American Mineralogist, Volume 59, pages 213–218, 1974

BOOK REVIEWS

THE OPAQUE MINERALS IN STONY METEORITES. By Paul Ramdohr. Elsevier Publishing Company, Amsterdam, London, New York, 1973. 245 pages. $22.50.

This book is the first of its kind and is a long-awaited expansion of Professor Ramdohr's pioneering articles dating from 1961–1963 on the opaque (and semiopaque) minerals in stony meteorites. One might logically assume that this 1973 book would be a compendium of updated information on the subject, but this is not the case. This by no means is a serious drawback as his observations will never be outdated and serve to complement the results of electron microprobe studies published in recent years. The preface, written in 1969, tells us that the book was essentially ready for printing in 1964. Inclusion of literature data is rather sparse. Of the 43 references, 28 cover the period 1960–1967, none beyond 1967. The book is almost completely concerned with the author's descriptions of the opaque and semiopaque minerals that he has observed in some 400 specimens available to him. This in itself is a formidable task and represents a significant contribution from one with such keen powers of observation. The emphasis is on appearances, textures, and associations, not on compositional details.

The book contains no index but there is a Table of Contents. A few pages are devoted to a summary of the minerals and their distribution in a number of selected stony meteorites representative of the various classes. The following 55 pages cover the minerals and textures subdivided under: elements and intermetallic compounds, sulfides, oxides, rare and insufficiently known minerals which include the minerals A through N from the author's earlier works, a few pages on fabric, texture and structure, weathering effects, fusion crust, and some helpful suggestions on the use of the reflecting microscope. The following 24 pages cover an alphabetical list of 355 meteorites studied together with their opaque and semiopaque mineral contents. The last 141 pages contain 304 photomicrographs of excellent quality printed on the enameled paper used throughout the book. The captions appear on the page to the left of the corresponding photographs to provide easy reference. The photographs and captions carry a letter prefix which corresponds to the subject as listed in the Table of Contents. Thus, all photographs B1 through B64 relate to the sulfides listed under B in the Table.

Certain parts under the author's mineral descriptions are incomplete. For example, the discussion of the pentlandite free-iron association, under pentlandite, is confusing. ". . . nickel will not in general form a sulfide rich in Ni as long as free iron is present" would be more acceptable if it was stated that under equilibrium conditions, pentlandite and kamacite (not taenite) are incompatible. The contention that pentlandite occurs in the carbonaceous chondrites which "lack" free iron does not agree with their reported coexistence in these meteorites, in his List of Meteorites and elsewhere in the text. This apparent conflict may arise through faulty translation, "have small amounts" may have been intended for "lack". With these corrections then the reader may rightfully deduce that the carbonaceous chondrites which contain pentlandite and kamacite have non-equilibrium assemblages. The ratio of Ni/Fe, stated to be about 1 for pentlandite, has more recently been shown to be closer to 0.4/1 for several Type III carbonaceous chondrites. Under chalcopyrrhotite, the author finds this mineral in many meteorites but does not acknowledge that its validity even as a terrestrial species has been questioned. Obviously he has observed the same mineral in numerous sections but somehow its composition is still a mystery. It is stated that the mineral in meteorites has variable composition. It is hoped someday we may learn more about these variabilities. Mineral C (djerfisherite), for some unknown reason, is listed under "Rare and Insufficiently Known Minerals." Perhaps this was true when it was Mineral C but now that it is djerfisherite it may only be rare! The composition of djerfisherite is only qualitatively discussed whereas the referenced paper by Fuchs presents quantitative data which essentially was verified later by El Goresy *et al.* The approximate formula, $K_3CuFe_{12}S_{14}$, was omitted in favor of "it appears to be an iron and copper mineral" and "a preliminary test with the electron probe showed iron and copper, sulfur and a little chromium" and according to Fuchs "contains potassium as a main constituent."

