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BOOK REVIEWS

RADIOCRISTALLOGRAPHIE. By Pierre Ducros. Dunod, Paris, 1971. ix + 143 pages. 26 f. (France), $6.80 (Canada).

This book is one of the collection *Dunod Universite,* especially intended for graduate students ("2 ième et 3 ième cycles"). The book is organized in the manner of lecture notes, and is extremely succinct. It does cover rather well the most important aspects of X-ray crystallography in a clear and concise fashion.

The first chapter ("cristallographie géométrique") contains essential facts on crystal geometry within 26 pages. Even the author recognizes that this is desperately insufficient space to deal with symmetry, space groups, point groups, Bravais lattices, reciprocal space, and atomic structure; apparently, the author plans another book to deal specifically with this subject.

To a lesser degree, the other chapters of this book are subject to the same criticism; they are extremely concise. The last half of the book (approx. 80 pages) covers X-ray diffraction by crystals, rotating crystal, powder, Laüe and Weissenberg techniques, Patterson function, crystal structure determination, and neutron and electron diffraction.

Most of the chapters of the book are followed by a set of problems (with answers at the end of the book); this constitutes a distinct advantage to students desirous to test their assimilation of the theory exposed. By its very concise nature, the book calls for further bibliographic work on most subjects; unfortunately, the author gives only three references to other books and none to original articles in scientific periodicals.

There are many very good books on X-ray crystallography in English, but there are very few in French; "Radiocristallographie" is a welcome addition in this field and will undoubtedly be of considerable interest to students registered in a graduate X-ray crystallography course.

GUY PERRAULT
Ecole Polytechnique de Montréal

CHEMICAL ANALYSIS OF SILICATE ROCKS. By A. J. Easton. Elsevier Publishing Co., New York, 1972. xii + 258 pages. $24.50.

At first reading, Easton's book gives an impression of triviality. Phrasing is sometimes quaint, and many statements have an annoying circularity and a flavor of amateurism (*e.g.* "For the conversion of soluble into insoluble ions, precipitation is used in a large number of separations in silicate analysis.")

On reflection, however, and on arriving at the heart of the book, where specific procedures are described, one realizes that the author (as, indeed, he intimates in his introduction) is writing at the level of the undergraduate in Geology, who is often without any analytical skill, and who is confused, rather than helped, by more high-powered works.

Recognizing this, one can say that the book is a useful primer. It is not more than this. Its subject matter covers the ordinary 13-constituent silicate analysis, with additional information on the determination of sulfur, chromium, and carbon. A short section on the sampling of meteorite material is worth the attention of anyone dealing with inhomogeneous geochemical samples. No attempt is made to cover the subject of trace analysis, and the effects of unusual constituents in the routines which are described are not properly evaluated. There is a short section on mineral calculations.

C. O. INGAMELLS
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THE ENCYCLOPEDIA OF GEOCHEMISTRY AND ENVIRONMENTAL SCIENCES. Edited by Rhodes W. Fairbridge. Van Nostrand Reinhold Company, New York, 1972. xxi + 1321 pages. $49.50.

At almost 4 cents a page the reader may purchase 400 articles devoted to summarizing the field of geochemistry, excluding much of mineralogy (to be treated in a future volume). A small number of the articles deal with environmental studies. It is remarkable that such a broad summary comes off so well. The overall impression is one of easy accessibility including a superb index of over 10,000 entries, continual references to other articles for further elaboration, comprehensive coverage including "Water Divining" and "Geophysical Methods for Hydrologic Search" as well as more conventional geochemical topics, clear format, readable style and diagrams, and a reasonable number of references. The majority of articles are of high quality and provide easy access to geochemical and environmental topics. The references indicate that the latest information present is from 1967–1970 with most citations of an earlier date.

The negative aspects of this encyclopedia are few, but of some concern. To what audience is this tome directed? Many articles are written for professional geologists and chemists, the implied audience as indicated in the preface. However, quite a few entries are aimed far below that level. The structure of water is treated below the level of a college freshmen chemistry course, with no mention of molecular orbitals, hydrogen bonding, clustering, *etc.* The sections on mineral classes and crystal chemistry can most charitably be called classical; they are about sophomore-junior in level. A companion volume will be offered devoted to mineralogy, so that such surficial treatment may be partially excused. Topics one would hope to find in an encyclopedia of geochemistry are not always present. For example, an attempt has been made to cover analytical techniques used in geochemistry. Topics such as Mössbaur and neutron activation analyses are included, but no treatment of electron microscopy (in a future volume) or of electron microprobe analyses is available. A short section on the probe technique is presented under X-ray spectroscopy with cross reference to the listing *electron probe microanalysis;* no such section can be found.

