American Mineralogist, Volume 59, pages 385–391, 1974

BOOK REVIEWS

GRANITES AND THEIR ENCLAVES. By J. Didier. Translated from the French by J. T. Renouf. Volume 3, *Developments in Petrology*. Elsevier Scientific Publishing Company, Amsterdam, 1973. xiv + 393 pages, $34.95.

Anyone who has studied granites has encountered foreign materials contained within them. Professor Didier has assembled the product of a career-long study of enclaves to present the geologic profession with an excellent synthesis of the subject.

Didier first recommends clarification of nomenclature. An enclave is defined as a "piece of foreign material enclosed within an igneous rock." An inclusion is a "piece of foreign material enclosed within a crystal." These are not new terms, but are considered the more appropriate of those available.

Part I of the book is devoted to descriptions of the variety of enclaves in granites, granodiorites, and some basic rocks of western Europe and Africa. There is also reference to the Sierra Nevada of California and some other famous localities around the world. The descriptive material is strongly supported by abundant petrographic data and illustrations. Part II treats the variety, significance, and origins of the enclaves. Conclusions, some original and many quoted, are presented concerning the big issues of granite petrology.

Didier's synthesis of the subject is stimulating. The book is a must for specialists in granite petrology.

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THE MEDITERRANEAN SEA. Edited by Daniel J. Stanley. Dowden, Hutchinson, and Ross, Inc., Stroudsburg, Pennsylvania 18360. xiv + 765 pages. $45.00.

This handsome volume contains 47 papers on the numerous aspects of the marine geology and geophysics of the Mediterranean basin. There are altogether 85 contributors from 15 countries, including 30 from the United States.

The book opens with a short review of the physiography and bathymetry of the Mediterranean, based on a new chart compiled by Carter *et al* (U.S. Naval Oceanographic Office). Two short reviews follow, dealing with the surface and deep circulation of the Mediterranean water. C. Vita Finzi (University College, London) reviews fluvial sedimentation during the past 20,000 years and concludes that the highest sediment yield occurred between 10,000 and 5,000 years ago, corresponding to the last stages of continental deglaciation and the earlier portion of the postglacial. A group of ten authors reviews in detail the evolution of the sedimentary regime of the Mediterranean during the Neogene, including the evidence for total desiccation in late Miocene time provided by the GLOMAR-CHALLENGER cores. Strong vertical movements in the Strait of Gibraltar area and throughout the Tyrrhenian Sea are indicated by various lines of evidence. Fabbri and Selli (University of Bologna) conclude that the Tyrrhenian sea was emergent until 4 million years ago and has been foundering since at a rate of about 1.1 mm/year, a conclusion also supported by studies by Burollet and Dufaure (Puteaux) on a deep well in the Gulf of Lion. A widespread, subbottom reflecting surface was found by Biscay, Ryan, and Wexel (Lamont Geological Observatory and University of Catania) to be an indurated coccolith ooze of basal Pliocene age.

A series of papers by Fairbridge (Columbia University), Laure Blanc-Vernet (Marseille), Yvonne Herman (Washington State University), and Bill Ryan (Lamont) deal with the climatic changes of the Quaternary as revealed by the sediments and microfossils of the Mediterranean. Because of its northern latitude and proximity to the European ice sheets, the Mediterranean was particularly sensitive to climatic change, and the data are particularly clear and impressive.

Two sections, a total of ten papers, treat shallow carbonate and non-carbonate sedimentation around the Mediterranean. Some of the points: high magnesium calcite is the phase responsible for beach rock cementation, as opposed to aragonite in the tropical seas; carbonate sediments (mainly by coralline algae and bryozoans) have been accumulating since the beginning of the Holocene on the shallow banks (−100 to −120 m) of the Alboran Sea; relict biogenic sediments deposited during the last ice age occur at depths 80 to 150 m off Algeria; oolites in the Ras Matarma Lagoon (eastern shore of the Gulf of Suez) have a C-14 age of 1740 years (including the nuclei); Pleistocene terraces on Cephalonia exhibit a very robust growth of encrusting red algae, while postglacial growth has been very limited; quartz grains in Paleozoic, Mesozoic, Pliocene, and Quaternary sediments indicate strong wind action, while those in Upper Eocene to Miocene sediments indicate more prevalent aqueous transport.

