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BOOK REVIEWS

ELEMENTS OF MINERALOGY. By Brian Mason and L. G. Berry. W. H. Freeman and Company, San Francisco, California, 2 ed., 1970. 550 pages, $9.50.

An earlier edition of this book published in 1959 has received wide use as a text for a first course in mineralogy. Relatively few changes have been made in the text. The most important is the inclusion of a summary of optical properties with the description of each nonopague mineral. A very brief (less than 4 pages) summary of X-ray diffraction theory and techniques is not adequate to give the student any understanding of how atomic structures of minerals are determined or of the relationship between the morphologic symmetries and crystal structure. As in the earlier version, the chapter titled *Crystallography* is devoted almost exclusively to morphologic symmetry.

The bulk of the book (306 pages and six chapters) consists of systematic descriptions of mineral groups and species. Each description includes symmetry (only the crystal system and class, not the X-ray space group) axial ratios and angles, unit cell dimensions, and cell-content (Z) optical properties (refractive indices, birefringence, optic sign, and $2V$) for the nonopague minerals, hardness, density, color, streak, habit, twinning, cleavage, and fracture, and descriptive sections of variable length on chemistry, diagnostic features, occurrence, and uses. Experimental data, crystal chemistry concepts, and petrological information are integrated with this descriptive material, commonly in the sections which introduce mineral groups or classes.

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A PETROGRAPHY OF AUSTRALIAN METAMORPHIC ROCKS. By Germaine A. Joplin. American Elsevier, New York, 1968. 262 pages, $12.50.

Books on petrography consistently seem to be dull reading and this is no exception. It is hard to see how it could be used as a text even in Australia. Nevertheless it does represent an invaluable record of the kinds of metamorphic rocks to be found on that intriguing continent. The value is, unfortunately, diminished by the lack of an author index and complete indexing of mineral assemblages in the general index. Furthermore, the book does not contain a single map either geographic or geologic, to assist the reader with the multitude of locality references. The only phase diagrams are three ACF diagrams on a single page.

The book is divided into four parts. Part I on the "Nomenclature, Classification, and Structure of Metamorphic Rocks" contains 12 pages of text, including a good historical summary of the concept of metamorphic facies from Goldschmidt to Miyashiro. It also contains 16 glossary pages of assorted terms including "anamorphism, topazization, beerbachite, calcflinta, embrechite, kakirite, trapshotten gneiss, dactylitic structure," and many others that one would hardly want to emphasize to students at the beginning of a text.

Parts II, III, and IV are entitled "Local Metamorphism," "Paleozoic Regional Metamorphism," and "Precambrian Metamorphism," and are each subdivided in

Harker's fashion according to bulk composition. The bulk of the book thus consists of verbal descriptions of rocks and thin sections, accompanied by numerous camera lucida drawings and a few tables of rock and mineral analyses in weight percent of oxides.

This book suggests to the reviewer two projects for the future: First, the preparation of a metamorphic map or maps of Australia, perhaps following the lead of the one recently produced for Japan. Second, the preparation of a detailed systematic documented catalogue of metamorhic mineral assemblages on a continent-by-continent or world-wide basis. Prof. Joplin's book will certainly provide a key starting reference for either project.

PETER ROBINSON
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PRINCIPLES OF CHEMICAL SEDIMENTOLOGY. By Robert A. Berner. McGraw-Hill Book Company, New York, 1971. 240 pages. $14.50.

This is another example of the change towards more use of physical chemistry in the interpretation of sedimentary processes. Processes and variables important in chemical processes are emphasized in this book. In addition to the use of reversible thermodynamics in the definition of sedimentary systems, Berner has also attempted to use kinetics and surface chemistry in the elucidation of processes. The book consists of a review of physical chemistry including thermodynamics, diffusion, nucleation, and surface chemistry; ion activities in natural waters; calcium carbonate systems; evaporite systems; diagenesis; silicate systems; and iron minerals. The book is short, concisely written, and draws heavily from the author's own work. It includes some new insights particularly in the area of kinetics that have not been previously discussed in a book. The student new to the field, however, will suffer from the lack of examples and problems, unnecessary and often unconventional notation, and a lack of complete coverage. In this sense the book should be regarded as more of an essay than a text.