The encyclopedia's virtues are easily appreciated, its defects tolerated; all in all, it is an excellent addition to the reference shelf. The impact of the high cost may be mollified by following the actions of one of my students. She purchased it from a book club at a very much reduced price.

S. E. SOMMER
University of Maryland

THE CHEMICAL PHYSICS OF ICE. By N. H. Fletcher. Cambridge University Press, 1970. 271 pp. $13.50.

A vigorous expansion in understanding of ice and its properties has been going on during the past ten years, and is well reflected in this attractive little book, which fills an almost unique place in the literature. No book-length synthesis of the modern understanding of ice physics existed prior to the appearance of Fletcher's book, and, almost simultaneously, Eisenberg and Kauzmann's *Structure and Properties of Water* (Oxford, 1969). These two books cover basically the same ground, but with rather different aims and emphasis. Fletcher's primary concern is the physical and chemical properties of the solid forms of water and their relationship to the underlying crystal and molecular structures, and to the properties of individual water molecules. Eisenberg and Kauzmann aim for a corresponding structural explanation of liquid water and its properties, and they consider solid water more for its value as background information than for its own sake. Nevertheless, both books succeed well in presenting the salient ideas about both the solid and liquid phases.

Fletcher approaches the subject "as an exemplification of the principles of chemical physics," and he addresses it to students who have completed courses in solid state physics and quantum mechanics and who "are looking for something on which to try their teeth." It serves this purpose admirably, a wide range of physical phenomena being encompassed under the unifying influence of the underlying molecular architecture of ice. The presentation stresses physical insight rather than mathematical development. The following topics are treated: (1) the water molecule (electronic structure, spectra, vibrations, forces of interaction); (2) structure of ordinary ice and its free energy basis in terms of molecular interaction energies and order-disorder phenomena; (3) other forms of ice; (4) liquid water and the nucleation of freezing; (5) crystal growth; (6) lattice dynamics, vibrational spectra, and thermal properties; (7) point defects and diffusion; (8) mechanical properties; (9) electrical properties. The electrical properties, which include static dielectric constant, dielectric dispersion, d.c. and a.c. conductivities, proton mobility, thermoelectric effect, ferro- or anti-ferroelectric transitions, and charge-separation effects in freezing, have been extensively studied in recent years and get suitable emphasis in Fletcher's book.

Three omitted topics that deserve inclusion are theoretical calculations of vibrational spectra, measurements of vibrational spectra by neutron inelastic scattering, and theories of dislocation mobility.

There is no consideration of the natural phenomenology of ice except in relation to the environmental factors that govern crystal habits. Those interested in the occurrence and diverse manifestations of ice in nature should turn to other sources.

The richness of the physical and particularly electrical phenomena shown by ice is probably responsible for the careful attention paid to it by solid-state physicists in recent years and for the comparatively advanced level of understanding reached. The present book conveys well the progress that has been made, and can serve mineralogists as a model for the application of solid state concepts to a seemingly simple mineral substance.

BARCLAY KAMB
California Institute of Technology

THE MINERALS OF FRANKLIN AND STERLING HILL. By Clifford Frondel. John Wiley & Sons, Inc., New York, 1972. 94 pages. $9.95.

The minerals of the Franklin-Sterling Hill area of New Jersey are well known to professional mineralogists and are legendary among rock hounds and amateur mineral collectors. The present contribution to the copious literature on this district is a check list designed to summarize, annotate, and bring up-to-date the mineral species known from this area. This small book is divided into three major sections:

(1) An introduction which provides interesting historical notes on the discovery, ownership, and mining of the Franklin-Sterling Hill deposits, a comparison with the somewhat similar deposit at Långban, Sweden, and a commentary on previous check lists and former and current mineralogical collections.

(2) A cursory discussion of the geology and mineralogy of the deposits with specific listings of the minerals of the ores, and skarns, the veins, the weathered zones, the intrusive dikes, the Franklin marble, and the neighboring magnetite deposits. There are also brief considerations of some geochemical aspects and of the origins of the ores.

