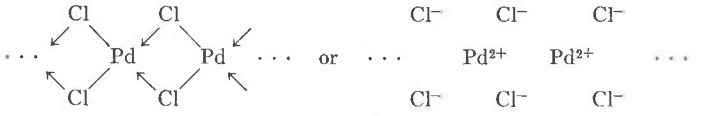
BOOK REVIEWS

FRITZ EPHRAIM'S INORGANIC CHEMISTRY

SIXTH ENGLISH EDITION. By P. C. L. Thorne and E. R. Roberts. Oliver and Boyd Ltd., Edinburgh and London. Interscience Publishers Inc., New York, N. Y. Pp. xii and 956. Figs. 96; 1954. Price $6.25.

According to the announcement of this new edition, the sections on Valence and on Radioactivity have been largely rewritten. The review of the fourth edition in the *American Mineralogist*, **32**, 97 (1947) emphasized the difficulties in presenting the electronic structure of molecules and crystals caused by the existence of widely divergent approaches to this aspect of "Valency." It is therefore rather satisfying to find that in the present edition these different points of view are explained more thoroughly than before and are applied throughout the book. In particular two theories are compared systematically in the case of relatively simple compounds. One is closely related to the scheme of classical valence bonds, interpreted by shared electron pairs. The difficulties of this approach, especially in the case of inorganic substances, have grown over the decades and some authors attempt to overcome them by applying the picture of multiple "structures contributing" to an experimentally unique molecular species. The other theory emphasizes the electrical attractive and repulsive forces acting between the atomic nuclei or cores and quantized groups of electrons. It succeeds in representing even the most complex compounds by single formulas. The difficulties which arose in the application of these two theories to SO_4^{2-} and SiO_4^{4-} in the fourth edition have been removed now on pp. 601 and 857. Discussing the structure of chlorine-oxygen compounds (pp. 382–4) the authors state: "The relative merits of these two views are left for the reader to assess."

Characteristic of this book since its first appearance in 1922 is the considerable space devoted to coordination compounds. The term coordination number, so important now also in considerations of crystal structure, was introduced by A. Werner in 1893. It was intended to express the fact that in many compounds an atom can be connected with a larger number of other atoms than its usual valency would allow. Hence, Werner distinguished main and secondary valences and represented the first ones in the customary way by solid lines, the others by dotted lines. This distinction is preserved in scores of formulas to be found in the present book as well as in an overwhelming part of recent literature. The main modernization consists in drawing, instead of a dotted line, an arrow which expresses the assumption that in such a secondary or coordinative bond the shared electron pair originated in one atom only. As an example formula *A* may serve which together with formula *B* are given on p. 358 of the book as alternatives for representing the structure of the chains



A. *B*.

in $(PdCl_2)_n$. However, the fact that the experimentally known structure of these chains in crystalline $PdCl_2$ shows only *one* internuclear distance (2.31 Å) between Pd and Cl, disproves the assumed distinction between true and coordinative covalent bonds.

Analogous contradictions were known to Werner and the first step for their resolution was made by W. Kossel in 1916. He took into account the electric nature of the binding forces and arrived e.g. at the conclusion that a cation A^{n+}, after having attached to itself *n* rigid anions B^{1-} exerts on a further B^{1-} an attraction which is stronger than the repulsion exerted by the *n* anions. These simple calculations do not explain why the coordination in

$PdCl_2$ is so different from that in $MgCl_2$ although $Pd^{2+}F^-_2$ and $Mg^2F^-_2$ have both the rutile structure and differ little with respect to internuclear distances. The answer can be found in points of view developed since 1923, if one formulates $PdCl_2$ as is done in formula *B*: the polarizability of Cl^- is much larger than that of F^- and the polarizing power of Pd^{2+}, which has not the noble gas type of Mg^{2+}, is more pronounced than that of the latter. These factors are responsible for the strengthening of the binding between Pd^{2+} and Cl^-.

