BOOK REVIEWS

MIND AND MATTER. Man's Changing Concepts of the Material World. By CECIL J. SCHNEER. Grove Press, New York, 1969, xiv+305 pages, 24 figures. $8.50.

The author of this book, a geologist at the University of New Hampshire, much of whose work has been mineralogical, is one of the rare members of his profession who has also concerned himself with the history of science. He states in his preface that this volume, like its predecessor *The Search for Order* (1960, reissued as a paperback *The Evolution of Physical Science* 1964), grew out of a "course in physical science for students of the liberal arts." Even though the use of mathematics is held to a minimum in both books one gets the impression that liberal arts students at the University of New Hampshire have been introduced to the physical sciences at a very high level.

On the back of the jacket the book is described as a "history of the material sciences". In the preface the aim of the book is stated to be "to introduce the principal ideas of chemistry through the history of their development". The account starts with a chapter entitled "From Speech and Fire to the Age of Iron and Letters". During this period "an enormous sophistication in the techniques for altering matter (chemistry) had appeared". The techniques listed are: cooking, tanning, brewing, dyeing, preserving, salting, smoking, pickling, bleaching. The account ends with a chapter entitled "The Structure of the Atom", followed by a three-page "Salute to the Reader".

The principal concern of the author is with underlying concepts and attitudes. Though the treatment is largely chronological this can be carried out consistently only in the earlier chapters. The need for coherence in the discussion of the more advanced phases of chemistry requires that most of the chapters are determined by subjects rather than by historical periods. Sorting out subjects and the consistent development of each presents some difficulties. Chapter 13 is entitled "The Revolt in Physics and the Chemical Bond". After an introductory paragraph on Boltzmann and Mach this chapter proceeds from relativity through quanta, photons, X-rays and radioactivity to isotopes, but discussion of the chemical bond is postponed to the last few pages of chapter 15, entitled "The Structure of the Atom". Even within a single chapter the conflicting demands of logical and chronological development may present problems. So, for instance, in chapter 14, "Crystallographic Atomism", there is reference to the "X-ray crystallographer" on page 243. This must be puzzling to the uninitiated as the account of the experiments marking the beginning of X-ray crystallography does not appear before page 248. Strangely these experiments are referred to on page 247 as having occurred "in 1911".

The touch of the mineralogist and geologist is felt at many points in the book. In the very first paragraph a hypothetical "X-ray mineralogist of clays" is mentioned. There are references to Steno, Hauy, Bravais, V. M. Goldschmidt, geochemistry, geophysics, and to the author's own map of the electron density in anglesite "made from statistical studies of the crystal form by the method of Fourier synthesis". The periodic table, carried to lawrencium, element 103, is appropriately used for the end papers. There is a bibliography of 15 pages in which primary sources are specially distinguished. Among these primary sources are works by Agricola, the Braggs, Huygens, and many others and the classical paper by our own Donnay and Harker.

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THEORY OF X-RAY AND THERMAL NEUTRON SCATTERING BY REAL CRYSTALS. By MIKHAIL KRIVOGLAZ. Translated from Russian by Simon C. Moss. Plenum Publishing Corp., New York, 1969. 405 pages. $25.00.

This book consists of two parts: the first part refers to elastic scattering and the second part treats inelastic scattering of X-rays and thermal neutrons.

From a purely thermodynamic point of view, the author discusses crystals containing departure from ideal structure arising in a state of thermodynamic equilibrium or non-equilibrium, in part I. He presents a fundamental theoretical basis for the scattering of X rays and thermal neutrons, and discusses a more detailed theory of X-ray and neutron scattering by real crystals *i.e.* nonideal crystal containing various kinds of defects, dislocations, displaced atoms, impurities and so on.

Recently, study on crystal structure analysis has developed rapidly and its achievements have become a center of attraction. In real crystals, there is commonly the disruption of the ideal structure of the crystal and it leads to a substantial change in the intensity distribution of the scattered radiation, which gives the data of real crystal structure and its properties. The study of these diffraction effects is one of the best methods of studying real crystals.

I am interested in distortion of clay minerals. The best method of studying defects and other departures of clay minerals may be the X-ray line profile analysis by powder diffractmetry, especially Fourier method. From these points of view, I am most interested in Chapter V and VII of Part I. In these chapters, the author estimates Fourier coefficients of line profile of X-ray scattering by real crystals, with departures, and suggests various kinds of causes that should be discussed in studying delicate defects in real crystals, such as clay minerals.

In addition to Part I, Part II treats inelastic effects, and, after an interesting development of the equations of the diffuse thermal scattering of X rays, the text is devoted exclusively to the inelastic scattering of neutrons.