The "Meteorite List" contains a few errors. Several names are misspelled and should conform to those used in *The Catalogue of Meteorites* by Hey (1966). Some are not listed in the *Catalogue;* these should have been footnoted with explanations. Ten meteorites are incorrectly typed, the more serious being that Tieschitz and Chainpur are not carbonaceous chondrites but Ornans is. Winona is a mesosiderite and not a bronzite chondrite. Grant County, Kansas (listed) is a chondrite whereas Grant, New Mexico, an octahedrite, was probably intended as having the designated mineral assemblage. There are some meteorites designated by the symbols A or C which are not included in the accompanying list of abbreviations. Presumably the achondrite or chondrite subtypes were unknown in those cases. According to Hey's *Catalogue,* Luhy is synonymous with Přibram and not Velka; Carrizalillo (incorrectly listed as an octahedrite) is synonymous with Vaca Muerta and they are not distinct meteorites. The symbol Te twice appears instead of Fe.

Among the advantages of the book are the many inferred topics for future investigation which arise from Professor Ramdohr's detailed descriptions. The reader may discover several such topics within a few pages of the text. Here are three examples which pertain to the descriptions of magnetite. (1) Magnetite in contact with ilmenite is called titanomagnetite, the implied assumption being that some equilibrium reaction formed the association. Probe analysis of the magnetite in such occurrences would be desirable. (2) Magnetite within olivine is explained as an exsolution product—that sometime during olivine formation excess Fe_3O_4 was present. A knowledge of the FeO content of these olivines compared to that in other olivines in the same meteorite together with the possible presence of free silica or exsolved pyroxene would provide a more lucid understanding of the conditions involved. (3) Carbonaceous chondrites contain spherules of magnetite which are said to have replaced metal. The Ni content of the secondary magnetite may provide a clue as to the nature of such a process. Later under the discussion of troilite (or pyrrhotite) in carbonaceous chondrites, it is stated that the mineral is typically idiomorphic but rarely so in other meteorites and is a useful feature to recognize inclusions of carbonaceous chondrites in other meteorites. This suggestion prompted this reviewer to reexamine several sections of Murchison, a recently fallen Type II. Idiomorphic FeS here, however, is very rare. Hence the feature may still be diagnostic for the carbonaceous chondrites but it is not characteristic of all.

There are some typographical errors which a careful proofreading could have eliminated. The binding on my copy already shows signs of wear. The relatively high cost of the book may, in part, be due to the many photomicrographs, but all have been creditably selected and reproduced. A few captions are slightly ambiguous for phase identifications but most are well done.

In spite of the criticisms given above, this book is a definitive study of the subject and very likely in the years ahead will be regarded as a classic in the field. In view of the advanced age of the author, those wishing his authentic flavor would be well-advised to purchase the book.

Louis H. Fuchs
Argonne National Laboratory

TEKTITES. Edited by Virgil E. Barnes and Mildred A. Barnes. Benchmark Papers in Geology. Dowden, Hutchinson, and Ross, Inc. Stroudsburg, Pennsylvania, 1973. xv + 445 pages. $20.00.

The objective of the Benchmark Papers in Geology is to collect and redefuse key publications which can provide in a single volume the critical material needed to reconstruct the background of major topics in geological disciplines. This objective is partly met by the subject book. The particular papers assembled present adequately the background for one view of a controversial scientific issue, while leaving the critical material supporting the major contending view ineffectively brought out. This is not surprising inasmuch as the overall evidence critical to the origin of tektites spans many disciplines other than those related to geology—disciplines such as trajectory dynamics, atmospheric entry aerodynamics, hypervelocity cratering, and blast wave phenomenon. It obviously would be very difficult for the editors who are knowledgeable in geology and languages (as the rear jacket on the book notes) to effectively collect and editorialize upon the significant papers involving disciplines quite foreign to geology. Inasmuch as the tektite evidence that does not support the views advocated throughout the volume comes from disciplines foreign to geology, the uninitiated reader will not obtain a balanced perspective of the real issues involved in this unsettled subject.

An inconsistency in logic pervades the editorial comments presented in the book. The standard of evidence used to infer probable conclusions about relationships between various tektites and possible source rock materials varies markedly from topic to topic. For example, in one topic it is noted that no rock yet returned from the moon has been chemically identified as the source material for tektites. The editors infer therefrom that tektites are probably not from the moon. They do not note or assemble papers which point out that, in spite of vastly greater coverage, no rocks on earth have been chemically identified as the source material for tektites. Were they consistent, they would have logically drawn the parallel inference that tektites probably do not come from the earth.

