BOOK REVIEWS

PROGRESS IN VERY HIGH PRESSURE RESEARCH, ed. by F. P Bundy, W. R. Hibbard, Jr., H. M. Strong. John Wiley & Sons, Inc., New York, 1961. xix+314.

An international conference on high pressure was held at Lake George, New York, in mid-1960, with the stated purpose of providing a common meeting ground for scientists from different categories of laboratories, and also providing the substance of a reference volume representing current research in high pressure in various fields. The hopes of the sponsoring organizations (Materials Control of Wright Air Development Division and the General Electric Research Laboratory) were met fully, as evidenced in the content of 27 papers and their attendant discussions which have been published with a minimum of delay.

It is to be expected that much of the material has been or will be published separately elsewhere, but this volume would be very valuable if only for the collection of references in the field of high pressure research amounting to over 350, with less than 10% of them more than 20 years old.

Earth scientists long have been interested in high pressure phenomena in syntheses, equilibria and physical properties to help them evaluate postulated models of the structure of the earth. Together with physicists and physical chemists they have developed a fund of experience of value to other scientists now searching with high pressure techniques for materials with unique properties.

The volume opens with three papers on apparatus and technique. "High Pressure Apparatus" by H. T. Hall, discusses gaskets, solid pressure transmitting media and high tonnage rams as related to their uses in conical or tetrahedral pressure devices. J. C. Jamieson describes the use of diamonds as high pressure bombs or anvils in "Diamond Cells for *X*-Ray Diffraction Studies Under High Pressure." In "Optical Studies at High Pressure," H. G. Drickamer gives details of his apparatus and modifications useful to pressures as high as 160–200,000 bars, mainly at room temperature but also to 500° C. Examples of typical optical studies of electronic transitions or interactions are given to show how they contribute to a better understanding of the structure of matter.

Geochemists will find of special interest "The Upper Three Phase Region in the System SiO_2-H_2O," by G. C. Kennedy, G. J. Wasserburg, H. C. Heard and R. C. Newton, and the paper by S. P. Clark, Jr., "Recent Geochemical Research at High Pressures." The first is particularly complete in descriptions of procedures and with much data and numerous informative diagrams. The second presents some experimental approaches which are being used to test out many concepts having their origins in seismology or petrology bearing ultimately on the structure of the earth. G. C. Kennedy and P. N. LaMori make a valuable contribution in "Some Fixed Points on the High Pressure Scale," and have been instrumental in bringing about a revision, generally downward, of many previously reported experimental pressures.

The always interesting story of diamond synthesis is extended by H. P. Bovenkerk in a fairly detailed description of the morphology and physical characteristics of synthetic diamonds, supplemented with 14 moderately well-reproduced photographs. A briefer paper in the same vein by R. H. Wentorf, Jr. covers the first synthesis of the cubic form of BN.

Metallurgists and geophysicists will be interested in "Melting and Other Phase Transformations at High Pressure," by H. M. Strong, and in "Effects of Pressure on Magnetic Interaction in Metals," by J. S. Kouvel and R. H. Wilson. Other papers go quite thoroughly into details of the thermodynamics and kinetics of processes and cover intensively other effects of high pressures on diffusion, emf, elastic constants, semi-conductors and elec-

trical resistance. The serious and advanced Russian effort in research and development in this field is given in a review by L. F. Vereshchagin, Director of the High Pressure Institute in Moscow.

In closing, this reviewer would like to help publicize the recommendation of the conference that for the sake of uniformity in published work, pressures be reported in bars or kilobars. (1 bar = 10^6dyne/cm^2 = 14.5038 lb/in^2 = 1.019716 kg/cm^2).

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THE RARE EARTHS, ed. by F. H. Spedding and A. H. Daane. John Wiley & Sons, Inc., New York, 1961. 640 plus xi pages. $14.75.

In 1915 there appeared the first important monograph on the rare eaths (THE RARE EARTHS, THEIR OCCURRENCE, CHEMISTRY AND TECHNOLOGY, by S. I. Levy, Longmans Green & Company, New York). THE RARE EARTHS, edited by Spedding and Daane, now brings under one cover all of the multitudinous information that has accumulated on the rare-earth elements, particularly that acquired at the accelerated research pace maintained from World War II. This monograph is published under the auspices of the American Society of Metals in cooperation with the Office of Technical Information, United States Atomic Energy Commission. In addition to the editors, twenty-nine other investigators participated in preparation of the monograph.