Five chapters (19 papers) are dedicated to various problems of open sea sedimentation. Three hundred and forty samples of surface sediments have been used by Emelyanov (Kaliningrad) to determine the distribution of different mineral phases throughout the floor of the Mediterranean sea. Clay mineralogy is used by Chamley (Marseille) to study past environments as revealed by the record of 25 piston cores; whenever the sediment column is undisturbed, a qualitative climatic picture of fair detail is obtained. About 800 samples of suspended matter collected at 180 stations were studied by Emelyanov Shimdus, 150 in detail. Particle concentration was found to vary from 0.2 to 5 $\times$ 10^6 per liter, with terrigenous particles the predominant nonorganic component. Geneviève Alla and co-authors (Monaco) present a series of illustrations showing the sub-bottom structure of the western Mediterranean basin, with abundant evidence of salt tectonics (the evaporites being of late Miocene age) and Plio-Pleistocene neotectonism. Huang and Stanley (Smithsonian Institute, Washington) discuss in detail the sedimentation in the western Alboran sea. Deep-sea cores studies and C-14 analyses show that a

major petrological change occurred 10,000 years ago, with a striking reduction in sedimentation rates (from 60–130 cm/100 years to 30–40 cm/1000 years) and in increase in the concentration of pelagic tests in the Holocene. Bioturbation and current-induced laminations of silt and clays of late Wurm age indicate that euxinic conditions did not develop in the Alboran sea during the glacial ages. Van Straaten (Groningen) notices the occurrence of dark layers, 7500 to 9000 years old by C-14 dating, in the sediments of the southeastern Adriatic sea and interprets them as resulting from surface temperature having risen much faster than bottom temperatures during the last deglaciation. Similar conditions probably occurred during each preceding deglaciation, explaining the numerous black layers found in eastern Mediterranean cores.

Fontes, Letolle, and Nesteroff (Paris) and Lloyd and Hsu (Houston and Zurich) report on their isotopic studies of Miocene and post-Miocene deep carbonates recovered by the GLOMAR-CHALLENGER. Both oxygen and carbon isotopes exhibit a great range and variability in the Miocene evaporitic facies, indicating that the evaporites were probably deposited in desiccating lacustrine basins. Bonatti, Honnorez, Joensuu, and Rydell (Miami) describe the occurrence of Fe and Mn rich submarine deposits from Thera and Stromboli, and discuss the geochemistry of these deposits and their similarity to deposits from oceanic seamounts and rifts.

The book ends with an epilogue consisting of two papers, one by Brambati (Trieste) on pollution problems (which are particularly grave in an enclosed basin such as the Mediterranean), and the other by Stanley and nine other authors discussing future sediment-related research in the Mediterranean. Among their recommendations: joint studies by physical oceanographers and geologists to analyse sediment dispersal with respect to sea water motions; more drilling, dredging, and coring; and additional micropaleontological and geochemical studies to further elucidate the environmental history of the Mediterranean.

The book represents an excellent contribtuion to our knowledge of the Mediterranean. The editor must be complimented for having assembled a fine group of very good papers, and the publisher must be congratulated for the handsome format of the book and the excellent quality of the illustrations.

CESARE EMILIANI
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ATLAS OF QUARTZ SAND SURFACE TEXTURES. By David H. Krinsley and John C. Doornkamp. Cambridge University Press, Cambridge, England, 1973. 91 pages. $19.50.

This collection of 122 scanning electron microscope photographs of quartz grains correlates observed surface textures to specific depositional environments. The summary table on pages 26–27 keys specific features to their environment of occurrence (source material, diagenetic, glacial, loess, subaqueous, glacial and subaqueous, aeolian, high-energy chemical) and to the specific photographs on which they can be observed. The quality of reproduction of the micrographs is high, and each is accompanied by a size scale and an interpretive caption. The dust cover states that, "Familiarity with these [surface] features has enabled various workers to identify ancient sedimentological events."

F. DONALD BLOSS
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DIFFERENTIAL THERMAL ANALYSIS. Volume 2, APPLICATIONS. Edited by R. C. Mackenzie. Academic Press, London and New York, 1972. xv + 607 pages. $35.00.

Applications of Differential Thermal Analysis is the second of a two volume set. An excellent review by Professor Keller [*Am. Mineral.* **56,** 1497 (1969)] was given to volume 1, *Fundamental Aspects of Differential Thermal Analysis,* which includes three sections: A on the basic elements of theory, instrumentation, and practice; B on the inorganic materials; and C on the organic materials.