In another example, on the topic of what association the layered tektites may have to normal tektites, a paper by the senior editor is presented which points out that the *major* element abundances in these two types of tektites are nearly identical, and they therefore associate the two in a common origin. In contrast, on the topic of what association lunar rock 12013 may have with the high magnesium tektites, they are not satisfied with basing conclusions on a comparison of major elements only, as these compare very closely indeed. Instead, papers are presented which note that some *minor* elements are distinctly different, from which the editors draw therefrom the inference that there probably is no associative relationship in this case. If they had applied the same latter standards of evidence to the question of layered versus normal tektites, however, they would have presented a paper noting that some minor elements (*e.g.*, copper, boron) in all Australasian layered tektites are distinctly different from normal tektites, and they could have drawn a parallel inference with equal illogic that these two types of tektites are probably not associated.

Two key issues about the supposition of a terrestrial origin of tektites are quite inadequately represented in the various papers assembled in the book: one is that no rock has yet been found anywhere on earth which has been identified as the source material of any group of tektites. Another is that the ballistic characteristics of small complete Australasian tektites are such that, irrespective of what velocity may be hypothesized for their ejection into the earth's atmosphere, they could not possibly have travelled further than a few 100 meters within the earth's atmosphere, and yet they are found several thousand kilometers apart.

In summary, the reader unfamiliar with the broad and conflicting background of tektite literature would obtain from this book a rather filtered view of what the important issues are in a difficult and still unsettled scientific controversy.

Dean R. Chapman
Ames Research Center

GEOCHEMICAL TABLES. By H. J. Rösler and H. Lange. Translated from the German by H. Liebscher. Elsevier Publishing Company, Amsterdam, 1972. 468 pages. $28.10.

The authors explain that the purpose of this book is to present a compilation of fundamental geochemical data "to promote the education of geoscientists at the Freiburg Mining Academy" and presumably elsewhere. It is specifically "not written for experts." Even with this proviso, it is a formidable task for two authors to attempt to be both current and comprehensive when geochemists require data of enormous diversity; consequently, even a modest success was unlikely.

Although classified under misleading headings, diverse topics included here are, in order, a short history of geochemistry, physical parameters of the elements, miscellaneous thermodynamic values, crystallographic data, geophysical energy values, phase and ionic equilibrium relations, techniques for chemical analysis of rocks and minerals, statistical methods, elemental abundances, compositions of rocks and natural waters, the hydrosphere and atmosphere, geochemical cycles, geochemical prospecting methods, together with very short sections on ore deposits, facies, trace elements, isotopic dating, units of measurement, and Greek and Cyrillic alphabets. Often, a short statement is given on a topic instead of, or in addition to, numerical data. Bibliographies follow each section and these often exceed the preceding segment in length.

The short statements are usually too brief to be useful except as a reminder to one already knowledgeable on that topic. For examples, phase equilibria is summarized (with several errors) on 4 pages and ore deposits in about a page of text; 11 analytical methods are each introduced by an average near a half page of generally confusing text.

Sources quoted are more often Eastern European. Those publications from which values were taken for the tables are dated dominantly between 1955 and 1965, although many of the bibliographies have been updated to include papers as recent as 1971 (one example). Consequently, many tables need revision as follows.

In Tables 2 and 3 archaic designations are given for some elements, such as an occasional A for argon, or the abbreviations of Cp for lutetium, Ct for hafnium, J for iodine, Nt or Em for rodon, Gl for beryllium, *etc.* The ionic radii of Table 18 are obsolete values from 1952. Table 26 shows thermodynamic data from *Circular 500* of the U.S. National Bureau of Standards (1959) instead of the Bureau's newer *Information Circular 270.* Metallic sulfide solubilities shown on Figure 34 from Verhoogen's 1938 paper are grossly incorrect; decomposition temperatures of sulfides in Table 45 are meaningless without specification of the physico-chemical conditions. One might wonder why the chapter on units includes for the geochemist (?) conversion factors for furlongs, chains, poles, and stones or why the inch is not given the defined value of 2.54 cm.

The book was printed in the German Democratic Republic (East Germany) and has many of the flaws characteristic of publications from Eastern Europe. Print is annoyingly visible through each page. Typescript is typically too light for comfortable reading and is frequently battered; it also is highly variable in weight from word-to-word and between pages. The quality of the binding is marginal. However, the book has been carefully edited and translated with few typographical errors or Germanisms, such as "chalcophil."