JAMES R. KRAMER
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ROCK WEATHERING. By Dorothy Carroll. Plenum Publishing Corporation, New York, 1970. 203 pages. $15.00.

This book stands as a remarkable testimony to the life and works of the late Dorothy Carroll. She certainly accomplished her goal "to bring together the results of research from several disciplines to explain the fundamental geochemical principles of weathering and soil formation." The book is one of the best, short, descriptive accounts available of the processes of rock weathering as related to soil formation. This descriptive, soils approach, as well as some outdated material, will make the book less palatable to those scientists familiar with recent advances in the application of the chemistry of mineral-water interactions and material transfer to problems of weathering and soil genesis. Furthermore, little emphasis is placed on non-pedogenic processes, or products of weathering. The data compilations, bibliographic references, and the author's interdisciplinary

treatment of problems of soil genesis, composition, distribution, and classification from a geological point of view, however, make this book invaluable to soil and agricultural scientists, geologists, and others interested practically or academically in soils.

The book includes 12 chapters, two appendices, and a bibliography of more than 250 references. Chapters 1–3 are very short and probably could have been condensed into one chapter. Chapters 1 and 2 are simply introductory and describe the composition of the earth's crust and the weathering environment. In Chapter 3, the concepts of geochemical and pedochemical weathering are presented; the former refers to processes leading to formation of saprolite, and the latter to processes, primarily biologic, operative during formation of soils on the surfaces of saprolites. Although Dr. Carroll uses this distinction as a major vehicle for discussion throughout her book, it is debatable whether this formalism is necessary; such distinction implies that the biologic and chemical processes of weathering and soil formation are separate entities, whereas, in nature they are highly interrelated.

In Chapters 4 and 5, soils and their mineralogy, and soil distribution and classification as applied to the conterminous United States are discussed. Chapter 6 is devoted to the chemical and mineralogic methods of calculation of the amount of chemical weathering. Physical weathering is discussed in Chapter 7. These latter two chapters are exceedingly brief and perhaps could have been reorganized and effectively incorporated into other parts of the book. Chapters 8 and 9 treat chemical weathering and the importance of biological processes in weathering. The former chapter needs updating, particularly from the standpoint of mineral-water interactions; the latter chapter will be of particular interest to geologists. Temperature and time in weathering are the subjects of Chapters 10 and 11; once again, I found these chapters too brief to be of substance. Chapter 12—Trace Elements in Weathering—represents a very important contribution. The concentration and distribution of these elements in the earth's lithosphere and their importance in plant and animal metabolism are discussed in detail. This chapter should be of particular use to those scientists interested in land use and pollution. Appendix 1 is a "case history" in the transformation of fresh rock to alteration products and soil. Appendix 2 is comprised of a table summarizing some 350–360 detailed studies of the alteration of individual rock types into soil by weathering in situ. This table is an invaluable reference work.

Dorothy Carroll's book, although at times too brief, somewhat out-of-date and repetitious, is an useful work that will be of interest to a spectrum of scientists. For geologists interested in the common products of rock weathering from a geological standpoint, this book fills an existing void in the field.

FRED T. MACKENZIE
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MOON ROCKS AND MINERALS. By Alfred A. Levinson and S. Ross Taylor. Pergamon Press, New York, 1971. 222 pages. $11.50.

This book was written "to disseminate, in as simple a manner as possible, the important findings which have resulted from the first study of the Apollo 11 lunar rocks" and is intended for "the layman, as well the scientist in any field other than those directly related to certain areas of geochemistry, cosmochem-

istry, mineralogy or geophysics." The subject matter is dealt with under the headings: *The Rocks and Soils; The Minerals; Chemistry of Samples brought by Apollo 11 and 12; Bioscience and Organic Matter; Petrology: Experimental Studies and Origin of the Lavas; Age of the Lunar Rocks, Isotope Studies, Cosmic Ray and Solar Wind Effects; Physical Properties;* and *Origin of the Moon.*

The authors have copiously illustrated their book with both color and black-and-white photographs, and have made extensive use of informative figures and tables. The text is lucid and, with the exception of the chapter on physical properties, the subject matter is adequately covered and accurately presented. The authors present opposing hypotheses in an unbiased manner and review them in the light of existing data. The origin of tektites is discussed and the authors argue convincingly against a lunar origin and in favor of a terrestrial origin for these enigmatic objects. The book also contains a good (though not complete) glossary of terms, a guide for converting metric to U. S.—British units together with some physical data on the Moon, a list of the chemical elements and their symbols, and a useful subject index.