For all these reasons the undersigned considers formula *A* and its numerous analogues as anachronistic. It would be a considerable further improvement of this book, if in a later edition formulations which allow the reader to recognize the electric nature of the binding as does formula *B*, were applied to the majority of coordination compounds. It can be only mentioned here that the presentation of some other topics was also taken over from former editions and needs adjustment in view of new developments.

The additions to the chapter "Radioactivity and Isotopes," as compared with the fifth edition, involve the table containing the four radioactive series as well as nuclear fission and the transuranic elements.

The new edition will again fill its well deserved place among advanced treatments of an important branch of chemistry.

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DIE MINERALFUNDE DER SCHWEIZER ALPEN, by Robert L. Parker, Wepf and Co. Verlag, Basel, 1954. viii+311 pages, with 2 panoramas and a colored map showing mineral localities. Price Sw. Fr. 36.00 or D.M. 34.60 (ca. $7.50).

This nicely printed and attractively illustrated book is essentially a second edition of Parker's earlier (1940) *MINERALVORKOMMEN*, which appeared as Part II of Volume I of *Die Mineralien der Schweizeralpen*, by P. Niggli,*J. Koenigsberger, and R. L. Parker [*Am. Mineral.*, **28,** 58–60, 1943].

The treatise has been brought up-to-date and completely reworked. The text is almost twice as long as the original and the numbers of plates and figures are much more than doubled.

The book starts off with a 16 page description of 26 characteristics Alpine mineral assemblages. The main portion of the text (216 pages) is a catalogue of the occurrences of these assemblages in 13 regions of the Swiss Alps. There follows a 14 page determinative table for identifying the various species. The alphabetical list of species, with references to the text, occupies 28 pages; the literature references, 20; and the list of mineral localities, 10. References to localities are by pages and appear to be complete, but those for mineral species are much more general, page references being given only occasionally and lists of localities, especially for minerals that occur widely, being woefully incomplete.

There are no colored plates of minerals, but the photographs of minerals are well chosen and printed on excellent paper. It is a pleasure to see pictures of minerals that resemble the originals enough so that they can be recognized.

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HOW TO KNOW THE MINERALS AND ROCKS, by Richard M. Pearl. McGraw-Hill Book Company, New York, 1955. 192 Pages, 8 colored plates. Price $3.50.

Pearl's book is aimed at the amateur collector or prospector, or at the man in a touring car who would like to know what he sees on a trip whether he intends to collect it or not. Such a book can do a great service to its audience and to the science, but in order to do so effectively it should be even more nearly free from errors of fact and interpretation than a book intended for the professional mineralogist or petrologist; the professional can check suspected inaccuracies for himself, but ordinarily the amateur does not have the means to do so and must take what he sees printed at face value.

It is very unfortunate, therefore, that there are so many errors in the book under review. The most noticeable inaccuracies are in the illustrations, both color photographs and the drawings. Very few of the colors in the plates are true and about half of them are completely off. The worst ones, which are apt to be actually misleading are:—

Mineral	*Color on plate*	*Color should be*
Chalcopyrite	Brown	Yellow
Franklinite	Blue	Black
Gold	Pinkish brown	Yellow
Selenite	Yellow	Clear or white
Hematite	Light blue	Dark red
Hematite	Green	Dark red
Limonite	Lavender	Yellow
Malachite	Light blue	Dark green
Pyrite	Green	Yellow
Jasper	Orange	Red
Rock crystal	Lavender	Clear
Rhodochrosite	Orange	Pink
Rhodonite	Orange	Pink
Variscite	Blue	Green

A few of the sketches of minerals are very good and should aid in identification , such as those of crystalline silver, galena, arsenopyrite, and stibnite. Most of the sketches of massive minerals, however, might better have been omitted, since they add nothing to the word picture given in the text. Some of them, such as those of covellite, graphite, gold, and tetrahedrite are likely to be misleading and hinder rather than help in identification. The sketches of rocks (pp. 165–186) are no better; except for those of porphyry, gneiss, conglomerate and obsidian they are likely to provide very little assistance in identifying rocks.

