unnamed $Pb_3Cu_3Bi_8S_{17}$

Microprobe analysis gave Bi 55.8, Pb 20.3, Cu 6.2, S 17.9, sum 99.7 wt.%, corresponding to $Pb_{2.98}Cu_{2.97}Bi_{8.05}S_{16.98}$, close to hammarite, lindstromite, and rezbanyite. The strongest X-ray lines (12 given) are 3.47(5), 3.15(10), 2.40(5), 2.31(9), 2.17(10), 1.958(6b), 1.577(8), 1.450(6), 1.382(7). It occurs in intergrowths with chalcopyrite, joseite-A, and joseite-B. **M.F.**

Unnamed sulfotellurides

C. N. Gamyanin, N. V. Leskova, and L. I. Bochek (1978) Composition and properties of bismuth sulfotellurides from deposits of eastern Yakutia. International Mineralog. Assoc., 11th Session, Novosibirsk. 1978, Sulfosalt Vol., 127–135 (1980) (in Russian).

Minerals E, F, K, L, M, P

Mineral M: $(Bi_{2.97}Pb_{0.01})(Te_{1.48}S_{1.47}Se_{0.05})$, or $Bi_3(Te,S)_3$, strongest X-ray lines (6 given) 3.61(5), 3.09(10), 2.119(8), 1.748(6); microhardness 44.6 to 72.4 kg/sq. mm, reflectance curve given. *Mineral E*: $(Bi_{2.97}Sb_{0.02}Pb_{0.01})$ $(Te_{2.0}S_{0.96}Se_{0.04})$, or Bi_3Te_2S; Strongest X-ray lines (6 given) 3.69(5), 3.151(10), 2.296(7), 2.160(9), 1.788(6), 1.379(8). Microhardness 35.9 to 67.6 kg/sq mm; reflectance curve given. *Mineral F*: $(Bi_{3.04}Pb_{0.03})(Te_{2.27}S_{0.73})$, strongest X-ray lines (6 given) 3.69(4), 3.13(10), 2.281(7), 2.15(6), 1.779(5), 1.378(7); microhardness 27.2–51.4 kg/sq mm; reflectance curve given.

No composition stated for *K*, *L*, and *P* (*K* & *L* are on the diagram p. 130). *K* $(Bi_{8.86}Sb_{0.04}Pb_{0.01})(Te_{3.90}S_{2.10}) = Bi_9(Te_4S_2)$. *L* $(Bi_{2.00}Sb_{0.01}Pb_{0.02})(Te_{1.00}S_{2.00}) = Bi_2TeS$; X-ray data. *M* $(Bi_{1.57}Sb_{0.01}Pb_{0.15})(Te_{1.01}S_{0.99}) = (Bi,Pb)_2TeS$; X-ray data. *P* $(Bi_{14.84}Pb_{0.16})(Te_{2.16}S_{8.00}) = Bi_{15}Te_2S_8$ or Bi_6TeS_3: Godovikov et al., Zapiski, 100, #3, 257-265 (1971), gives the following data from the Sokhodno deposits, E. Transbaikal: *K* av. of 2: Bi 76.84, Pb 0.32, Sb 0.22, Te 20.56, S 2.80, sum 100.74%. *L* av. of 2: Bi 78.63, Pb 0.60, Sb 0.18, Te 17.32, S 3.70, sum 100.43%. *M* (1 anal.): Bi 63.30, Pb 6.10, Sb 0.20, Te 25.00, S 6.10, sum 100.70%. *P* (1 anal.): Bi 83.40, Pb 0.90, Sb --, Te 7.40, S 6.90, sum 98.60%.

Optics given for *K* and *M*. **M.F.**

Unnamed vanadium porphyrin

S. A. Miller, T. W. Hambley, and J. C. Taylor (1984) Crystal and molecular structure of a natural vanadyl porphyrin. Australian J. Chem., 37, 761–766.

Single-crystal X-ray study of a natural vanadyl deoxophylloerythroetioporphyrin shows it to be monoclinic, space group $P2_1/c$, unit cell: $a = 12.912$, $b = 14.151$, $c = 18.404$Å, $\beta = 70.34°$, $Z = 4$. Lattice parameters were determined by least squares fit to the setting angles of 32 high-angle reflections obtained from a four-circle diffractometer. X-ray diffraction peaks not given.

