BOOK REVIEWS

THE PHYSICAL CHEMISTRY OF THE SILICATES, by WILHELM EITEL. The University of Chicago Press, Chicago, Illinois, 1954, xvii+1592 pages, $6\frac{3}{4}\times9\frac{5}{8}$ inches. Price, $30.00.

William Eitel is eminently, perhaps uniquely, qualified to write on the physical chemistry of the silicates. He has had broader all-around experience in performing and directing silicate research, and in teaching and writing about silicate systems, technology, and theory than anyone else in the world.

The nucleus around which the present impressive volume grew, however, was formulated by another man, while Eitel was still much more concerned with studying books than with writing them. In 1915 H. E. Boeke had come to realize the great importance that physical chemical research was having, and would have, in interpretative petrology. In his classic work published that year, *Grundlagen der physikalisch-chemischen Petrographie*, he emphasized fundamental studies of silicate melts, transformation points, and other properties of silicates, and used the few silicate systems that had already been worked out as examples in his discussion of the groups of igneous rock-forming minerals.

In the early 1920's Eitel went to study with Boeke and was eventually given the responsibility of preparing a second edition of Boeke's book. In the meantime many more silicate systems had been worked out; and the second edition, Boeke-Eitel, 1923, although following the general outline of the first edition closely, reflects the new work in one important innovation: the 80-page treatment of igneous mineral groups in the first edition is reduced to 25 pages in the second, and a new section of more than 100 pages is devoted to artificial systems.

Eitel then made a trip to the United States, where he gained firsthand knowledge of the work of the Geophysical Laboratory and other American research centers in silicate chemistry. On his return to Germany he was charged with organizing and directing the Kaiser Wilhelm Institut für Silikatforschung, which was to do for silicate technology what the Geophysical Laboratory has done for experimental petrology.

It was at once apparent that the workers at the new institute needed a summary of the current status of silicate science. Eitel's 1923 revision of Boeke's book contained much useful information, but it was primarily a textbook and contained much extraneous material on techniques, mineral groups, and treatments of sedimentary and metamorphic rocks. The result of this need was the first edition (1929) of Eitel's *Physikalische Chemie der Silikate*. Although the purpose and emphasis of this book are different, the first five parts are, in subject matter, treatment, and order closely parallel to the *Grundlagen der physikalisch-chemischen Petrographie*. The last three parts of the latter, however, on weathering, sedimentation, and metamorphism, are replaced in Eitel's book by a new section on Die technische Silikatsysteme, in which glass, ceramics, and cement are discussed.

The second edition, 1941, removed most of the remaining textbook aspects—the chapters on elements of x-ray diffraction phenomena, mineralogical-optical methods, and the theoretical treatment of 1-, 2-, 3-, and 4-component systems. It became almost a straight reference work, and enough additional data were included to increase the size about 50% (from 552 to 826 pages).

The current encyclopedic treatise is in reality a third edition of the *Physikalische Chemie der Silikate*. It follows the outline of the German editions closely, but many new topics have been added and the size is almost twice that of the 1941 edition. For example, under Constitution of Melts and Glasses, discussions of the following topics have been added to the five previously treated: (*a*) Experimental Results of Structure Investigations on Silicate Glasses; (*b*) Freezing-in Reactions; (*c*) Glass Color and Glass Constitution; Fluor-

escence As an Indicator Method; and (*d*) The Surface Structure of Glass and Its Properties. Under Colloids a section on Electron Microscopy of Colloids has been added.

In addition to entirely new subjects, some of the old ones have been completely rearranged and rewritten. For example, a 6-page summary of Formation of Clay Minerals from Gel Mixtures in the 1941 edition has been replaced by a 90-page discussion of Clay-Water Systems.

The chapter on the thermochemistry of the silicates has been omitted from the new edition. This material was expanded and published as a separate volume in 1952 (Thermochemical Methods in Silicate Investigations, Rutgers University Press, 132 pages).

In spite of all the changes and additions, the original framework of Boeke's 1915 book is still much in evidence and many of the headings are translations of his topics.