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INORGANIC CRYSTAL CHEMISTRY. By I. NARAY-SZABO. Translated by P. Hedvig and G. Zentai. Akademiai Kiado, Budapest, 1969, 480 pages. $12.00

This volume is not intended as a crystal chemistry text. While the first 45 pages comprise a very sketchy introduction to crystallography and such crystal chemical topics as polymorphism and isomorphism, the remainder of the book is a compendium of description of inorganic crystal structures. This "systematic crystal chemistry" is divided into sections treating, in order, elements (25 pages), alloys (25 pages), compounds of nonmetals (52 pages), and metallic compounds (234 pages). The term "metallic compounds" is used in a broad sense, and includes most of the phases of mineralogical interest. The emphasis is, naturally, that of a chemist; by way of example, phosphates are covered in ten pages, borates in five pages, and silicates are allotted thirty pages, of which one page is devoted to feldspars, two short paragraphs to pyroxenes, and one short paragraph to amphiboles.

A few structures are well characterized by discussion of coordination and diagrams, but most receive only a very terse description. The author unfortunately makes extensive use of the outmoded structure classification scheme employed in the early volumes of *Strukturbericht*. Lacking any word of explanation, this system is not only uninformative but unintelligible as well.

There are some 160 tables giving unit-cell dimensions and usually additional data such as densities or bond distances for representative compounds having a particular structure. Space group information is consistently given. The list of references is extensive (some 1500 listed in the chapter on metallic compounds), and contains entries as recent as 1968. Complete author, subject, and formula indices contribute significantly to the book's usefulness.

The book is well constructed and printed on good quality paper. The translation appears to be accurate and the typesetting remarkably free of errors. Those who desire a single compact volume giving minimal structural data on an extremely large number of compounds, and who will perhaps use such a volume primarily as a means of rapid access to the original crystal-structure literature, may well find this book a good investment.

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A BIBLIOGRAPHY OF THE FELDSPARS. Ed. by D. R. WALDBAUM, University Microfilms, Ann Arbor Michigan, 1969. $3.75.

This small, reasonably priced volume is a necessary addition to the personal library of the mineralogist or geologist concerned with the feldspars. This is equally true whether his interests are in field, laboratory, or theoretical studies concerning the volumetrically most abundant group of minerals in the earth's crust. The explosion in the literature regarding the feldspars within the past two decades is particularly well documented in this bibliography, as approximately 70 percent of the references fall within this period.

This bibliography of 2000 references is annotated in that references are classified according to information contained in any one or more of the categories: I. alkali feldspars; II. chemical and isotopic data; V, VI, VII. occurrence in igneous, metamorphic, or sedimentary rocks; VIII. thermodynamic, synthesis, and thermal properties; IX. crystallographic data. A large number of the references are to very recent abstracts, both from North American and foreign sources. In general the foreign references, both to abstracts and journal articles are quite well represented. Cross references to *Mineralogical Abstracts*, and *Chemical Abstracts* are noted where the original reference was not available.

One would like to say that a bibliography of 2000 references is exhaustive, however given the nature of the problem this is neither desirable nor possible. An exhaustive bibliography of the feldspars would necessarily be in large part a bibliography of petrology. The editor has placed the emphasis on recent papers (50–60% of the references are post-1960) and those which deal in large part with feldspar relationships and specific studies pertaining to the feldspars.

The bibliography is published as a reproduction of high-speed line printer output, and is of high legibility and quality. A random check of the references revealed a remarkable lack of typographical errors in the citations.

In the preface, the editor refers to "subsequent revisions" of the bibliography. It would be extremely useful to have the bibliography updated on a regular (perhaps five year) basis. In view of the low cost of the volume, periodic revision seems quite feasible and desirable.

The bibliography will be extremely useful both to specialists in the area, students, and others interested in gaining an understanding of this important group of minerals.

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THE PARTICLE ATLAS: A PHOTOMICROGRAPHIC REFERENCE FOR THE IDENTIFICATION OF PARTICULATE SUBSTANCES. By W. C. MCCRONE, R. G. DRAFTZ, AND J. G. DELLY, Ann Arbor Science Publishing Co., Inc. Ann Arbor, Michigan. 1967. 406 pp. $125.00.

Once in a blue moon there appears a work of transgressive nature—one which deals with materials of a particular category irrespective of their composition or origin. Such a work is represented by this extraordinary book which concerns itself with the microscopic identification of particles, especially those particles that make up the manifold dusts repre-

senting samples of man's more successful attempts to pollute his environment. Mineralogists have long employed the immersion method of microscopy to the identification of mineral grains and rock microfragments. Indeed the technique remains as the single most useful method of recognizing non-metallic species. Microscopists working in other fields similarly have adopted our techniques for characterizing natural organic particles and a host of synthetic organic and inorganic products. However, most microscopists have been limited to their domains of direct interest. The purpose of this book is to expand and meld these individual domains. This compilation becomes available at a most opportune moment in the development of increasing interest on the part of earth scientists, in general, in problems of environmental geology. Geologists, perforce, have begun to concern themselves with such human ecological problems as, for example, sanitary fill locations; solid waste utilization, reclamation, and disposal; mineral site conservation in urban planning; recovery of by-products from industrial wastes; the geology of zeolite deposits for "molecular-sieve" entrapment of radioactive isotopes; and the hydrology of garbage dumps. Mineralogists will undoubtedly be required to expand the use of their abilities to characterize crystalline phases into areas other than that of "pure" mineralogy. This book is a first step in compiling characteristics of particles of both inorganic and organic nature—particles that are common and widespread constituents of the pulverulence generated in the quern of our civilization.