The porphyrin was extracted from a sample of oil shale from the Julia Creek deposit (Toolebuc formation) in Queensland, Australia. This deposit is known to contain high concentrations of porphyrins. Ideal chemical formula $C_{33}H_{35}Cl_3N_4OV$. Crystals of the porphyrin grown from chloroform were prismatic, dark red in color, and up to 0.26 mm in length. D. 1.37 meas., 1.353 calc. The molecular structure is shown to consist of an isocyclic five-membered ring centered on a vanadium atom in a distorted four-fold site. The similarity in structure indicates this new porphyrin is a derivative of chlorophyll. The crystal structure consists of these porphyrin molecules in planar arrangement nearly parallel to the XY plane that are separated by chloroform molecules. **J.E.S.**

BOOK REVIEWS

CARBONATES: Mineralogy and Chemistry, Reviews in Mineralogy, Vol. 11. Edited by Richard Reeder. Mineralogical Society of America, Washington, D.C., 1983. 394 pages. $13.

CARBONATES: Mineralogy and Chemistry is another excellent addition to this most useful series. Extensively annotated with approximately 1000 references, this volume covers nearly all aspects of the mineralogy, crystal chemistry and phase relations of natural carbonate minerals, together with their low temperature aqueous behavior. Each chapter is well written by an authority (or authorities) and well illustrated with copious line drawings and/or electron micrographs. Most of the illustrations are clear and in only a few cases do the labels approach illegibility. Difficult to reproduce under the best of circumstances, most of the electron micrographs have been well chosen and have been reproduced well, although a few of the high resolution lattice images are less clear than one might like.

The book progresses from a consideration of crystal chemistry, phase relations, solubility relations and low temperature kinetic considerations, to a discussion of trace elements and isotopes in low temperature carbonates, and finally to the comparatively new field of microstructure characterization made possible by the advent of modern high voltage electron microscopes. Most chapters end with suggestions for future work, a humbling exposure of how much more we need to know.

Richard Reeder summarizes the crystal chemistry of the rhombohedral carbonates in Chapter 1, and although he concentrates on calcite and dolomite (as do most other authors), other phases are not neglected. Julian Goldsmith succinctly summarizes what we know (and how much we don't) about phase relations among the rhombohedral carbonates. His scholarly summary should send the experimentalists running to their laboratories and points to the need for a "rebirth" of hydrothermal work. Eric Essene summarizes solid solutions in metamorphic carbonates and concludes that essentially only the calcite-dolomite solvus is presently useful in metamorphic rocks between about 400 and 600°C, if applied carefully. Considerable potential exists in other systems, however, particularly those which contain $FeCO_3$. Again, the need for additional experimental work is indicated. Fred Mackenzie and five co-authors summarize some views of this same solid solution at low temperature, namely the behavior of Mg-calcites in aqueous solution. Considerable controversy exists over how to handle the behavior of this metastable system in a rigorous thermodynamic framework. Mackenzie et al. summarize what is known and what is thought. But the last word has yet to be written!

Chapter 5, by J. Alexander Speer, summarizes crystal chemistry and phase relations in the orthorhombic carbonates, a group about which a considerably smaller body of knowledge exists. Bill

Carlson follows with a discussion of $CaCO_3$ polymorphs, emphasizing the calcite-aragonite transition, to which his own contributions are not inconsequential.

Chapter 7, by John Morse, delves into the kinetic complexities of dissolution-precipitation at low temperature. This is an exciting area of low temperature aqueous studies, and Morse and his students have made significant contributions to the complex solution behavior of these complex, metastable systems.

Jan Veizer summarizes trace elements and isotopes in sedimentary carbonates (an omission from this book is the hydrothermal realm). Although primarily descriptive in nature, the reader will recognize from what has come before (and what is to follow!) how difficult the quantitative interpretation of sedimentary carbonate rocks really is. Veizer provides a solid summary on which to build.

The *piece de resistance* of this meaty book is the final chapter by Wenk, Barber and Reeder on microstructures in carbonates. Seen at state-or-the-art resolution, we at last see why these minerals are so complex. Holocene dolomite (Fig. 38) is seen to be a crystallographic marble cake, and the unexplained modulated structures so typical of calcian sedimentary dolomite (Fig. 29) are well illustrated in all their confusing complexity.

"All you ever wanted to know about carbonate mineralogy" is well summarized in 367 pages, and if that is not enough, there are always the 1000-odd papers which are referenced. But the real utility of a book like this is that it provides a stable plateau on which we can rest and reflect as we climb toward ever increasing knowledge. As a bonus this book clearly points to directions in which we badly need to extend our knowledge of this fascinating, complex group of minerals.