In volume two, there are two sections. Section D on physical chemistry contains five chapters: determination of physical constants, calorimetric measurements, reaction kinetics, phase studies, and low temperature studies. Section E on applications in industry contains sixteen chapters: ceramics; building materials; cements; glass; mineral industries; soils; catalysts; atomic energy; explosives; plastics and rubber; textiles; pharmaceuticals; oils, fats, soaps, and waxes; food industries; forest products; and general applications in industry with special reference to dusts. These twenty-one chapters contain contributions from thirty-one specialists working in eleven countries from widely diverse backgrounds.

The standard of English is high, even though there are many authors whose native tongues are not English, which implies good editing. Some essentials are repeated in different chapters, although the amount of overlap is not serious. The reference lists at the end of each chapter contain a total of 1,500 references; however, very few references are post 1969. Details of many applications are described with a reference, but in some chapters little attempt has been made to evaluate critically the use of differential thermal analysis for each particular application, whereas other chapters such as soils are excellent. The range of applications is wide and well-balanced. In general the technique is considered a useful adjunct to other methods such as X-ray diffraction and chemical analysis. For the specially reactive minerals, such as carbonates and hydrates, it can be more sensitive than X-ray diffraction for minor quantities.

This comprehensive and interdisciplinary book will be of considerable value to pure scientists, research and development personnel in industry, and technologists in physics, chemistry, metallurgy, biology as well as in mineralogy. This book should be available in all major libraries.

PETER BAYLISS
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ROCKS AND MINERALS OF CALIFORNIA. 3rd revised edition. By Vinson Brown, David Allan, and James Stark. Naturegraph Publishers, Healdsburg, California 95448, 1972. iv + 200 pages, 8 color plates, 51 locality maps. $3.95.

A perusal of the principal parts of the table of contents shows the extent of coverage in this book:

Physical and chemical tests (very simple) for minerals of common occurrence in California.

Identification key to common California minerals.

List of minerals by "habitat" (geologic setting).

Brief classification of rocks.

Color plates of some California minerals and rocks.

Sketch maps (51) indicating (roughly) mineral localities.

Listing of many mineral localities to the nearest ¼ section, in areas covered by topographic quadrangles from all of the California counties.

The tests are of course primitive, but at least serve to lead the searcher in an approximately correct direction. The sections on mineral occurrence and on geologic history help in the same way, especially that on occurrence ("habitat").

More than half of the book is devoted to the sketch maps and the listing of occurrences, and this portion is of very considerable assistance to the searcher, although there is not enough cross-keying of quadrangle information with the more generalized sketch maps to take full advantage of this.

For its avowed purpose, this book probably serves the lay user fairly well.

JOSEPH MURDOCH
University of California, Los Angeles

THE WORLD'S FINEST MINERALS AND CRYSTALS. By Peter Bancroft. A Studio Book by the Viking Press, New York, 1973. 176 pages. $28.50.

This book is a stunning collection of 78 color photographs of mineral specimens that were judged to be among the world's finest by Dr. Bancroft, and by a panel of judges and consultants chosen by him. A description of the general properties of each mineral featured, as well as a brief history of the particular specimen, usually faces the colored plate. The specimen of native silver from Kongsberg, Norway, and now in Peter Bancroft's own collection, is a strikingly beautiful specimen of wire silver so crystallized as to reproduce a swirl of motion reminiscent of that in the classic Greek statue, "Laocoön and his Sons."

Preceding the collection of 78 colored plates are short sections which describe the criteria for selection of the specimens photographed, a map illustrating their worldwide distribution, and hints about the storage of mineral specimens (some specimens cause deterioration of others, if in proximity).

Unfortunately, the section on "The Birth of Minerals" would have itself profited from control. In it the author describes ". . . the life cycle of three of the greatest specimens ever uncovered." *For the Cullinan diamond*—"Picture, if you will, a small, black, shapeless lump of pure carbon located many miles deep. . . . Centered in a gigantic molten mass of dense rock, it was subjected to enormous pressure and to temperatures of more than 1000 degrees centigrade. Hardly discernible changes began to take place in the anatomy of the carbon; the formation of a crystal had commenced." *For euhedral rose quartz*—"A second specimen, born in the back country of Brazil, started some years ago as a glob of silicon dioxide in a quartz vein which coursed its way through a pegmatite structure in the earth." Bancroft then describes the formation of milky and smoky quartz followed by the remarkable rose quartz crystals. He continues with, "Mother Nature then 'kissed' the large crystals lightly, leaving little groups of sparkling, brownish eosphorite crystals about the termination faces." The author then refers the reader to Plate 52 for a picture of the specimen, but the 78 plates lack such numbers (and mineral formulae). *For cerussite from Australia*—". . . nearly a mile below the surface of the earth and some millions of years ago, there existed a large and very rich mass of lead and zinc minerals. Prominent . . . were the primary sulfides of galena and sphalerite with the mineralized mass surrounded in part by a great bed of limestone. Surface waters percolated downward into the ore body and then flushed back, bearing minerals in solution from the heavy rocks below. As the mineral-laden waters came to rest in the limestone formations nearer the surface, new oxide and carbonate minerals formed."