The book has five parts: 1. Principles and Techniques, 2. The Atlas, 3. Analytical Tables, 4. Appendices, and 5. Index. Part 1, 94 pages, is a short course combining optical microscopy and elementary crystallography with descriptions of collection, separation and handling techniques and descriptions of electron microscopic and electron microprobe techniques. The subdivisions in this part are entitled: Optics and the Microscope; Collection of Atmospheric Particulates; Preparation of Samples for Microscopical Examination; and Analytical Techniques. Most mineralogists will find this section elementary; however, it is a useful and useable summary.

The meat of the book is in Part 2 (192 pages), which is divided into the subtopics: Introduction; Procedures for the Study of Samples; Identification of Particulates; Classification of Particles; Use of the Atlas; and Descriptions and Color Photomicrographs. The particulate classification devised employs a six-digit code involving 1 and 0: First digit: transparency; 1 means the particle is opaque, 0 means it is transparent. Second digit: color; 1 means the particle shows some color (by transmission if first digit is 0; by reflection if first digit is 1), 0 means the particle is colorless. Third digit: 1 means anisotropic, 0 means isotropic or apparently isotropic. Fourth digit: refractive index; 1 means that at least one index is greater than 1.662 (Aroclor 5442), 0 means all apparent indices are less than or equal to 1.662. Fifth digit: Shape; 1 means that one dimension is one-fourth (or less) of the other two; 0 means the particle is elongate or equant. Sixth digit: Shape; 1 means that one dimension is four times (or more) the other two; 0 means flat or equant. Together digits 5 and 6 describe the particle shape:

——————11 elongated, flattened rod, ribbon, blade, lath, etc.
——————10 plate or tablet
——————01 needle or rod
——————00 equant particle

The six digit code is adapted to a binary code based on values of 32, 16, 8, 4, 2, and 1, in that order for the six digits. Thus a particle that is trasparent, colored, isotropic, high index and equant is coded 20:010100.

Dusts can be classified conveniently into three main groups each of which has several sub-categories:

A. Wind erosion particulates
   1. Biological substances
   2. Fibers
   3. Rocks and minerals
B. Industrial dusts
   1. Abrasives and polishes
   2. Catalysts
   3. Cements
   4. Detergents and cleaners
   5. Fertilizers
   6. Food processing
   7. Metals refining and processing
   8. Polymers
   9. Miscellaneous
C. Combustion products
   1. Incinerators and trash burners
   2. Domestic furnaces
   3. Small boilers
   4. Large industrial and public utility boilers

Examples are pictured and described of all these categories in the form of 512 color photomicrographs on 176 pages. A sampler includes dandruff, diatoms, ragweed pollen, hemp fibers, cat hair, dacron, glass wool, anhydrite, beryl, anthracite, periclase, zincite, pumice, tricalcium aluminate, cement, phosphorite, dried sheep manure, caffeine, tortilla flour, coffee, bone dust, ferrite, molding sand, rubber dust, sawdust, paint pigment, pencil sharpener dust, oil soot, cigarette ashes, and office dust. The last includes paper fibers, eraser dust, human hair, natural and synthetic cloth fibers, dandruff, tobacco, cigarette ashes, graphite, wood shavings, oil soot, paint chips, glue particles, and fingernail filings—what a place to work! Material from outside the office is hardly worse; a sample of street dust from an industrial area contains quartz stained by asphalt, sodium carbonate pellets, dried leaves, glass, glass fibers, paper fibers, cement dust, hematite, limestone, olivine, coal dust, oil soot, and burned wood.

The photomicrographs are superb. Proofs were made and color-corrected at three separate steps before the full-color press proofs were approved. The paper is the highest grade available on the U. S. market. The book is bound in buckram and comes with a protective slip case. It is indeed a work of art as well as a notable scientific compendium. Although its price will doubtless somewhat limit its purchase by teaching fellows and assistant professors, it should be in all mineralogical libraries.

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MINERALS OF CALIFORNIA FOR 1965 THROUGH 1968. By H. Earl Pemberton. *Mineral Explorer*, vol. 3, no. 2, Mineral Research Society of California, P. O. Box 601, Montebello, Calif., 62 p., $2.50.

This is a supplement to the definitive list published as *Calif. Div. Mines. Bull.* 189 (1965), published in cooperation with the California Division of Mines and Geology by the Mineral Research Society, according to Ian Campbell in the Introduction, ". . . To demonstrate that private enterprise should do what it can for itself . . . " It is a scholarly treatment fully up to the standard of previous lists, adding four new minerals, 12 changes of name, 50 deletions, and reports of new occurrences.

William T. Holser