LYNTON S. LAND
University of Texas

COMPARATIVE CRYSTAL CHEMISTRY. Temperature, Pressure, Composition and the Variation of Crystal Structure. By Robert M. Hazen and Larry W. Finger, Foreword by Charles T. Prewitt. John Willey & Sons, 1982. Hardcover, xv, 231 pages.

This review is long overdue, especially in the sense that when this book was published, it was a complete and up-to-date description of the cutting edge of a major theme of modern mineralogical research. Although much related research has taken place since its publication in 1982, it retains much of its value, and today remains the one definitive text of its kind.

The theme of the book is inherent in the term 'Comparative' in that detailed crystallographic studies may be carried out independently as a function of solid solution, temperature or pressure, such that the absolute and relative variations in individual components of the structure such as ionic radii or polyhedron geometry may be studied in an empirically comparative way. Such functions in turn lead to an understanding of physical and chemical properties of minerals: properties such as thermal expansion and compressibility, for example, and these in turn permit definition of mineral and rock properties over the limits of conditions of the solid earth. In short, such comparative crystallographic data lead to a definition both of mineral properties in their own right and of minerals as components of rock systems over the limits of geologic conditions.

The authors have been at the forefront of crystallographic studies as a function of pressure and temperature and this is one of the reasons why this book is complete and authoritative. It is divided into two sections. Part one deals with experimental procedures. In Chapters 2, 3 and 4 the histories of the developments of high temperature and high pressure devices and techniques are reviewed, with emphasis on the design, construction and use of modern devices for generating high P–T conditions for crystallographic studies. Chapter 5 is concerned with the interpretation of crystallographic data. These chapters are complete enough (especially in that comprehensive literature references are included) so that a novice, armed only with an elementary understanding of diffraction relations, could build or obtain the necessary devices and carry out basic experiments. Tricks of the trade which can usually be learned only through trial and error are detailed as could only be done by experimentors who have lived with the problems. Appendices to Part I include a list of suppliers of materials and equipment, and listings of essential computer programs.

Part 2 consists of a review, synthesis and discussion of the published literature dealing with experimental results. Chapters 6, 7 and 8 deal with variations in structure as a function of temperature, pressure or composition, while Chapter 9 considers interrelationships of such changes, noting that the ultimate goal is to create T–P–X equations of state. In Chapter 10 are considered factors that limit continuous changes, emphasizing parameters that influence polymorphic transitions.

This book is already so well known and used by crystallographers who actually carry out research in these fields that this review is hardly necessary for such researchers. For those who may not yet be aware of it and who are interested in mineral and rock properties as a function of pressure, temperature and composition over the limits of geologic conditions, this book is essential reading. For non-X-ray crystallographers it provides an understanding of the nature and limits of the crystallographic data and a comprehensive review of the actual experimental results. Lastly, for physical scientists contemplating carrying out high P,T research this is a basic starting point. In short, this is a landmark book for geological and materials scientists with interests in the solid state at high P–T.

DONALD R. PEACOR
The University of Michigan

NOBLE GAS GEOCHEMISTRY. By Minoru Ozima and Frank A. Podosek. Cambridge University Press, New York, 1983. x + 367. $79.50.

The isotope geochemistry of the group VIII elements (He, Ne, Ar, Kr, Xe, and Rn) is rapidly coming of age. Elements in this group first became important to geosciences in the K/Ar and U/He clocks. During the 1960s and early 1970s most of the practitioners of the more general noble gas geochemistry studies were interested first in meteorites and then in the lunar samples and to many geoscientists this field appeared to be an esoteric subfield of cosmochemistry. The discovery of juvenile ^{3}He emanating from midocean ridges in 1969 sparked a renaissance of terrestrial work which continues to the present. Noble gases are currently being used for everything from predicting earthquakes to constraining models of the chemical and thermal evolution of the Earth's mantle and atmosphere. The field was ripe for a monograph which reviews and synthesizes the diverse literature of terrestrial noble gas geochemistry. Ozima and Podosek's book admirably fulfills the need.

This small book is very readable. The authors have an understated writing style that packs a wealth of information into a small space. They leaven the information with a dry humor that sneaks up on the reader at unexpected times. The book is technically excellent with surprisingly few typographical errors.

Ozima and Podosek are in complete command of the literature—not surprising since they wrote much of it. The tone of the book is that of a critical review which emphasizes the unknowns as much as the knowns. The authors review their own work with the same skepticism they accord the work of others. The book repeatedly points out how thin is the data base in terrestrial noble gases and how much work remains to be done.