(3) An annotated check list of minerals which includes a generalized chemical composition, the original reference, where found, and miscellaneous comments on the mode of occurrence.

As a check list the book fulfills its intended purpose, albeit in an expensive and abbreviated manner. However, a comparison of this book with similar texts of other areas (*i.e., A Guide to the Minerals of Switzerland* by M. Weible, 1966, and published by the same publisher) or previous listings of Franklin area minerals (*The Minerals of Franklin and Sterling Hill, New Jersey,* by A. S. Wilkerson, 1962, or *An Abbreviated Manual of Franklin Minerals* by E. F. Kushner, 1970, or *Natures Hidden Rainbows* by R. Jones, 1964) leaves this one looking second best. This book is handicapped by offering only black and white plates, many of which do not adequately illustrate the mineral properties for which they are intended. By far the best photographs, and the only ones in color, are those on the dust jacket; unfortunately they are not identified.

The mineralogical descriptions are sparse, usually 2 to 4 sentences, and offer little not already available in previous texts. The broad chemical compositions (*i.e.*, "friedelite, a silicate chiefly of manganese") could well have been replaced by explicit chemical formulae. A few minerals are not given any composition (*i.e.*, ferroschallerite, oligoclase) but this is made up for by giving at least one, clinohedrite, two different compositions—a lead silicate (p. 23) and a calcium and zinc silicate (the correct one, p. 51). A disappointment is the paucity of data on the fluorescent minerals, an unfortunate shortcoming in view of the renown such minerals have brought to the deposits.

The author's scheme of referencing earlier works is incomplete and unclear; as a result, Palache's *U.S.G.S. Professional Paper* **180** (1935, reprinted 1960) will be a necessary supplement to sort out references prior to 1935. The referencing of more recent works is far more complete, but the dates of papers are occasionally in error.

The annotations in the check list are useful and clarify the position of obsolete and redundant mineral names, but it is not clear just what constitutes "verification" of a mineral species when "cleiophene" is preserved as a name for sphalerite.

The Minerals of Franklin and Sterling Hill will prove an interesting and up dated, though sketchy, check list for mineral collectors and amateurs, but will be of little value to professionals.

JAMES R. CRAIG
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GLOSSARY OF GEOLOGY. Edited by Margaret Gary, Robert McAfee, Jr., and Carol L. Wolf. American Geological Institute, Washington, D.C., 1972. xiv + 804 + A-52 pages. $22.50.

This book, now grown to 33,000 entries, is a welcome up-dating of its predecessors [*Glossary of Geology and Related Sciences,* 1957 (14,000 entries); *Glossary of Geology and Related Sciences, with Supplement,* 1960 (the supplement added 4,000 entries)]. Definitions range in size from that for a graywacke (900 words) to one-word definitions or synonyms. The entries relating to mineralogy and crystallography are very satisfactory in scope and quality. The less commonly used synonyms and varietal names for minerals will be useful to mineralogists and non-mineralogists alike. Petrologic and petrographic terms are well covered.

Many of the terms and acronyms ushered in by lunar geologists are covered. For example, "KREEP An acronym for a basaltic lunar rock type first found in Apollo 12 fines and breccias and characterized by unusually high contents of potassium (K), rare-earth elements (REE), phosphorous (P), and other trace elements in comparison to other lunar rock types. The material, which is found in a variety of crystalline and glassy (shock-melted) rock types, is distinctly different from the iron-rich mare basalts. The term *nonmare basalt* is equivalent."

The reviewer noted with pleasure the reappearance of the tongue-in-cheek entry of the original (probably also tongue-in-cheek) definition of a cactolith, namely "A quasi-horizontal chonolith composed of anastomosing ductoliths, whose distal ends curl like a harpolith, thin like a sphenolith, or bulge discordantly like an akmolith or ethmolith." This time, however, it is preceded by a more digestible definition.

The writer assumes that the coverage of geologic terms from general geology, geophysics, paleontology, geomorphology, and other facets of geology are as impressive as those he checked. There are a few minor errors—for example, crystal lattice is used as a synonym for "crystal structure" in the definition of *coordination number.* The definitions 'crystal latice' and 'crystal structure' at present seem almost interchangeable and hence require sharpening and correction. The denfiition for sanidine, "It is a highly disordered, monoclinic form of orthoclase . . . ," would become correct if "$KAlSi_3O_8$" were substituted for the word 'orthoclase.'