To write a book for both the layman and the scientist in another field is a difficult undertaking, requiring delicate judgment regarding the selection or rejection of material and the level at which the discussion is conducted. It would appear that the authors have not achieved their goal, the discussion probably being too sophisticated for most laymen. The authors themselves stress that the book is based on data and interpretations available as of April 30, 1970, and that later Apollo missions will inevitably add to and modify some of the interpretations presented. Nevertheless, *Moon Rocks and Minerals* is a valuable summary of Apollo 11 and early Apollo 12 results and this reviewer has no hesitation in recommending it as a starting point for anyone with a more-than-casual interest in lunar geology.

MICHAEL J. DRAKE
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ANALYTICAL GEOCHEMISTRY. By The Lord Energlyn and L. Brealey. Elsevier Publishing Company, Amsterdam, London, New York, 1971. 426 pages, $25.75

This book of ten chapters begins with an introduction to geochemistry. This is followed by chapters on qualitative and quantitative analysis for the major and minor elements of rocks and minerals, emission spectrography, flame photometry, X-ray spectrography, X-ray diffraction, fluorimetry, and chromatography. There are nine pages of references and a very comprehensive index.

In the preface it is stated "our intention is to introduce some analytical techniques to those geologists who did not study chemistry as undergraduates." The subject matter is such that only an experienced analytical chemist with some knowledge of mineralogy could follow the directions outlined.

The chemical classification of igneous and metamorphic rocks fills seventeen pages of chapter one, and a discussion of organic geochemistry requires about the same space.

The microchemical qualitative tests of M. N. Short are briefly discussed. These tests were widely used when published in 1940 and are still applied in many laboratories. Forty-four pages are given to "Membrane Colorimetry." Here are outlined methods for the qualitative detection of about twenty metals, using, for

the most part, organic reagents that are not found on the shelves of most analytical laboratories. It should be noted that all of these metals can be detected in less time by the simple qualitative procedures that are routinely employed in most laboratories.

More than fifty pages are devoted to quantitative analysis. Here are outlined "quickie" methods, which in skilled hands can yield results that only approach the accuracy obtainable by the classical procedures of Hillebrand and Washington.

X-ray diffraction is treated in about twenty pages. Both single crystal and powder methods are outlined, but due to the complexity of the subject the chapter could well have been omitted.

The book is plagued by more than fifty errors. These include eighteen misspelled mineral names, and fifteen mineral formulas wrongly composed. Nineteen erroneous statements were found. These include (page 3) pronouncing that the carbonates of strontium, lead, and barium form trigonal crystals instead of orthorhombic. On the same page it is stated that the carbonates of copper, nickel, manganese, magnesium, and ferrous iron are orthorhombic. These are trigonal. On page 168 bauxite, a rock, is called a mineral. Although this book was written for international usage, some British mineral names are retained, for example: niccolite (NiAs) on pages 145 and 183 is labeled kupfernickel, and copper glance, a term used by miners, is applied to chalcocite (Cu_2S). Arsenopyrite (FeAsS), page 145, is called mispickel.

Space does not permit the enumeration of all the errors found. I can not recommend this book for either the amateur or the professional.

JOSEPH J. FAHEY
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THE CLAY MINERALOGY OF BRITISH SEDIMENTS. By R. M. S. Perrin. Mineralogical Society (Clay Minerals Group), London, 1971. 247 pages. $7.50.