The book is divided into four sections: 1) Occurrence and Extraction of Rare Earths, 2) Preparation of Rare-earth Metals, 3) Properties of Rare-earth Metals and Alloys, and 4) Application of Rare-earth Metals and Compounds. The only major fault that this reviewer can find with the compendium is that Part I does not fully live up to its title; namely, *Occurrence* of Rare Earths. The book would have received much more widespread attention by workers in the earth-sciences field had summary chapters been prepared on the geochemistry, mineralogy and geology of the rare-earth elements. The book contains essentially no information on any of these three major and important topics. Except for this minor carping, the reviewer can only conclude that the work represents a prodigious effort, both on the part of the individual authors and on the part of the editors. It is modern, complete and accurate, and as such will undoubtedly be the standard reference work on these interesting and significant elements for many years to come.

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CLAY SCIENCE

Two copies of this new journal have just come to hand. It is published by The Clay Research Group of Japan, and is obtainable from the Secretary-General, Mr. Tomoji Egawa, National Institute of Agricultural Sciences. Nishigahara-machi, Kita-ku, Tokyo, Japan. The annual subscription is $1. It is likely to be welcomed by all clay mineralogists everywhere and particularly by those to whom Japanese is a closed book. It is published in English and the spelling and grammar of the two parts available are remarkably good; the page size is $5\frac{1}{4}'' \times 8\frac{1}{4}''$, and it is printed clearly on good-quality paper. Each part contains 44 pages, with six papers and (in one case) some news items and abstracts mainly of clay papers in other Japanese journals. Although the scope of the publication covers all aspects of clay science, the two parts contain a large predominance of topics of mineralogical and geological interest. In view of the large amount of clay mineral work undertaken in Japan, of which only a small part can be published in English-language journals of other countries, the new publication has great value as a channel for bringing Japanese work to

the knowledge of the Western world, and therefore the reviewer hopes that at the low subscription rate of $1 per year it will be well supported by the western world.

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MINERALS FOR THE CHEMICAL AND ALLIED INDUSTRIES, 2nd Ed., by Sydney J. Johnstone and Margery G. Johnstone. John Wiley & Sons, Inc., New York, 788 plus xii pages. 1961. $25.00.

The first edition of this general reference work was not reviewed in *The American Mineralogist*. The title of the book, namely, Minerals for the Chemical and Allied Industries, is insufficient to describe the coverage of the work. To categorize the scope completely, the title should be "Metals, Minerals, and Rocks for the Chemical and Allied Industries." The materials that are covered in this compendium are as follows: aluminum, antimony, arsenic, asbestos, asphalt, bitumen, barium, bentonite, beryllium, bismuth, boron, bromine, cadmium, cesium, rubidium, calcium chloride, chromium, clays, cobalt, copper, corundum and emery, diamond, diatomaceous earth, feldspar, fluorspar, cryolite, fullers' earth, garnet, germanium, gallium, gold, graphite, greensand, gypsum, anhydrite, hafnium, helium, indium, iodine, iron ores, lead, limestone, chalk, whiting, lithium, magnesium, manganese, mercury, mica, molybdenum, nickel, niobium and tantalum, nitrates, ochre, iron oxide, sienna, umber and other mineral colors, perlite, phosphates, platinum group metals, potassium, rhenium, salt, scandium, selenium, tellurium, silica, tripoli, pumice, sillimanite minerals, silver, slate waste, sodium carbonate, sodium sulfate, strontium, sulfur, pyrite, talc, soapstone, steatite, pyrophyllite, thallium, thorium, rare earths, tin, titanium, tourmaline, tungsten, uranium, radium, vanadium, vermiculite, wollastonite, yttrium, zinc, zirconium.

For each of these substances, the book gives concise information on sources, nature, modes of occurrence, methods of treatment, products derived, specifications for commercial application, and selected bibliography. Information on production, specifications, and uses is presented in particularly detailed form. Information on the mineralogy and geology of the substances is markedly abbreviated. Many data, particularly on analytical specifications are compressed into tables, which number 282. The preface to the second edition indicates that the new chapters are on diamond, gold, helium, iron ores, hafnium, scandium and indium, and that other sections, notably that on China clay, have been enlarged.