In the text there are many places where usage, interpretation, or classification is questionable, and there are also many outright errors in statements. Neither the minerals (pp. 56–160) nor the rocks (pp. 165–186) are arranged according to recognized classifications. In the general discussion of igneous rocks (pp. 19–21) it probably would have been better to substitute *diorite* for *monzonite* and to mention *rhyolite* as including *obsidian* and *pumice*. *Felsite* is a waste basket term for light colored aphanitic rocks and might better have been omitted in favor of more specific names like *trachyte* and *andesite*.

Volcanism (p. 20) properly includes only surface and near-surface manifestations of igneous activity; *vulcanism* is the term which "includes the behavior of all molten rock, whether it takes place on the surface or far below. . . ."

Many textural differences between extrusive rocks and chemically similar intrusive rocks are certainly due to differences in cooling rate. For the extreme example mentioned in the last paragraph of p. 20 (coarse pegmatite), however, there can be little doubt that the presence of abnormal quantities of water and other volatile constituents is more important than the cooling rate.

The statement (p. 22) that "Even the most deeply buried igneous rocks will someday be exposed by erosion" is open to serious question. There is good evidence that the igneous rocks beneath large parts of the ocean basins have never been exposed to erosion, and there are no cogent reasons for supposing that they ever will be.

On page 50 uraninite and pitchblende are said to be "cousins": actually "twins" would be a more accurate relationship, since they are varieties of the same species. They are said to be "the radioactive minerals described in this book," yet on page 92 it is said of carnotite "it is at present the only significant ore of uranium in the United States." Nor is this statement true; unoxidized ores of uranium have been in important production since long before Pearl's book went to press.

No authority is given for the statement (p. 94) that "deerhorns (are) found to have changed to cassiterite in the streams of Cornwall"; it is highly improbable that a substance as insoluble as in SnO_2 at ordinary temperatures and pressures could replace anything by the action of cold surface waters.

Other instances of questionable usage occur in the section on petrology. On page 161, for example, it is said that in hand specimens of rocks "there is scarcely any difference between texture and structure." Actually many, if not most, rocks (slate, phyllite, schist, gneiss, etc.) show structures that are visible in hand specimens, and are quite distinct from texture. On page 177 "expanded" would describe pumice better than "perforated"; also, fibers (l. 3) are rare in pumice, the shards that separate the open spaces being much more commonly segments of sphere-like surfaces.

The book is gratifyingly free from typographical errors. The locality listed as Lauvig, Norway, should be *Lauvik.*

As indicated above, there are many errors in statements throughout the book. For example, in the section on minerals "rhombic cleavage" is used both for orthorhombic prismatic cleavage (Fig. 25, p. 45) and for rhombohedral cleavage (rhombohedral carbonates, pp. 99–100, 114–115, and 117), but in two of the latter (rhodochrosite, p. 114, and siderite p. 115) the sketches show cleavages that look for all the world like orthorhombic pinacoidal!

The formulas given in the middle list on page 52 are for radicals, not compounds as stated. Gold is not "copper color" as indicated on page 62.

On page 106 kernite is said to occur only in the Mojave Desert of California, but it is now known to occur in considerable quantities in northern Argentina.

Sodalite is correctly characterized as having six cleavage directions (p. 108), but the illustrative sketch shows octahedra (4 directions) and cubes (3 directions).

The sketch showing the cleavage of pyroxene (p. 109) is also in error. Traces of two cleavages are shown approximately at right angles to each other, but they are not parallel to the unit prism, as they should be. The sketch of amphibole cleavages, on the other hand (p. 110), is correct.

Clear potassium feldspar (erroneously called "potash" feldspar by Pearl, p. 125) is by no means always orthoclase. Indeed, it is more apt to be sanidine or adularia.