This book is a mine of information for those who are interested in British sediments, but also has an indirect interest for a wider readership. Most of the book, pages 20–201, is occupied with tabulated data arranged according to the stratigraphic column and broad geographical areas. Thus, if information is required on the clays of the Upper Carboniferous Namurian beds in Yorkshire, one turns to the U. Carboniferous title at the top of the page, then to the Namurian beds, given on the left of the page, and one proceeds geographically from north to south passing north England on the way. The tables list data on lithology, localities, grid references, analytical methods, clay minerals with estimated proportions, the laboratory or reference providing the information, sample preparation, and sundry other remarks. Much of the information is said to be hitherto unpublished work. Each main section of the stratigraphic column is preceded by a short description of the available data with respect to geology and geography.

Clay mineralogists not specially concerned with British sediments will probably be interested mainly in how the author handled the many problems inevitably arising in compiling the data, and in his general conclusions. A good deal of clay mineralogical work is not oriented towards relating clays to geology. Sources are often poorly described. The relation of the clay fraction to the whole

rock often is not considered. Analyses are seldom better than estimates and even these may be dependent on the particular techniques used. One can only marvel that the author had the tenacity to go through with the job. In his preface he remarks: "perhaps more than most, this book sets out to make itself obsolete." In other words, by showing how imperfect are the present data, new and better work may be stimulated. The final conclusions regarding the occurrence, distribution and modifications of the principal clay minerals will be read with interest by all clay mineralogists. The book is bound with a firm paper cover, satisfactory for private use, but a more substantial cover will be needed for laboratory and library usage. It is a pity an abbreviated title is not given on the spine of the book. The paper is good and does not have that painful gloss common to many modern texts. The printing is excellent; the use of different styles of type makes it very easy to locate any particular information.

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EVOLUTION OF SEDIMENTARY ROCKS. By Robert M. Garrels and Fred T. Mackenzie. W. W. Norton and Company, Inc., New York, New York, 1971. 397 pages. $11.50.

According to the authors a major object in writing the book was to provide a modern introductory text to geology for students and informed laymen. The treatment is general, not specific except where examples illustrate principles, and global, in that the entire earth is the subject, not surficial objects that attract the eye of the traveler. The method of presentation is almost exclusively analytical, using geochemical balances and evolution of sedimentary rocks and processes as a media to synthesize the nature and evolution of the earth—principally the continents, oceans, and ocean basins, and crust and mantle relationships—through global processes.

The analytical geochemical treatment utilizes appropriate techniques and terminology logically and lucidly. Phase diagrams, chemical equilibria, and mass equilibria equations abound, with special emphasis given to sedimentary mineralogical systems. Since the approach to earth evolution is through sedimentary geochemistry, igneous and metamorphic petrogenesis play but a supporting role.

The book will probably not greatly interest the igneous and metamorphic mineralogist other than intellectually, but it might well lead many a sedimentary geochemical mineralogist out of his cloistered laboratory to expound a new and refreshing approach to the mature student wishing to investigate modern concepts of global geology.

Louis I. Briggs
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PHYSIKALISCH—CHEMISCHE KRISTALLOGRAPHIE. By Klaus Meyer. V.E.B. Deutscher Verlag für Grundstoffindustrie, Leipzig, 1968. 337 pp.

This is a welcome volume. The author aims to acquaint physical and inorganic chemists with the relationships of their field to crystallography, and to

supply the fundamentals of physical chemistry required by crystallographers, mineralogists, physicists, materials scientists, and metallurgists for the solution of problems in their fields. The thermodynamic treatment of important physical and chemical properties of crystals occupies a central place in the volume.

The author begins with a short chapter on the geometry of crystals, then treats the thermal properties, the caloric properties, the calculation of specific heat, and the lattice energy in succeeding chapters. This is followed by a discussion of the second and third Laws, phase equilibria, the structural and thermodynamic properties of phases, the structure of real crystals, diffusion in crystals, the thermodynamics of crystal surfaces, crystal growth, the structure and properties of crystal surfaces, solid state reactions, and finally—activated solids, tribophysics, and tribochemistry.

The treatment throughout the book is straightforward and simple. It was written for students in their later semesters and grew out of the author's lectures at the Mineralogical Institute of the Humboldt University in Berlin. I could well imagine the book as a text or as correlative reading for American graduate courses in chemical mineralogy or in geochemistry courses which are strongly oriented towards solids. An English translation would of course be most helpful.

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