Nevertheless, there are 78 striking colored plates of mineral specimens of breath-taking beauty.

F. DONALD BLOSS
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MINERAL OPTICS, PRINCIPLES AND TECHNIQUES. By William Revell Phillips, W. H. Freeman, 1971. ix + 249 pages, 128 illustrations including 15 color plates. $12.50.

As the author points out, it is the aim of this text to introduce the student to fundamental techniques of optical crystallography with only so much theory as is essential to his being able to utilize them as a tool in mineralogy and petrography. In this respect the book is eminently successful. Theoretical considerations are reduced to a minimum (for example, only ray velocity surfaces are discussed), and emphasis is placed on optical behavior and appearance of minerals when viewed with the petrographic microscope. The organization is good; the style clear and direct. A brief introductory chapter on elementary concepts of light is followed by a practical approach to the petrographic microscope, and a chapter on refractometry. The next five chapters deal with the elementary theory of light behavior in isotropic, uniaxial, and biaxial crystals, each being immediately followed by a utilitarian discussion of the behavior of these substances in practice. The next three chapters deal with the universal stage and its application to practical petrographic and mineralogical problems. This is a very welcome addition to an introductory textbook. A

brief final chapter deals with sample preparation. There are no descriptive tables, selected minerals being described within the text as illustrations of specific phenomena or applications. This shortcoming, and the omission of detailed theoretical considerations, are in part remedied by an excellent bibliography arranged according to various topics.

The book is excellently illustrated throughout. Particularly noteworthy are the color plates, mostly of interference figures, which are grouped together near the middle of the book. The hand colored originals lend an element of realism to these figures which is rarely seen in illustrations. This is particularly apparent in the plates illustrating dispersion; these succeed in capturing the subtleties of the phenomenon. Of equal excellence are the illustrations of the universal stage combined with corresponding stereographic projections.

It is perhaps a pitfall of attempting a very simple approach to theory that brings about a number of unfortunate broad generalizations in the text. In describing birefringence the author states: *maximum birefringence is a fixed characteristic of the mineral variety*. A few pages later one finds the statement: . . . *only the maximum value* (of birefringence) *is a characteristic property of the mineral species.* It is not clear whether a distinction is being made between the terms *variety* and *species,* and in any case birefringence is not likely to be fixed. Furthermore, birefringence of fragments lying on cleavage surfaces are often more useful characteristics of some minerals than the maximum value. In conjunction with this observation is the one that little comment is made about the effect of compositional variation on optical properties except as it pertains to very special cases. Another such example is the statement: *Minerals* . . . (with) *high birefringence usually show large differences in absorption.* While the converse is often true, it is certainly not the usual case for the many colorless examples of highly birefringent minerals, at least not in so far as the visible spectrum is concerned, and that after all is what the text is dealing with. A number of errors in both fact and terminology exist, particularly in regard to crystal morphology and twinning. For example, it is stated that: . . . *pinacoidal planes are impossible twin planes (they are symmetry planes)* . . . in orthorhombic crystals. This seems to presume that all orthorhombic crystals have the maximum symmetry of that system, yet there are numerous examples of crystals in the class *2mm* which are twinned on the pedion, though admittedly they do not lend themselves to optical study. The use of the term *composition plane* in reference to penetration twins is unfortunate. A number of other crystallographic terms are also used vaguely or in an ambiguous manner. A number of errors in Miller indices appear, particularly in the description of the twin laws of quartz where Miller-Bravais indices appear with all signs positive. The general remark that *the composition plane* (in monoclinic crystals) *is usually {001} or {110} for normal twins* is immediately followed by the example of normal twins of amphiboles and pyroxenes with twin plane and composition plane {100}. In view of the nontheoretical character of the text, it seems rather much to expect the student to grasp the fact that in monoclinic crystals there is no substantive difference between the *a* and *c* crystallographic axes.