It may be possible to induce quartz to scratch quartz (p. 151) under certain conditions where directions are favorable, but it certainly cannot be done readily enough for use as a key to identification.

Texture cannot always tell whether a rock is intrusive or extrusive (p. 161); the central part of a thick flow may be much coarser grained than the border facies of a fairly deep-seated intrusive.

Page 167, line 9, *iron* should read *iron oxide.*

The orbicules of orbicular granite are not composed of "foreign minerals" (bottom of p. 168), but are formed by an unusual concentration and arrangement of the normal minerals of the granite.

Smoky quartz is common in pegmatites, but this is by no means the only source, as stated on page 169. Smoky quartz occurs not only in non-pegmatitic granite, but also as large fine crystals in quartz veins with no trace of pegmatitic affiliations.

It is true that in areas of folded rocks the cleavage of slate is commonly developed at an angle to the original bedding (p. 180), but the two structures may also be parallel.

High pressure is not necessary for the formation of quartzite (p. 184); the cementation can be accomplished at elevated temperatures and relatively low pressure.

The "mineral content" of basalt is given as pyroxene and olivine (p. 186), whereas plagioclase feldspar (commonly labradorite), which is usually more abundant in basalt than pyroxene and olivine combined, is not mentioned in its description. The Deccan region of India (p. 186) is not a peninsula and contains nearer 200,000 square miles of basalt than half a million.

How to Know the Minerals and Rocks is interestingly written. Sections like "Soils and Scenery" (pp. 28–30) can create a desire in collectors to know more about the broader aspects of their hobbies. If another edition should be called for it is to be hoped that these sections could be expanded somewhat and the whole book re-written and edited much more carefully than was the current edition.

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SOUTHERN AFRICA, A GEOGRAPHICAL STUDY: VOLUME II, ECONOMIC AND HUMAN GEOGRAPHY, by JOHN H. WELLINGTON. New York: Cambridge University Press, 1955. xviii+283 pages. Price $6.50.

This is the second volume of a series dealing with all of Africa south of the Congo-Zambezi watershed, including the Union of South Africa, with South-West Africa, the High Commission territories of Basutoland, Bechuanaland and Swaziland, Southern Rhodesia (except the Northern Province), Nyasaland, Mozambique and Southern Angola. Volume I treated, in its three parts: Structure and Surface; Climate, Vegetation and Soils; and Hydrography.

The current volume is also divided into three parts: Land Utilization, 118 pages; Mineral and Other Industries, 82 pages; and The People, 69 pages. With so few pages devoted to so large an area treatment is necessarily brief, but the discussion of mineral resources is particularly sketchy, being limited to 48 pages. Of the 21 pages devoted to the gold deposits six are taken up with a discussion of the problem of water for the mines and two pages are devoted to labor problems. Diamonds and platinum together take up six pages and the tremendously important and interesting copper deposits are skimmed over in three pages. Coal is given eight pages; iron, six; asbestos, chromite, and manganese have one page each. None of the other varied mineral resources of the area are even mentioned.

The book can be recommended as a brief and general treatment of a large, important, and interesting area of the earth's surface, but not for any details of the geology or mineralogy of the region.

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THE COLLOID CHEMISTRY OF SILICA AND SILICATES, by RALPH K. ILER. Cornell University Press, Ithaca, New York, 1955. xii+324 pages. Price $5.50.

Into this little volume is compressed a great deal of information on properties and uses of colloids of silica and silicates. As would be expected from the author's connection (du Pont) emphasis is on applications to paint, oil purification, soil conditioning, paper and textile processing, latex products, commercial waxes, plastics, culture media, etc. Minerals are treated incidentally as raw materials, but much of the information in the book can have a bearing on problems of mineral genesis.