The volume concludes with two appendixes—Appendix A, a list of organizations and firms who have assisted by supplying information; and Appendix B, a valuable list of international and overseas standards organizations. The book is an important reference work for all who deal with metalic and non-metallic materials, particularly for economic geologists and mineral technologists concerned with the preparation of precise products in the mineral field. As such a reference work, the volume belongs in all earth-sciences libraries. Unfortunately, its horrendous price will probably prevent the wide adoption it deserves.

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INTRODUCTION TO PHYSICAL GEOLOGY, by Chester R. Longwell and Richard F. Flint. John Wiley & Sons, Inc., New York, Second Edition, 1962. 504 pp., inc. 5 appendixes. $7.95.

This standard textbook for introductory geology has undergone a complete facial uplift, and the result is extremely pleasing. The sections dealing with mineralogy, and petrology are virtually unchanged from the first edition. In view of the backgrounds and

abilities of the students now entering our colleges and universities, it seems that the introduction to the general principles of mineralogy and petrology could give a deeper understanding than that of mere description. To the mineralogist, the text suffers from the omission of modern concepts of mineral classification and geochemical principles.

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ORE MICROSCOPY. by Eugene N. Cameron. xii+293 pp., 138 figs. and an Appendix with 7 tables. John Wiley & Sons, Inc. New York, 1961, $10.50.

This is a very important text which should be in the hands of all those concerned with ore microscopy. It fills a serious gap in the literature on this subject, and, consequently represents an indispensable tool for any ore microscopist who wishes to maintain good standards. The book is divided into nine chapters. At the end of each there is a list of carefully selected references. After a short introduction, chapter 2 (29 pp.) gives a well-illustrated review of modern ore microscopes of American, English and German design. Stress is laid here on equipment for quantitative measurement of rotation properties. Chapter 3 (19 pp.) deals with the preparation of polished sections and polished thin sections. Chapter 4 (33 pp.) presents a concise account of the physical properties of ore minerals in polished sections. The importance of microhardness for ore mineral identification is emphasized, and different types of instruments are discussed. We then come to the most important part of the book, chapters 5 and 6, dealing respectively with the optical properties of ore minerals (56 pp.), and the theory of reflected light (64 pp.). These chapters give a complete and lucid discussion and explanation of bireflectance, anistotropism, reflectivity, rotation properties and dispersion phenomena.

The measurement of rotation properties, dispersion of polarization figures, and phase differences are discussed in greatest detail and in a brilliant manner. The subject matter dealt with in these chapters is not to be found in any other textbook, and gives this book its exclusive place among the standard works in the field of ore microscopy. The practical significance for determinative purposes of the properties mentioned above is clearly demonstrated by Table 5 at the end of the book. Chapter 7 (18 pp.) deals with microchemical techniques for determinative and structural purposes. Chapter 8 (7 pp.) discusses different systems of mineral identification. The author's conclusion here is that "A concerted effort on the part of ore microscopists to place their work on a quantitative basis . . . seems essential." The reviewer agrees. Without any doubt the author himself has accomplished a great deal of work in approaching this target. The last chapter (32 pp.) gives full information about the applications of ore microscopy both for the mining geologist and the mill man.

The appendix consists of 7 tables: Table (1) lists 104 minerals arranged in order of increasing Vickers hardness numbers; Table (2) lists 236 minerals arranged in order of increasing polishing hardness; Table (3) includes 213 minerals arranged in order of increasing reflectivity (values are given mostly for white light, in air); Table (4) presents the minerals showing internal reflection, arranged according to the color of this reflection; Table (5) gives rotation properties for 82 minerals for 6 different wave lengths; Table (6) microchemical tests for specific elements; and Table (7) gives specific tests for elements by means of contact printing.

Misprints are very few. On pp. 17–18 is found "Huyghenian oculars." This should be: "Huygens' oculars." On p. 108, line 2 and 3, the author copies the error made by Schneiderhöhn in Table 15 of his "Erzmikroskopisches Praktikum": "206" must be "165" and, consequently, "30 per cent" must be "38 per cent."

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