The type is clear and readable, on white glareless paper. This is a distinct improvement over the earlier edition.

The book is a necessary addition to university and public libraries. Private individuals who wish to have close at hand a source of concise definitions of terms from the geological sciences will also be interested in this book.

F. DONALD BLOSS
Virginia Polytechnic Institute and State University

HUNTING DIAMONDS IN CALIFORNIA. By Mary Hill. Naturegraph Publishers, Healdsburg, California, 1972. 80 pages. $2.00.

This is a very nice little booklet for field workers, well put together, with good information presented concisely. The book is illustrated with old plates, black and white, from formerly published sketches.

DR. C. A. MICHAEL
Curator, Michael Collections
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OPTICAL ABSORPTION AND DISPERSION IN SOLIDS. By J. N. Hodgson. Barnes and Noble, New York, 1971. 131 pages. $8.00.

This small volume contains a condensed mathematical treatment of the theory of interaction of quanta with pure crystals to produce characteristic absorption spectra. A minor but important aspect of the treatment includes the dispersion theory of classical oscillators and dispersion associated with exciton effects, that is, effects associated with interactions between electrons and holes in crystal structures. Theory is correlated with experimental results from recent measurements within the range of vacuum wave lengths of electromagnetic oscillations from 50 nm to 500 μm and provides a basis for an improved understanding of data obtained from precise optical measurements of solids.

ERNEST E. WAHLSTROM
University of Colorado

KRISTALLE UNTER DER LUPE. By Werner Leiber. Ott Verlag, Thun, Switzerland, und München, 1972. 244 pages, 84 text figures, 100 photos (88 in color). $29.20.

DER MICROMOUNTER. By Alex Kipfer. I. Auflage. Ott Verlag, Thun, Switzerland, 1972. 212 pages, many text figures and photos, some in color. $9.75.

It seems remarkable that, in the same year, not one but two books should appear to suddenly fill the conspicuous gap in micromounting literature. Even more remarkable is the fact that both were issued by the same publisher. However, when these books are compared side by side it becomes clear that there is little real redundancy and that in fact they complement each other.

Werner Lieber of Heidelberg, well known for his recent books on mineralogy and collecting, is also well known for his expertise in color photography of small to large mineral specimens. The present work stresses the photographic aspects of micromounting, and in considerable detail tells how one may also achieve success in color photography of micromounts by following the rules, advice, and equipment recommendations of the author. The first chapter provides a brief history of the development of the science of crystallography and contains a useful section on single and aggregate crystal habits with text figures. This is followed by a brief chapter on collection and preparation of micromounts and a much longer and more detailed one on the optical equipment employed and on photography. Next follows a section of remarks upon each of the color plates, which includes data on lens, filter, exposure time, illumination and its problems, magnification, and other useful information, giving, in effect, the author's solution to the problems of photography posed by each of the specimens depicted. The final section of the book consists of the plates themselves, all on glossy paper *recto,* with decriptions, remarks, and crystal drawings facing *verso.* Each plate measures 220 x 205 mm. On the whole, all are fine. Especially noteworthy are those portraying the notoriously difficult metallics, semimetallics, and the colorless or white minerals. Naturally each specimen has been selected with the view of providing a pleasing composition and spectacular beauty, but it is to the author's credit that his artistic impulses were not allowed to overshadow scientific accuracy nor fairness of representation.

On the other hand, Kipfer treats the subject entirely from the practical standpoint, omitting photography altogether but being careful to include almost everything else of value to the experienced micromounter as well as the amateur. He points out the historical foundation of micromounting, mainly as it was developed into a distinctive branch of mineral collecting in the United States, and then discusses the advantages of collecting micromounts as compared to collecting larger specimens. Advice follows on types and formation of collections, acquisition of material by personal collecting, exchange, or purchase, and the implements and tools required in the field and at home.

Following sections take up cleaning, shaping, mounting, boxes and storage, labeling, and the other minutae of micromounting, with much practical advice and a comparison of methods used in the United States and in Europe. Two lists of recommended readings appear in the text. Final sections are devoted to magnifiers and microscopes and their employment and care. The book closes with a series of glossy leaves bearing photographs, some colored, illustrating lessons of the text.