The first three chapters of the book provide an introduction and background to the field of noble gas geochemistry. The 4th chapter is an excellent summary of the physical chemical behavior of the noble gases and brings together a very diverse literature. This chapter should be required reading to anyone interested in noble gases. Chapters 5 and 6 condense the extensive extraterrestrial literature into a useful background against which to discuss the terrestrial data. Chapters 7 through 10 review the data for Water, Sedimentary Rocks, Igneous Rocks, and Emanations respectively. Chapter 11 discusses how noble gas data are used to elucidate mantle structure and evolutionary history. Chapter 12 reviews the question of what are the significant terrestrial reservoirs of noble gases. The final chapter concerns noble gas constraints on the origin of the atmosphere. The last chapter is the only one with any mathematical models. While the authors admit it would be "naive to suppose [the models] are rigorously applicable to the earth", the models do allow "plausible generalizations" about the evolution of the atmosphere. Chapter 13 is by far the most coherent synthesis of the models yet presented in the literature.

This book is required reading for, and should be on the bookshelf of anyone who uses noble gases in the geosciences. It is of interest to almost any isotope geologist and chapters 5, 6, 11, 12, and 13 will be useful to a wide range of geologists. This book will certainly be the standard reference for the noble gas geochemistry for many years.

The only negative observation I can offer is the price—$79.50 for a book of this size effectively prices it out of the reach of all but research libraries and funded scientists. In particular, the price is an unreasonable burden on graduate students, who, in principle, should be a major market for this book. The price must be staggering when exchanged into the home currencies of non-U.S. scientists. One can only hope that publishers will eventually remember the parable of the goose that laid the golden egg.

E. Calvin Alexander, Jr.
University of Minnesota

NOTICES

EXPERIMENTAL MINERALOGY AND GEOCHEMISTRY
Applications to Petrology and Ore Deposits

17–19 April, 1986—Nancy, France: International Symposium on the most recent advances in methods, results and applications of experimental studies in the following subject areas: Geochemistry, crystal chemistry, mineralogy, mineral deformation.

The Symposium is organized by: Société Française de Minéralogie et Cristallographie (F), the Mineralogical Society (GB), the Deutsche Mineralogische Gesellschaft (GFR), the Institut National Polytechnique de Lorraine (Ecole Nat. Sup. de Géologie, Nancy) and the Centre de Recherches Pétrographiques et Géochimiques (C.N.R.S.) (Nancy).

Information: Prof. A. WEISBROD, E.N.S.G., B.P. 452 - 54001 NANCY CEDEX (FRANCE).

AIPG

The American Institute of Professional Geologists (AIPG), Arvada, Colorado, has produced and is making publicly available two new booklets explaining in lay terms the background, present status of, and the Institute's recommendations for positive action on two matters of concern to the Nation having serious geologic implications.

Titled respectively "Hazardous Waste: Issues and Answers" and "Radioactive Waste: Issues and Answers", the two booklets were written by ad hoc committees of AIPG Members expert in each of these areas. More than two years in production, both are "primers" on these crucial and timely topics.

The new "Issues and Answers" are 8½" × 11", soft cover. Printed on top quality paper, the two publications are written for a general audience in a not-overly technical fashion. Both include numerous full color photos and artistic illustrations, plus charts, graphs and explanatory drawings, also in color. "Hazardous Waste" is 25 pages long and "Radioactive Waste" is 27 pages in length.

Copies of either of the booklets are available from AIPG Headquarters, 7828 Vance Drive, Suite 103, Arvada, Colorado 80003. One to 99 copies are $3.00 each postpaid. One hundred or more copies are $2.25 each postpaid. Orders of under $100.00 total must be accompanied by check.

AIPG certifies the competence and ethical conduct of professional geologists from all specialties. The organization is concerned with informing the public on geology-related subjects such as hazardous waste and radioactive waste. It presently has nearly 4,500 certified members in the U.S. and abroad. Founded in 1963, the Institute's National Headquarters is in Arvada, and it also maintains an office in Washington, D.C.

Request for Abstractors

The *new mineral names* section of the American Mineralogist is a collective effort on the part of many mineralogists. The bulk of the abstracting has been done in recent years by Dr. Michael Fleischer, but there is now a need for additional abstractors. The most urgent need is for those willing to prepare abstracts of new minerals described in Russian. There is also a need for abstractors of papers written in English. Those interested in contributing to this most important part of the Society's work should write to Dr. Frank Hawthorne, Dept. of Earth Sciences, University of Manitoba, Winnipeg, M6 R3T 2N2, Canada.