P. J. D.**

BOOK REVIEWS

CRYSTALLOGRAPHY: AN INTRODUCTION FOR EARTH SCIENCE (AND OTHER SOLID STATE) STUDENTS. By E. J. W. Whittaker, Pergamon Press, Oxford, 1981. xii + 254 pages. $19.95 soft cover.

As noted in the Preface by L. G. Berry, this book is divided into two parts corresponding to a two course sequence offered to undergraduates at the University of Oxford. Part I (Chapters 1–7) deals with the more classical aspects of crystallography whereas Part II (Chapters 8–18) considers the crystallographic applications of diffraction. Each chapter includes a problem set for which answers are provided.

Many basic concepts are developed rapidly, though clearly, in the first four chapters (p. 1–36). Starting with the analogy of stacking bricks to the formation of a euhedral crystal, the concepts of axes, axial ratios, interaxial angles and interfacial angles are introduced. Building on this analogy, the concepts of translational symmetry—repetitive patterns and simple lattices—and the unit cell are developed. Next, symmetry operations (reflection, proper rotation and roto-inversion) and their relationship to crystals and unit cells are explained and combinations of symmetry operations are used to define the seven crystal systems. In Chapter 4 the crystallographic axes are defined and nomenclature for crystal faces (Miller indices) and zone axes are covered.

The remainder of Part I consists of stereographic projection (Chapter 5), an introduction to crystal forms (Chapter 6) and a development of the 32 crystal classes (Chapter 7). This is more or less standard fare; however, the author does note his preference for several specific form names (ditetragonal sphenoid rather than tetragonal scalenohedron, for example). Hermann–Mauguin notation is used exclusively in Part I in preference to the less popular Schoenflies notation which is not mentioned. Part I concludes with a brief appendix which points out the similar properties within each of the three sets of rotoinversion axes : 2n+1, 2(2n+1) and 4n.

Perhaps the most remarkable aspect of this book is the breadth of topics covered in Part II. Although coverage of each topic is by necessity brief, the author has concisely treated each topic with detail and rigor sufficient to provide a firm foundation from which the student may choose to build. This part opens with a discussion of the properties of X-rays and an introduction to diffraction (Bragg's Law). Chapters on the geometry, applications and indexing procedures involving both powder techniques (Debye-Scherrer, Gandolfi, Guinier) and selected single crystal techniques (rotation, oscillation) are included.

A brief but excellent treatment of X-ray reflection intensities is given in Chapter 10. This includes development of the structure factor (F_{hkl}) and the various correction factors (temperature factor, multiplicity, Lorentz, polarization, *etc.*). Chapter 15 gives an overview of structure determination using rutile as an example. Other topics include electron diffraction (Chapter 16) and crystallographic aspects of twinning, polytypism and crystal defects (Chapter 17).

The development of the 14 Bravais lattices (Chapter 11) and space group concepts including screw axes and glide planes (Chapter 14), are also reserved for Part II. By covering these topics after the student has been exposed to X-ray diffraction, the author is able to stress the application of systematic extinctions to lattice and space group determinations.

In summary, this book is a well organized, concise and clearly written introduction to both "classical" and "modern" crystallography. It should serve as an excellent text for any two course introductory sequence in crystallography similar to the Oxford University format.

M. W. PHILLIPS
University of Toledo

MINERAL DEPOSITS OF EUROPE, VOLUME 2: SOUTHEAST EUROPE. Edited by F. W. Dunning, W. Mykura and D. Slater. The Mineralogical Society and The Institution of Mining and Metallury, London, 1982. 304 pages, 183 figures, numerous tables. Price to members £35 or US$87.50 (including postage); nonmembers £42 or US$100.