Both books stress the mechanics of micromounting, one photography, the other the treatment of the specimen. But both could have said more about the most troublesome area of micromounting—the identification of microscopic crystals. The luxury of ordinary physical and chemical testing is largely denied the micromounter because of specimen size and therefore heavy reliance must be placed on visual clues, prominent among these being single crystal and aggregate habits, crystallographic forms, cleavages and associations. Lieber's book provides useful sketches of habits and crystal forms to accompany the plates but could use more. While it is not feasible to provide drawings of every variation in form and habit in the manner of Goldschmidt's *Atlas,* it should be possible to provide not only conventional drawings of the more common habits but also some cross-sections to help the beginner visualize the whole crystal when viewed from an angle other than that given in textbooks. Equally helpful would be a preliminary discussion, with sketches, of the significance of face arrays in displaying the symmetry of the crystal. For example, terminal face arrays on confusingly similar crystals of apatite, tourmaline, and beryl, all possible associates on one specimen, can be used to settle upon the class of the hexagonal system in which the unknown belongs, in itself an enormous aid in identification. Other face arrays, etch pits, growth hillocks, striations, *etc,* can also be pointed out as providing valuable clues to symmetry. In regard to associations, Kipfer rightfully stresses their importance but could profitably have said more about this highly important subject. Without going into the enormous detail of some discussions of parageneses, *e.g.,* the Swiss alpine types, it should not expand the text too much to include the more important with typical examples from well-known occurrences.

Both books are pioneering efforts and no doubt will pass through several editions. The only comparable work is that by Milton L. Speckles, *The Complete Guide to Micromounts,* published in 1965. Its ground, and more, is covered by Kipfer's book while Lieber's photographic masterpiece is unique. Perhaps the appearance of these two German language works will stimulate the writing of comparable books in the English language, for which there seems to be plenty of room in current mineralogical literature.

JOHN SINKANKAS
Earth Sciences Literature

MINERAL SCIENCES INVESTIGATIONS, 1969-1971 Edited by William G. Melson. Smithsonian Contributions to the Earth Sciences, No. 9, Smithsonian Institution Press, Washington, D. C., 1972. 94 pages. $1.25 (paper cover).

This small booklet contains a collection of 17 contributions from the Department of Mineral Sciences of the Smithsonian Institution, covering studies from 1969-1971. Most of these articles are by in-house personnel (15 authors

and coauthors), but a number of publications are also coauthored by scientists from outside the Smithsonian (4 coauthors).

The papers cover seven broader areas of research, namely lunar studies (2); petrology and volcanology (5); meteoritics (5); mineralogy (2); standards (1); collections (1); and thin-section preparation (1). The lunar studies deal with the mineralogy and petrology of crystalline rocks and breccias from Apollo 12 fines, and the microhardness of a lunar metallic iron particle as compared to high-purity terrestrial iron. Papers on petrology and volcanology deal with iron-rich saponite as well as euhedral olivine crystals from the Mid-Atlantic Ridge (22°N latitude), and the origin and composition of rock fulgurite glass. Of particular interest is an experimental study of the crystallization sequence of minerals from two Kilauean basalts of nearly identical composition (1919 and 1954 eruptions) which seems to suggest that the earlier appearance of plagioclase in the 1919 basalt is controlled by a minutely higher Al_2O_3 content ($\sim$0.2%); and a study in the field and laboratory of a small nuées ardentes eruption of Ulawun Volcano, New Britain, that consisted of high-alumina basalt material (18-19% Al_2O_3). Bulk and mineral compositions as well as textural descriptions are given of four meteorites, namely the mesosiderite Estherville, Iowa; and the chondrites Forest Vale, New South Wales, Australia; Nejo, Ethiopia; and Nakhon Pathom, Thailand. Another paper gives Ni, Co, and P analyses of 12 iron meteorites. The mineralogy section deals with gorceixite from Buffels River, Namaqualand, South Africa; and tocornalite from Broken Hill, New South Wales, Australia, followed by a report on wet-chemical analyses of homogeneous Kakanui hornblende and pyrope, omphacite, and garnet suitable for electron microprobe standards. An article on the acquisition of the Carl Bosch Collection, and one on the preparation of doubly polished thin sections, a method which proved instrumental in the study of lunar fines in thin section, complete the volume.

This collection of articles provides valuable insight into the varied and diverse research activities of the Smithsonian group. Although the papers are brief and usually of descriptive rather than interpretive nature, they represent valuable original contributions to a broad spectrum of earth and planetary sciences. The booklet should be of interest to meteoriticists, mineralogists, petrologists, volcanologists, and geochemists. It can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C., 20402 and, for only $1.25, is a real bargain.