The Physical Chemistry of the Silicates is far and away the most complete and up-to-date reference book on the subject. Emphasis has slipped away from mineralogy and petrology, but for treatment of principles, and especially summary of the results of laboratory work on silicates, no other book approaches it. Perhaps the best way to give an idea of its scope and content will be to list the primary and secondary headings and to indicate the number of pages devoted to each:

A. The States of the Silicates	
I. The Crystalline State	114 pp.
II. Fused and Glassy States	230 pp.
III. Colloids	210 pp.
B. Fusion and Polymorphic Equilibria in Dry Silicate Melts	
I. General Remarks on Fusion and Polymorphism Phenomena	57 pp.
II. Special Silicate Systems	214 pp.
C. Pneumatogenic and Hydatogenic Silicates	
I. Silicate systems with Volatile Components	148 pp.
II. Silicate Hydrates of the Zeolite, Permutite Group	61 pp.
D. Solid-State Reactions and their Ceramic Use	
I. Reactions in the Solid State	51 pp.
II. Reactions in Ceramic Bodies	70 pp.
III. Reactions in Hydraulic Cements	105 pp.
E. Silicate Melts as Industrial Glasses and Slags	
I. Reactions in Glass Melting; Industrial Glasses, Enamels, and Glazes	127 pp.
II. Industrial Slags	31 pp.

Even a volume of this size cannot record *all* of the experimental data now available about the silicates. But where a summary is incomplete, earlier summaries or bibliographies are listed in the copious footnotes; so the original references are easily available. For example, only 31 pages are devoted to hydrothermal syntheses; 4 to techniques and apparatus, and 27 to a summary of experimental work on 6 mineral groups. Reference is made to an earlier summary of all work on hydrothermal syntheses of silicates.

It is gratifying to see a comprehensive reference work like this with indexes that are accurate and adequate both in number and in type of entries. There are 6 separate indexes totaling 142 pages. References are to section and paragraph; in some instances it takes a little longer to find the page this way, but the paragraphs average much less than a page, so once the place is found it is easier to locate the topic than if it had been referred to by page number.

Literature references are handled in an interesting manner. Just preceding the index there is an alphabetical list of 714 "periodicals in silicate research" to each of which is assigned a key number. The titles of the journals are written out in full to avoid confusion.

References from the text are to footnotes giving key number, volume, year, and pages. The author's name is given in the text or footnote, as required.

The University of Chicago Press is to be heartily congratulated, not only on their breadth of vision in undertaking the publication of a work of this nature and its completion in commendable style, but also on the excellent cooperation evidently extended to the author. Much of the late literature is included in the text; and still more recent references, although it was not possible to incorporate tables, illustrations, or extensive summaries from them in the text, are at least given in footnotes. This makes the book about as complete and up-to-date as it is possible to have a comprehensive reference work on such a large field of science.

There is no need to recommend this book. It will be automatically required for reference wherever there is interest in silicates, silicate science, or silicate technology.

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PETROGRAPHIE DES ROCHES SEDIMENTAIRES, by ALBERT CAROZZI (1953); with a preface by EDOUARD PAREJAS. F. Rouge and Cie S. A., Librairie de L'universite Lausanne, 257 pp., 27 figs. Suisse Fr. 23.40.

This volume is one of a science series published by the library of the University of Lausanne. The table of contents at the end of the book—there is no index—lists the following:

Part I: The minerals of sedimentary rocks
Chapter 1. Detrital and authigenic minerals
Part II: The detrital rocks [including pyroclastics—GJN]
Chapter 2. Conglomerates and breccias
Chapter 3. Sandstones
Chapter 4. Argillites
Part III: The bio-chemical rocks [biochemical and chemical sediments—GJN]
Chapter 5. Carbonate rocks
Chapter 6. Siliceous rocks
Chapter 7. Ferruginous rocks
Chapter 8. Phosphatic rocks
Chapter 9. Saline rocks
Chapter 10. Carbonaceous rocks

The major structure of the classification of sedimentary rocks used in this book is well indicated by the table of contents. The classification is broken down to include further gross details of composition, and the rocks are finally classed according to their mode of formation. The treatment is concerned primarily with the petrology of sediments, their petrography—in the American sense of the word—being limited to short descriptions sufficient to explain the subjects under discussion. Emphasis is placed on environment and mode of deposition and their general significance in terms of stratigraphy. Almost no quantitative aspect of sedimentary geology is included; for instance, not one histogram is to be found in the book.

In a relatively few pages, Carozzi has presented a well-balanced perspective statement of the content and meaning of sedimentary petrology. The book is very well written and provides easy and coherent reading. Bibliographies at the end of each chapter contain a choice assortment of literature on sediments. It is interesting to note that of 298 listings, including repetitions, 177 or 60 per cent of the references are in the English language; French is second in number. This book is to be recommended for its well-organized discus-

sion and definition of sedimentary petrology in broad and meaningful context, uncluttered with digressions into detailed descriptions.