There are available other more current and authoritative compilations of the data in this book. Consequently, instead of this combination reference and textbook, students would be better served by buying two books for a smaller total cost: (1) either the latest edition (eleventh) of Lange's *Handbook of Chemistry* (at half the price from McGraw-Hill) or the *Handbook of Chemistry and Physics* (Chemical Rubber Company) for physico-chemical information, and (2) for discussion and explanations of abundance and other geochemical data, a textbook such as *Geochemistry* by K. H. Wedepohl (Holt, Rinehart, and Winston, Inc., 1971). A much more complete alternative for those with grant support is the series *Handbook of Geochemistry* (edited by K. H. Wedepohl, Springer-Verlag, Inc.) but at the staggering price of $176.20 for Volume 1 (1969) and Volume 2, parts 1 (1969), 2 (1970), and 3 (1972).

H. L. Barnes
The Pennsylvania State University

X-RAY CRYSTALLOGRAPHY. *An Introduction to the Theory and Practice of Single Crystal Structure Analysis.* By G. H. W. Milburn. Butterworth and Co., London, 1973. 218 pages.

The avowed purpose of this compact book—it measures approximately 5½ × 8½ inches for its 218 pages—is "to provide the reader with the basic knowledge needed to solve crystal structures by X-ray diffraction methods" and "presumes no prior knowledge of the technique."

Dr. Milburn has chosen to present this material roughly in the order that would be followed in experiment. Thus he has divided his book into four main sections: (1) Some crystallographic principles, (2) Collection and measurement of intensity data, (3) Crystal structure analysis, and (4) Crystallographic computer programs.

I have to admire Dr. Milburn for his ambition in presenting this book as an introduction to crystal structure analysis. All of the information necessary to the solution of a crystal structure is present. It is, unfortunately, not presented in such a manner that a neophyte (crystallographically speaking) would be able to follow through with understanding. It becomes clear quickly enough that no one book can adequately cover all facets of crystal structure analysis, and the reader feels compelled to consult the myriad of references provided to glean an understanding of the process.

We see a fundamental assumption that the reader has been exposed to some X-ray diffraction theory throughout Part I. That is, subjects are discussed without the author's going into detail, yet the same is not true of optical theory, and an inordinate number of pages are spent on optical theory solely for the purpose of mounting and aligning a crystal by means of the polarizing microscope.

In the reference to optimum crystal size, $2/\mu$, the reader is led to believe that this is almost a must for operational purposes, whereas the attainment of small crystal size may not be practical considering the technique used and the quality and quantity of data required.

On page 54 the mean copper wave length is given instead of the weighted $K\alpha$ value.

Part 2 is devoted to the collection and measurement of intensity data. It is as complete as space allows. However, it would seem appropriate to have the Weissenberg and precession cameras and geometry, uses, technique of indexing, and measurement of data all placed in one section. For example, the Weissenberg camera is discussed beginning in part 2 on page 71, the Weissenberg template chart for indexing is placed on page 63. We have been using the Weissenberg camera for all purposes from page 41. Indexing procedures are presented on page 74, yet the discussion of the determination of space groups and systematic absences appears on page 62.

On page 80 a section dealing with scaling of film data has the statement that "all the corrections to the data, *e.g.* Lorentz polarization, absorption, *etc.* should be applied before scaling is carried out," yet the corrections cited are not discussed until page 121 in part 3.

The importance of the precession method for determination of lattice constants, space groups determination, and the measurement of interaxial angles is not stressed. In connection with this is the statement that the usual setting for monoclinic crystals is such that the *b*-axis is the spindle axis. This is a convenient orientation for Weissenberg photography in many instances. However, for the precession method the a^* or c^* axis is used as a spindle axis more often in order to obtain accurate measurements of the Beta angle from one photograph and also to determine the space group.

Crystal alignment on Weissenberg geometry diffractometers is discussed in some detail. However, it is not brought out that the alignment procedures used for oblique crystal systems can also be used with success for crystals belonging to orthogonal systems. Further, it is not stated that the μ-angle settings should be calibrated. The assumption is made that μ has been set correctly whereas there may be a discrepancy of several minutes of arc.

Part 3 and 4 are the stronger portions of the book although the reader is still faced with having to consult many additional references.