KLAUS KEIL
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SAND AND SANDSTONE. By F. J. Pettijohn, Paul Edwin Potter, and Raymond Siever. Springer-Verlag, New York, 1972. xvi+618 pages, 258 figures. $31.10.

Sand and Sandstone is a textbook on how to study and think about deposits of sand size siliceous sediments and resulting rocks. It is an outgrowth of a syllabus for a short course originally published by the Indiana Geological Survey. Nearly half of the book (285 of 618 pages) is devoted to topics of direct interest to mineralogists and petrologists (mineralogy, composition, petrology, provenance, and diagenesis). The book presents an evaluation of the state-of-the-art of the study of sand and sandstones rather than summarizing new original data. The text gives a general review of concepts with strong emphasis on principles and philosophy rather than detailed description of examples. As the authors point out in the preface, it is not a case study treatment. The intention that the book serve as a learning tool for students is clear from the presentation of a variety of points of view and the repeated delineation of areas where problems exist and further research is needed. This constant emphasis on evaluation of knowledge is stimulating and the book is generally a pleasure to read. My only quibble is that the discussions of terminology are seldom clearly summarized in the text. One must either remember a series of partial conclusions scattered through a discussion or turn to the glossary to fix the authors concepts firmly in mind. For instance, the first three pages are devoted to "sand and sandstone defined" yet sandstone is not formally defined even though the concepts used in the glossary definition on page 170 are all alluded to.

The book is organized into twelve chapters grouped into four larger sections. The introductory chapter presents the concepts of what sand and sandstone are, their geologic importance, and a review of the history of the study of sand and sandstones. The next three chapters (Mineralogy and Chemical Composition, Texture, and Sedimentary Structures and Bedding) are grouped as part I under the heading "Fundamental Properties." Part II, "Petrography," consists of chapters on classification, common sands and sandstone, and volcaniclastics. The next three chapters (Production and Provenance; Transport, Deposition, and Deformation; and Diagenesis) comprise part III entitled "Processes." The last part is called "Broader Aspects of Sand Deposition" and contains chapters on depositional environments and the analysis of basins and continental evolution. The book concludes with an appendix, "Petrographic Analysis of Sandstones," and author and subject indices.

The authors take the attitude that sand and sandstone bodies exist and ask what can be learned from them. This brings a definite slant to the text. Observations on deposits and data collected from them are discussed at much greater length than geological phenomena which may be involved in the origin, transport, deposition, and lithification of sands but which may not leave distinctive effects on the deposit. For example, the exact process of weathering and erosional release is seldom recorded by a sand grain but the source lithology of a sand may be determined in many cases. The chapter on Production and Provenance of Sand has only 2½ pages on sand production but 29 pages on provenance.

Within this framework of emphasis on interpretation of deposits, the authors have compiled a remarkable set of concise discussions of problem topics and short reviews which are models of synthesis of information. The discussions of "arkose" and the matrix problem in graywackes exemplify the skillful handling of problem areas. The chapter on volcaniclastics is unusual and provides a much needed summary which is particularly welcome in the general literature on sediments. As for review topics, the two text pages, table, and four figures used to summarize

the sandstones of the Central Appalachian Geosyncline is a good example. While I question a few details—I don't agree that the Silurian Keefer sandstone is redeposited from the continental interior as is postulated (admittedly with qualifications)—I wish introductory books in historical geology were as adept at presenting regional summaries.

The illustrations are of the highest quality. The series of photomicrographs is superb and makes the petrographic section extremely useful. The overall production of the book is also of high quality. There are virtually no typographical errors in the text but a few do appear in the references; for example, on p. 257 there is an error in the page numbers for the Merifield and Lamar (1968) *Jour. Geophys. Res.* article; on p. 381 the reference to an article by Rusnak is misalphabetized. The reference lists, both annotated and general, are another strong point of the book.

In summary, this book is a thought provoking guide to the study of deposits of sand and sandstones. Any geologist would profit from reading the book. It will be the standard reference in its field for some time to come.

RICHARD K. BAMBACH
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ELEMENTAL COMPOSITION OF SURFICIAL MATERIALS IN THE CONTERMINOUS UNITED STATES. By H. T. Shacklette, J. C. Hamilton, J. G. Boerngen, and J. M. Bowles. U.S. Government Printing Office, Washington, D. C., 1971. $0.70.