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DIE GRUNDLAGEN DER THEORIE DES MIKROSKOPS, by KURT MICHEL (1950). Wissenschaftliche Verlagsgesellschaft M. B. H., Stuttgart, xi+314 pages, 160 figures, and 15 tables. DM 27.00.

This brief statement of the nature and contents of Michel's book on optical theory is offered as notice of a book of exceptional value and use to the petrographer, a book not likely in the ordinary course of affairs to come to his attention. This is not a critical review; such is best provided by the physicist: an unusually favorable review is to be found in *Jour. Roy. Micro. Soc.*, Ser. IV, vol. **71**, Pt. 1, pp. 148–149 (1951). I am simply impressed by a dissertation of unusual clarity, completeness, and authority, features generally lacking in the optical texts used by geologists.

The table of contents lists the following major headings:

Part I: The most important laws.

1. Propagation of light, its absorption, reflection, and refraction.
2. The basic laws of geometrical optics (including a comprehensive discussion of aberrations).†
3. The formation of images by lenses according to the wave nature of light.
4. The eye as an optical apparatus and as a receiver of light energy.
5. Other receivers of light energy (photochemistry, the photocell, and the photoelement).

Part II: The theory of optical instruments.

6. The geometrical optical theory (microscopical apparatuses, telescopes, and the camera).
7. The wave-optical theory of the microscope (containing much that has not been found outside of professional journals).
8. Appendix (containing 120 formulae, lists of illustrations and tables, references cited, and errata).

The style is short and lucid; the illustrations, many in color, are unusually clear and helpful. These in connection with the tables and formulae make the book usable even to those who read no German. The book neither illustrates nor describes any given manufactured optical instrument, and even excludes those made by Zeiss-Winkel, the firm with which Michel is associated. The simple, clear, and complete authoritative explanations of the bases of optics relative to microscopy comprise a dissertation such that the book will become, if it is not already, a foremost standard on the subject. It most certainly should be the principal reference used in preparation of any future texts on optical mineralogy, and it is a book that petrographers would do well to add to their working library.

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ERZLAGERSTÄTTEN, by HANS SCHNEIDERHÖHN (1949). Kurzvorlesungen zur Einführung und zur Wiederholung, Piscator-Verlag, Stuttgart, xv+326 pages, 2 figures and 26 tables, 2nd edition. DM 14.00.

This book is an outgrowth of a two-semester lecture course on ore deposits, which are

* Publication authorized by the Director, U. S. Geological Survey.

† Statements in parentheses added by reviewer.

‡ Publication authorized by the Director, U. S. Geological Survey.

described in three sections according to their assignment to the magmatic, sedimentary, or metamorphic sequence (Abfolge). The table of contents is far too imposing for quotation here. Each of the three sections opens with a simplified statement of the ore-forming processes involved in the sequence and of the classification employed. In a few places, brief digressions on matters of genesis are offered. For the most part the book consists of short descriptions of types of ore deposits with fine-print remarks on principal examples of each type. Many of these descriptions are almost barren of usable information because of their brevity, although many odd gems of generally overlooked and interesting observations are to be found.

The book is most notable for its lack of illustrations in treating a subject in which illustrations have become a principle mode of description. Not only are maps and sections lacking, but there is almost no mention of the structural aspect of economic geology. An atlas of illustrations for this book is promised in the foreword to the first edition. I noted no reference to this atlas in this second edition.

Literature citations are few in number, and most of them are to an earlier, more comprehensive text by Schneiderhöhn. Such a brief introduction as this book offers to the subject would be infinitely more useful with an extensive bibliography.

Technical criticism of the ideas expressed in such an elementary text as this can be of little value. Schneiderhöhn has presented in a remarkably succinct and highly readable fashion much observation of a general nature and his notions and opinions concerning the realm of economic geology. It should suffice to say that many, if not most of his ideas are not free of controversy and that to such controversy he rarely gives heed. Despite this single-minded approach and the highly generalized character of the book, Schneiderhöhn's lectures are interesting for the perspective view of the subject that they provide.

It is appropriate to expect the reader of this book to be fully aware that he peruses one man's prejudices, a man who, however, has a remarkable wealth of experience in this field.

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