In part 3 the author gets to the phase problem and actual solution of a crystal structure. Here he treats corrections to intensities which have been assumed in a prior part of the book. There appears to be no emphasis on the importance of the structure factor in any initial calculations either for direct comparison with observed values or for the assignment of phases in Fourier map preparation. The importance of the Patterson function is not overlooked, but I still prefer to read a treatise on the subject such as "Vector Space" in order to gain the perspective necessary to use the technique.

I like the section on computer programs used in structure analysis in part 4. They are presented in outline form (not the detailed program) providing the reader with a sequence of events to be programmed. This is the section where the reader really sees the logical sequence to be followed in structure analysis.

The references used in the book are good. At approximately page 174, however, the use of numbered references essentially ceases and further references are footnoted, an unnecessary change in style.

Dr. Milburn has managed to provide a tremendous amount of information in a small volume. I cannot, however, justify purchase of the book either in terms of cost ($29.00) or content in view of the other more informative books on the subject.

J. J. Finney
Colorado School of Mines

CRYSTALS AND THE POLARISING MICROSCOPE, 4th ed. By N. H. Hartshorne and A. Stuart. American Elsevier, New York, 1970. xi + 614 pages, illustrations. $29.50.

Whereas previous editions of this well known British book were aimed mainly at chemists, the newest one is addressed to a wider clientele, including geologists. Although originally more of a text, the book is now a general and reasonably comprehensive treatise, having been enlarged, I would estimate, by a third or more. Some of the more elementary matters as well as the function of an introductory textbook have been extracted and published by the same authors as *Practical Optical Crystallography*, already in the second edition (1969) [see *Am. Mineral.* **55**, 1824 (1970)].

In as much as the earlier editions do not seem to have been reviewed in this journal, it may be appropriate to outline the coverage chapter by chapter. (The chapter titles are not all given below exactly as they are in the book.)

The crystalline state (35 pages): in addition to standard topics such as crystal structures, anisotropy (general), solid solution and polymorphism, there are also brief treatments of crystal imperfections and crystal growth. The treatment of stereographic projection (15 pages) and of morphology of crystals (45 pages) is of the traditional sort, as is that for crystal optics (70 pages), using wave surfaces and indicatrices; in addition, the relation of optical properties to crystal structure (26 pages) and the subject of optical activity are considered. Here and elsewhere, organic crystals are used as examples as well as inorganic ones (including minerals).

The polarising microscope (48 pages): a good deal of detail is covered here that usually is omitted from current textbooks. Preparation and mounting of material (33 pages): the emphasis is on chemical, polymer, and biological materials. Grain mounts of minerals and other hard materials are only briefly referred to, as are thin sections.

Orthoscopic observation (71 pages): in addition to coverage of such standard topics as Becke lines, oblique illumination, immersion media, interference colors, and extinction, there is also treatment of rotary compensators, the method of the Poincaré sphere, and accurate determination of small retardations. Conoscopic observation (40 pages): an essentially standard treatment of conoscopic crystal optics.

Rotation methods (59 pages): 33 pages are devoted to spindle stages and their operation; most of the rest of the chapter deals with universal stages and their operation (including conoscopic methods).

Special methods of determination of refractive indices (25 pages): here are treated phase contrast, index variation methods, and focal plane screening. Hot and cold stages (25 pages): a wide variety of types and applications are described.

Methods of attack (9 pages): an outline of a simple procedure for identifying unknown crystalline materials. Chemical and industrial applications (23 pages): examples are given of optical investigation of such things as explosives, pharmaceuticals, crystals in human tissue, particles in air pollution, phase relations, slags, refractories, ceramics, and glasses.

Liquid crystals (53 pages): provides an introduction to the mesomorphic state, optical study of it, and descriptions of illustrative substances. Polymers and biological materials

(33 pages): an introductory presentation of the nature and methods of study of materials such as fibers, spherulitic polymers, and cell walls of plants.

Four appendices (7 pages) provide information on sources of polarizing microscopes, literature references to optical-crystallographic studies of organic compounds, sources of optical-crystallographic data, and sources (American and British) of certain materials mentioned in the text.

A large, fold-out nomogram, relating refractive indices to the optic angle $2V$, is attached to the end cover. For people with less than acute eyesight, it is much easier to use than the page-sized (or smaller) charts given in most texts.

In spite of the generality of the title, the subject of reflected light optics is not dealt with. None the less, I find this book to be an exceedingly useful one and recommend it for every laboratory using one or more petrographic microscopes.