Despite these errors and unnecessary confusions, the book should succeed well in serving its prescribed purpose. The material can be comfortably encompassed in the usual one semester course, and in accompaniment with appropriate descriptive material should serve as both text and laboratory manual. In view of the need for such descriptive material, a paper-back version of this text might be desirable.

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MICROSTRUCTURAL ANALYSIS: TOOLS AND TECHNIQUES. Edited by James L. McCall and William M. Mueller. Plenum Press, New York, 1973. viii + 343 pages. $22.50.

This book is a symposium of structure analysis techniques that will serve as a reference in current attempts to specify more precisely the behavior of materials in terms of their microstructure. The chosen topics cover a broad distribution of microscopical and analytical techniques.

Individual Chapter Comments

A. D. Booth, "Photographic Techniques": At first this chapter appears to contain too much historical material but actually it gives useful guidelines about performance of objectives and selection of microscope illuminators.

J. H. Richardson, "Specimen Preparation Methods": This chapter is notable for its omission of methods for transmission electron microscopy (not discussed in detail by Mitchell).

E. E. Underwood, "Quantitative Stereology": A good theoretical discussion of a rarely described topic. The automation of techniques is well covered in the chapter by Bartosiewicz and Eichen.

J. McCall, "Scanning Electron Microscopy": A useful brief introduction is followed by a wide selection of examples of polished and etched metal surfaces.

T. E. Mitchell, "High Voltage EM": Of the claimed advantages of high voltage electron microscopy, the statement about decreased radiation damage is incorrect. The author does not discuss the fact that a cheap scanning microscope can substitute for an expensive HVEM if increased penetration is required. Otherwise, the chapter is a good review of the subject.

R. W. Armstrong and C. Cin Wu, "X-ray Diffraction Microscopy": This chapter is a valuable discussion of a new and rarely described technique.

"Leed, Auger, Field Ion, Microprobe Analysis, Ion Spectrometry, and Scattering." These chapters give useful introductions to the techniques together with an adequate number of examples.

The volume is a valuable one for metallurgists since it provides a good review of new techniques. However, the title is misleadingly general since microstructural analysis of non-metals is discussed to only a small extent.

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THERMODYNAMICS OF ROCK-FORMING CRYSTALLINE SOLUTIONS. By S. K. Saxena. Vol. 8 in a Monograph Series of Theoretical and Experimental Studies; Minerals, Rocks, and Inorganic Materials. Springer-Verlag, New York, Heidelberg, Berlin, 1973. xii + 188 pages. $17.80.

This monograph represents volume 8 in a series begun in 1968 entitled "Minerals, Rocks and Inorganic Materials." Its intended users include graduate students and professional mineralogists, experimental petrologists, and physical geochemists. The author has written this book in order to stress the importance of understanding relevant solutions in natural assemblages from the standpoint of thermodynamics.

The book begins by defining crystalline solutions, with emphasis on the choice of components and reference states, and the concepts of ideality and non-ideality. Several practical models are briefly presented as an aid in considering non-ideal solutions. In chapter 3, examples are presented to illustrate immiscibility relations in binary and ternary solutions based on equilibrium thermodynamics. These concepts are then discussed in terms of mineralogically pertinent crystalline solutions. Since the experimental determination of the compositions of coexisting phases is the chief source of data in delineating the thermodynamic behavior of mineral solutions, common techniques assuming ideality, non-ideality for two simple mixtures, and a regular solution model are reviewed. One important factor in petrogenesis is whether natural assemblages represent equilibrium conditions. This can often be ascertained by consideration of the partitioning of a component between two coexisting binary phases at a constant pressure and temperature. Several graphs are presented in the book to illustrate this concept. Phase compositions can sometimes be used to predict pressures and temperatures at which a natural assemblage crystallized, and an example involving orthopyroxenes is presented. Techniques are given in chapters 5 and 6 for determining activities in crystalline solutions from compositional data of coexisting phases using (1) no model, (2) a simple mixture model, (3) a two- or more-constant asymmetric model, or (4) a regular solution model. Such models often provide useful approximations when experimental data are lacking or difficult to obtain. Equilibrium phase diagrams are often helpful in calculating thermodynamic functions of mixing in crystalline solutions.