This pamphlet shows the results of analyses of 863 samples of soils or other regoliths taken approximately at eight inches depth and 50 miles apart all over the U.S. (excluding Alaska and Hawaii, which is the reason for "conterminous"). Thirty elements were determined, mostly by optical spectrometry, including beryllium, cerium, gallium, lanthanum, neodymium, scandium, vanadium, yttrium, ytterbium, and more common ones.

A table compares the averages with data compiled by Hawkes and Webb, Vinogradov, Jackson, and Mitchell. For each element, a separate map shows the points of sampling, indicated by small circles, and there is a histogram which shows the distribution of values and the ranges corresponding to the different symbols used for contents (open circles, black circles, *etc*).

There is no saying when a complete inventory of the soils of the U.S.A. will have been made in detail. Meanwhile, this study shows the general trends, the deficiencies, and the excesses, and furnishes most valuable information to the geochemist, the agriculturist, and the biologist.

ROBERT E. DELAVAULT
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MICROSCOPIC IDENTIFICATION OF CRYSTALS. By Richard E. Stoiber and Stearns A. Morse. The Ronald Press Company, New York, 1972. 278 pages. $10.50.

Some introductory courses in optical mineralogy place so much emphasis on the theoretical basis of crystal optics that insufficient time is left for the student to learn the down-to-earth methods of mineral identification under the microscope. As a result he avoids the use of the microscope in his subsequent academic work, and in Life-After-Graduation whatever theory he might have grasped is unfortunately soon forgotten.

In contrast, this textbook aims to provide the student with practical means for mineral identification while giving relatively simple and brief explanations of the optical phenomena observed and applied in the course of the measurements. Based on years of successful teaching of the material from preliminary drafts, the present text clearly has been written with the needs of the beginning student uppermost in mind. Upon completion of the course he should have a useful tool for future work and, if he chooses to specialize in the field, a solid base on which to build the more complete theory.

Generous space has been allotted to description of specific techniques in immersion methods for measuring principal refractive indices—parameters that are of foremost importance for reliable identification. A 30-page chapter deals systematically with interference figures of biaxial crystals as important aids for recognizing those grains in the mount that are correctly oriented for determination of principal refractive indices, optic angle, optic sign, and other properties. Applications of these principles in the determination of minerals in rock thin-sections are briefly mentioned, and frequent citations to the literature on more advanced and specialized techniques are keyed to a list (140 references) at the end of the book. An appendix describes and annotates the many available compilations of optical properties of known natural minerals (also those on synthetic inorganic and organic crystals), to which one turns as the final step in the identification of an unknown. A relatively detailed index of more than 700 entries provides convenient references to specific subjects in the text.

Some gaps obviously must be filled by the instructor. The treatment of the basic optics and mechanisms of the microscope, for example, is brief and lacks any illustrations. (In fact, the text in general could benefit by more illustrative figures.) Basic care and adjustment of the polarizing microscope is dealt with only sketchily. The "random search" procedure (statistical procedure of some authors) as outlined here for detemination of principal refractive indices assumes that only one substance is present in the multi-grain mounts, and does not suggest ways to handle the common case in practice where two or more similar appearing substances are present.

RAY E. WILCOX
U. S. Geological Survey

THE MINOR STRUCTURES OF DEFORMED ROCKS. A PHOTOGRAPHIC ATLAS. By L. E. Weiss. Springer-Verlag, New York, 1972. 431 pages, 203 plates. $29.80.

As its name implies, this book is almost strictly a collection of photographs. Plates of photographs occupy 203 right-hand pages with the facing page sparsely occupied by a descriptive caption for the figures. These photographs are preceded by a 19-page introduction plus a preface which states that the photographs were "selected to illustrate as clearly as possible the obvious characteristics of the minor structures of deformed rocks."

The photographs, taken in all parts of the world, bear witness to the author's ability as a photographer. Unfortunately, coins of the country where the rock was photographed have sometimes been used to illustrate scale, and the reader may not always be familiar with their size. Some photographs lack any indication of scale.

However, there are many beautiful black-and-white photographs of geologic features from all over the world, which permit the book to achieve its quoted purpose. The price of this book may confine it largely to libraries, perhaps as a reference.

F. DONALD BLOSS
Virginia Polytechnic Institute and State University