I fear that, nowadays, more than a few geoscientists may consider polarizing microscopes somewhat passé and that a book such as this one is a rather inconsequential matter. In my opinion, however, the petrographic microscope is still the most economical, rapid, and effective single tool for the study of non-opaque solid matter. Moreover, all X-ray diffraction, electron microprobe, and spectroscopic work, as well as all chemical analysis (of non-opaque material), should be preceded by optical (polarized light) study.

D. M. Henderson
University of Illinois

ELECTRONIC TRANSITIONS AND THE HIGH PRESSURE CHEMISTRY AND PHYSICS OF SOLIDS. By H. G. Drickamer and C. W. Frank. Chapman and Hall, London, 1973. x + 220 pages. $16.50.

This monograph deals with the effect of high pressure on the electronic properties of solids, particularly electronic transitions which the authors define as a shift in the energy of one set of orbitals with respect to another leading to a new or a greatly modified ground state.

Following the introduction, some of the essential aspects of molecular orbital theory, ligand field theory, band theory of solids, and the electron donor-acceptor complexes are reviewed in chapter 2. Chapter 3 presents a brief analysis of the relationship between the energies associated with optical and thermal electron excitation processes. Chapter 4 gives a phenomenological analysis of the electronic transition phenomena, establishing the cooperative nature of certain of these transitions. In chapter 5, methods for studying the transitions at very high pressure (beyond 100 kbar range) are presented, including a description of the Bridgman anvil and the supported taper cell. The techniques for measurement include optical absorption, electrical resistance, X-ray diffraction and Mössbauer resonance. Chapter 6 reviews experimental data on *d-d* transitions in transition metal ions, charge-transfer in molecular and transition metal complexes, excitation from the valence to the conduction band in insulators and semiconductors, excitation of F centers in alkali halides and π-π^* transitions in aromatic molecules. Chapters 8 and 9 present changes in spin state of iron compounds and reduction of ferric iron by pressure, respectively. Chapter 10 discusses changes in the oxidation and spin states in organic molecules, and chapter 11 discusses reactions in aromatic hydrocarbon under high pressure.

Although this book is primarily addressed to solid state physicists and chemists, it would be of great interest to mineralogists, who are currently interested in the electronic transitions in silicates and oxides under mantle conditions.

Subrata Ghose
University of Washington

ATLAS OF THE TEXTURAL PATTERNS OF GRANITES, GNEISSES, AND ASSOCIATED ROCK TYPES. By Stylianos S. Augustithis. Elsevier, Amsterdam, 1973. xi + 378 pages. $55.00.

This 21.5 × 30.2 cm volume is a collection of 687 black and white pictures and 96 pages (27 chapters) of text. The stated purpose of the atlas is to show that "for the understanding of the granite problem, it is essential first to present a picture of the textural patterns of these rocks and then to attempt to interpret these textures on the basis of the concept of comparative anatomy." The author concludes, among other things, that both autochthonous and intrusive granitic bodies have been formed as the result of transformation of preexisting sediments and that "most common textural patterns of granites are hydrogenetic in origin." Also discussed are such phenomena and subjects as symplectic and graphic intergrowths, perthites, rapakivi structures, and relationships between hydrothermal metallogenesis and granitization.

Nearly all of the pictures are photomicrographs; the rest include photographs of outcrops, handspecimens, X-ray fluorescence spectra, and an electron microprobe scan. All but a few of the scales are indicated in captions rather than graphically. In a number of cases, several very similar photomicrographs are given to show the same phenomenon.

The text and captions are for the most part understandable, but some are subject to possible misinterpretation because the reader must decide whether certain terms are intended to indicate genesis or to be purely descriptive. More disturbing is the presence of relatively unfamiliar terms—for example, three petrologic terms in the Table of Contents are not in the AGI *Glossary of Geology* (Gary *et al*, 1972). Especially unfortunate, in this reviewer's opinion, is the use of the term "blastoid" to indicate a product of "blastesis."

Two of the particularly interesting photographs (Figures 30 and 31) have neither captions nor text descriptions that really say anything about what appear to be extremely fine examples of country rock features extending through a transecting hornblende-rich "xenolithic vein."

The high price of this book will very likely greatly restrict any impact it might have.