The section on clay minerals (pp. 190–217) is more complete and up-to-date than might be expected in a book of this kind. The nomenclature employed is that which is becoming accepted American usage. It is surprising to find that Iler uses the compositions and formulas of the clay minerals proposed by Ross and Hendricks (Minerals of the Montmorillonite Group, *U. S. Geol. Survey Prof. Paper* **205-B,** 1945) without mentioning these authors or listing the publication in the bibliography. For the most part the references are very full and up-to-date.

Throughout the work "silicic acids" are discussed as if they were actual compounds that have been identified, although Iler recognizes (p. 127) that they "have not been isolated or characterized."

It is probably too late to stem the flood tide of usage, but the reviewer would like to make a belated plea for the use of the word "presently" (p. 114) with its correct meaning of "shortly," "in a little while."

There is an interesting chapter of 23 pages on Silica in Living Organisms in which there is speculation concerning the role of silicates in the origin of life, and information not summarized elsewhere, so far as the reviewer is aware, on the occurrence of silica in plants and animals.

The book is well printed and nicely bound. It will be a valuable handbook for the information and references contained for those interested in the formation, properties, and uses of colloids of silica and certain of the silicates.

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NUCLEAR GEOLOGY, edited by Henry Faul, John Wiley & Sons, Inc., New York, 1954, 414 pp., $7.00.

Faul states in the preface that this volume was compiled to introduce graduate students and professional geologists "to a new approach to some questions of the Earth," i.e., the application of nuclear physics to certain geologic problems. The various sections have been written by workers in their respective fields and from this point of view it is up-to-date and authoritative. However, while the essential problems are covered, no attempt has been made to produce an exhaustive treatment of nuclear geology. The author freely admits that stable isotope studies as applied to geologic problems have been omitted because of the rather complete coverage in other books currently being published.

The volume is set up in the form of a symposium, essentially each chapter being contributed by a different author. The first chapter is a brief introduction to nuclear physics, the instruments used, and the techniques of detection and measurement. The explanations are simple and easily understood by the geologist who has had only an introductory course in physics.

The next three chapters treat thorium, uranium, potassium, and the rare gases as found in nature. There is a rather thorough treatment of the distribution of thorium and uranium in igneous, sedimentary, and volcanic rocks, and also in ocean waters and sediments. The discussion of potassium is rather short and is limited to the abundance of potassium in the earth's crust. Chapter 4 is an interesting discussion of helium, argon, and radon as the products of nuclear reactions in nature.

Chapter 5 describes the generations of heat in rocks, evaluation of the abundance data necessary for the calculations, and some theoretical considerations based on our present knowledge.

The next two chapters deal mainly with natural radiation damage. Chapter 6 is a discussion of the damage and changes due to alpha, beta, and gamma rays passing through rocks and minerals, and some of the consequences of this action. Chapter 7 describes the production of liquid and solid hydrocarbons due to the bombardment of gaseous hydrocarbons by alpha particles. Theoretical conclusions based on known organic content of marine sediments are examined.

Chapter 8 describes some of the instruments and techniques used in geophysical prospecting for radioactive ores, and neutron well logging. Chapter 9 is an extensive review of the important methods being used for the determination of geologic age. It is well supplemented with experimental data and a discussion of errors in the methods used. The volume is terminated with a chapter on the origin of the earth. Various recent theories are discussed and arguments for and against various phases are presented.

This book has been amply supplemented with well over 700 references. Its simple presentation, numerous illustrations, and tables of experimental results make it a valuable reference for those geologists who are not steeped in the science of nuclear physics, but who nevertheless want to keep up with the most modern techniques and methods now being applied to geologic problems. It is highly recommended for those "people who pick up rocks and stop to think."

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THE PEAKS OF LYELL, by GEOFFREY BLAINEY, Melbourne University Press, Carlton, N. 3, Victoria, and Cambridge University Press, London and New York, 1954. x+310 pages, 18 plates, 5 maps. Price, $5.00.