An introductory chapter by W. Petrascheck (12 p., 1 table, 3 figs.) provides a general geological framework and a discussion of the various periods of mineralization. This is followed by national chapters: Hungary, by G. Morvai (42 p., 15 tables, 27 figs.); Romania, by V. Ianovici and M. Borcos (88 p., 1 table, 74 figs.) Yugoslavia, by S. Jancović (60 p., 7 tables, 36 figs.); Albania, by E. Pumo, V. Melo and B. Ostrosi (12 p., 1 table, 9 figs.); Bulgaria, by B. Bogdanov (18 p., 8 figs.); Greece, by G. Marinos (21 p., 13 figs.); Cyprus, by Y. Hadjistavrinou and G. Constantinou (23 p., 5 tables, 15 figs.). A concluding chapter by A. J. G. Notholt, Mineral Production and Developments in Southeastern Europe (11 p.) includes extensive statistical data, by commodity and by country, for 1960, 1970, 1977, 1978, and 1979 (for Albania, Bulgaria, and Romania many of the figures are estimates).

This volume maintains the high standard set by Volume 1 (Northwest Europe) in providing excellent descriptions in English for many mineral deposits for which little or no information has been available in other than the national language. It includes both metallic and non-metallic deposits (fuels are not covered). The volume has a large page size (11 1/2 × 8 inches), enabling the adequate reproduction of maps and diagrams. This book is

certainly a must for any economic geologist concerned with this region, and should be available in all geology libraries.

BRIAN MASON
Smithsonian Institution

ORE GENESIS, THE STATE OF THE ART. By G. C. Amstutz, El A. Goresy, G. Frenzel, C. Kluth, G. Moh, A. Waschkuhn, and R. A. Zimmermann, Editors, 1982. New York. 793 pages.

Ore Genesis was written in 1980 by friends and former students to honor Paul Ramdohr on the occasion of his 90th birthday. The volume contains 74 papers and attempts to emphasize the main interests of Dr. Ramdohr's long and productive career. Ore genesis studies are based on textural, geochemical and crystal chemical aspects of the deposits. Examples chosen are from deposits scattered throughout the world, many of which were previously studied by Dr. Ramdohr. South Africa, South America, Australia, and especially Europe are well represented. Several of the examples are from deposits in Hungary and Romania that are little known to modern Western readers.

The book is divided into thirteen sections, as follows: (1) Detrital Sedimentary Rocks (thirteen papers). (2). Evaporites (one paper). (3). Genesis of Ores in Volcano-Sedimentary Sequences (five papers). (4). Genesis of Deposits in Recent Sediments (three papers). (5). Weathered Products of Ore Deposits (five papers). (6). Deposits in Acidic Volcanic and Subvolcanic Rocks (two papers). (7). Deposits of the Pegmatitic-Pneumatolytic and Hydrothermal Associations (five papers). (8). Deposits in Basic Plutonic and Extrusive Rocks (five papers). (9). Genesis of Ores in Metamorphic Rocks (nine papers). (10). Studies of a Regional Nature (thirteen papers). (11). Spatial and Temporal Considerations of Ore Genesis (two papers). (12). Experimental Studies of Ore Mineral Associations (four papers). (13). Mineralogical Studies (seven papers).

As would be expected in a volume that has some 156 authors and 74 papers the subjects of the articles and their quality vary widely. Some are excellent. Many emphasize ore microscopy, determinative mineralogy and X-Ray and microprobe studies, subjects in which Dr. Ramdohr has been particularly interested.

Some of the articles are difficult to read and understand. Not all contain index maps, but the writers assume that the reader is familiar with the local geography of the area described. The text frequently contains references to articles that are not listed in the bibliographies, and several of the articles use involved sentences that are difficult to follow and to understand. For example: "They are interesting not so much for their ruditic, arenitic, and lutitic detritus, which originates from the surrounding sediments and has been geopetally and discordantly sedimentated, but rather for the chemically-internally apposited clacites and the authigenic crystallizates of barite, fluorite, pyrite, galena, and gypsum (Figs. 4 and 5), the latter of which were, however, only found in an exposure". Such difficult reading greatly detracts from otherwise excellent studies.

Printing errors are minor but have been noted in a few places and in one illustration, p. 524, Plate 2e is missing. The binding of the book is poor and may not withstand continued usage. However, in spite of its deficiencies, the book does contain some excellent materials and will be of considerable interest to mineralogists and geologists working on the complex subject of ore genesis.

CHARLES F. PARK, JR.,
Stanford University