R. V. Dietrich
Central Michigan University

MINERALS IN WORLD AFFAIRS. By Alexander Sutulov. University of Utah Printing Services, Salt Lake City, Utah 84112, 1972. 200 pages. $10.00.

An interesting development of the economic role of minerals in world affairs. The author defines minerals very broadly. He thus notes, "The air we breath [sic], the water we drink are minerals but in gaseous and liquid forms . . ." Rate of use and reserves for coal, oil, gas, and metals are compared for Communist countries, "Third World," and Western Industrial Nations. The author points out that we are living in a Second Industrial Revolution which will annually require as much mineral commodities as were used between 1770 to 1900 (The First Industrial Revolution). Whereas man has lived relatively comfortably within the ecological system for eighty centuries, the author emphasizes that exponential population growth and consumer demand will have an ever increasing impact on our natural resources and environment.

F. Donald Bloss
Virginia Polytechnic Institute and State University

List of Books Received

DEVELOPMENTS IN APPLIED SPECTROSCOPY. Volume 10. Edited by A. J. Perkins, E. L. Grove, Emmett F. Kaelble, and Joan E. Westermeyer. Plenum Press, New York, 1972. ix + 359 pages. $26.50.

GEMSTONE AND MINERAL DATA BOOK. By John Sinkankas. Winchester Press, New York, 1972. 346 pages. $6.95.

MINERALOGY, MINERAL-CHEMISTRY, AND COMPOSITION OF THE MURCHISON (C2) METEORITE. By Louis H. Fuchs, Edward Olsen, and Kenneth J. Jensen. Smithsonian Contributions to the Earth Sciences, No. 10, Washington, D. C., 1973. iii + 39 pages. $0.75, U. S. Government Printing Office.

MODERN PETROLEUM TECHNOLOGY. 4th edition. Edited by G. D. Hobson and W. Pohl. Halstead Press, New York, 1973. xiii + 996 pages. $45.00.

PROCEEDINGS OF THE SECOND LUNAR SCIENCE CONFERENCE. VOLUME I, MINERALOGY AND PETROLOGY. VOLUME II, CHEMICAL AND ISOTOPE ANALYSES. ORGANIC CHEMISTRY. VOLUME III, PHYSICAL PROPERTIES. Edited by A. A. Levinson. *Geochimica et Cosmochimica Acta, Supplement 2.* The M.I.T. Press, Cambridge, Massachusetts, 1971. 986, 966, 864 pages.

PROCEEDINGS OF THE IMA-IMAGOD MEETING '70. SPECIAL PAPER 1: INTERNATIONAL MINERALOGICAL ASSOCIATION, PAPERS AND PROCEEDINGS OF THE SEVENTH GENERAL MEETING. Edited by Y. Takeuchi, H. Minato, T. Ozawa, and Y. Shimazaki. Mineralogical Society of Japan, Tokyo, 1971. 301 pages. $24.00.

SAND AND SANDSTONE. By F. J. Pettijohn, Paul Edwin Potter, and Raymond Siever. Springer-Verlag, New York, 1973. Paperback edition, xvi + 618 pages. $14.50. Reviewed, *Am. Mineral.* **58,** 567–568 (1973).

SPECIAL ISSUE NO. 2: GEOCHEMISTRY AND CRYSTALLOGRAPHY OF SULPHIDE MINERALS IN HYDROTHERMAL DEPOSITS. Edited by Y. Takeuchi, T. Takeuchi, A. Sasaki, and Y. Sakamaki. Society of Mining Geologists of Japan, Tokyo, 1971. 193 pages. $20.00.

SPECIAL ISSUE NO. 3: INTERNATIONAL ASSOCIATION OF THE GENESIS OF ORE DEPOSITS: PAPERS AND PROCEEDINGS OF THE TOKYO-KYOTO MEETINGS. Edited by Y. Takeuchi, T. Tatsumi, T. Miyazawa, Y. Kekine, T. Fujii, S. Takenouchi, K. Kanehira, A. Kato, S. Ishihara. Society of Mining Geologists of Japan, Tokyo, 1971. 500 pages. $40.00.

UNDERSTANDING THE EARTH: A READER IN THE EARTH SCIENCES. Edited by I. G. Gass, Peter J. Smith, and R. C. L. Wilson. 2nd edition. M.I.T. Press, Cambridge, Massachusetts, 1972. 383 pages. $8.95.