This interesting and well-written little book is a history of mining in western Tasmania. It is woven around the story of the Mt. Lyell Mining and Railway Company and is much more concerned with the men who ran the mines and the dividends declared by the companies than with the mineralogy and geology of the deposits. Metallurgical processes are discussed only as they bear on the success or failure of a mining venture.

In the extensive bibliography there are only two papers that deal with the geological setting and mineralogical composition of the ores. Three more recent ones that might have been mentioned are:

Edwards, E. B.: Some observations on the mineral composition of the Mount Lyell copper ores, Tasmania, and their modes of occurrence, *Proc. Austral. Inst. Min. and Met., No.* **114,** pp. 67–110 (1939).

Stilwell, F. L.: Observations on the zinc-lead lode at Rosebery, Tasmania, *Proc. Austral. Inst. Min. and Met., No.* **94,** pp. 43–68 (1934).

Hills, Loftus: A synopsis of the geology of the Lyell District, Tasmania, *Proc. Austral. Inst. Min. and Met., No.* **66,** pp. 129–148 (1927).

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COALS AND BITUMENS AND RELATED FOSSIL SUBSTANCES. Nomenclature and Classification by S. I. TOMKEIEFF. 122 pp., 3 figures, 3 tables. Pergamon Press Ltd. 242 Marylebone Rd., London N. W. 1, England. 1954. 17s.6d.

This is a valuable little book that seeks to bring a much needed order out of the chaos of names relating to fossil carbonaceous substances, chiefly the coals and bitumens, groups of natural organic substances plagued by an over-exuberant nomenclature and a correspondingly emaciated definitiveness. In addition to compiling a relatively complete, but compact, glossary, Dr. Tomkeieff presents a simple but effective classification of carbonaceous substances (Introduction). Part I, the largest section, is an alphabetical glossary. Appendix 1 is a list of some German, French, and other non-English terms; Appendix 2 is a list of abbreviations relating to the bibliography; and Part II consists of the Synoptic Tables. Both scientific and vernacular terms are included. If the meaning of the term or the approximate composition of the substance is known, the name may be secured by consulting the appropriate synoptic table; conversely if the term is at hand, its definition can be obtained from the alphabetical list.

The book is a valuable reference tool for mineralogists and geologists and workers in allied fields such as mining engineers, fuel technologists and organic chemists.

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THE BIRTH AND DEVELOPMENT OF THE GEOLOGICAL SCIENCES, by FRANK DAWSON ADAMS, Unabridged republication, 506 pp., 92 illustrations, Dover Publications, Inc., 1780 Broadway, New York 19, N. Y. 1955. $1.95 paperbound, $3.95 clothbound.

In 1938 the first edition of the classic work, The Birth and Development of the Geological Sciences by the late Professor Frank Adams was published. Now it has been reissued in unabridged form at a price that makes it readily accessible to students as well as to professional geologists. The typography is legible, and the numerous illustrations are in general clear. The book remains not only the authoritative work on the histories of mineralogy and geology but also offers fascinating reading to any worker in or at the margins of the earth sciences.

Since the original edition was not reviewed in the *American Mineralogist*, at least a listing of the chapter subjects seems desirable in order to acquaint those few unfortunate uninitiates with this remarkable and extraordinarily entertaining account.

Chapter 1. Introduction.
2. Geological Science in Classical Times.
3. The Conception of the Universe in the Middle Ages.
4. On the "Generation of Stones."
5. Medieval Mineralogy.
6. The Birth of Modern Mineralogy and its Development from Agricola to Werner and Berzelius.
7. The Birth of Historical Geology with the Rise and Fall of the Neptunian Theory.
8. "Figured Stones" and the Birth of Palaeontology.
9. The Origin of Metals and Their Ores.
10. The Origin of Mountains.
11. Earthquakes and the Nature of the Interior of the Earth.
12. The Origin of Springs and Rivers.
13. Quaint Stories and Beliefs.
14. Conclusion.

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