The monograph then addresses itself to the problem of determining thermodynamic properties of rock-forming silicates. Silicates contain relatively inert structural sites having regular geometry. Complete order or disorder is not usually possible, in contrast to metal alloys. Chapter 7 deals with the basic concepts in order-disorder phenomena, intracrystalline ion exchange, and site activities in silicate solutions. These concepts are then used to determine activity-composition relations of a homogeneous crystalline solution. The next three chapters are concerned with applying the outlined principles to the determination of the thermodynamic properties of pyroxenes, olivines, and feldspars at high temperatures. Results are presented in a series of illustrations, combined with the relevant equations. The final chapter deals with the determination of geothermometry from inter- and intracrystalline equilibria and the great limitations inherent in such determinations. An extensive appendix presents several computer programs (1) for the calculation of activities from two-phase data, (2) for the analysis of the partitioning of a component between two binary crystalline solutions, and (3) for the calculation of a ternary miscibility gap. A listing of numerous references completes the book.

In general, this monograph will be of considerable use, and I recommend it to the limited number of geoscientists presently engaged in thermodynamic determinations. It presents a useful consolidation of widely scattered concepts and examples for calculating the thermodynamic properties of crystalline silicate solutions. However, the reader will be disappointed if he is looking for significant new concepts in this rapidly changing field.

The book employs a telegraphic writing style, which is usually easily understood; however, there are some awkward paragraphs that are confusing and detract from the overall succinct presentation of the concepts. The 67 figures are clear and readily understood. A few pages of text in my copy were poorly printed. Some of the computer printouts in the appendix were also difficult to read.

I envision that this would be a book normally shelved in technical libraries for use by specialists. Its relatively high price for the thin volume precludes many students and others from including it in their personal libraries.

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THE OXIDATION-REDUCTION POTENTIAL IN GEOLOGY. By Mikhail F. Stashchuk. Translated by J. Paul Fitzsimmons. Consultants Bureau, Plenum Publishing Corp., New York and London, 1972. 121 pages. $30.00.

In his preface, the author states that his purpose is to provide "a physiochemical evaluation of existing methods for determining the oxidation-reduction conditions under which sedimentary rocks form." Stashchuk's goal is a laudable one, for the literature on methods of determining redox conditions during the formation of sedimentary rocks is in large part a morasse of pseudoscience, revealing a serious lack of understanding among many researchers of the meaning of redox potential or Eh and what controls it. Most of the development and application of methods of Eh determination in sediments have been performed by Russian scientists. One of the most useful functions of this book is its critical review and rejection of much of the published research dealing with the conception and interpretation of Eh measurements in sediments. Fallacies noted by Stashchuk include confusing the redox capacity of a sediment with its Eh; computing the original Eh of an ancient sediment from the rock's present Fe^{3+}/Fe^{2+} ratio, or its total sulfur or organic carbon content, or grinding the rock and measuring Eh in the wetted powder. Stashchuk points out that to learn the Eh-pH conditions in a sedimentary rock when it is formed, we must study the rock's composition in redox-sensitive elements, and that the most accurate judgment of such conditions is possible when two or more minerals containing such elements coexist. Another useful

contribution of this book is its citation and discussion of the voluminous Russian literature. The bibliography contains 273 references, mostly Russian, dated from 1882 to 1965. Stashchuk also reproduces in tables and graphs many measurements of Eh, pH, and redox-related species in recent sediment waters, data not generally accessible to English readers.

However, in spite of these positive aspects, the book displays a wide variety of flaws, some serious. In Chapter 1, Stashchuk describes and critiques methods of determining redox conditions in recent and older sediments. Chapter 2 develops the thermochemical principles of the equilibrium constant, Gibbs free energy, and redox potential at a level intended for the neophyte. Unfortunately, Stashchuk's presentation is sprinkled with inaccuracies and oversights. For example, he states that ion activities are *always* equal to or less than their concentrations. He neglects complex ions, such as $Fe(OH)^{2+}$, and complexation in general. He is unaware of the major effects of variations in particle size and crystallinity on mineral stabilities. Most of his thermochemical data is from pre-1952 sources, and much of it is in error. For example, he recommends an E° of 0.75 v for the Fe^{3+}-Fe^{2+} couple at 25°C, whereas the established value is 0.771 v.

In Chapter 3, which is devoted to the construction of and discussion of stability diagrams of iron minerals, the author argues that measured Eh is determined by the most poised system in the water. This is not true when more than one redox couple is producing a significant current flow at the electrodes. In this case, a mixed potential or Eh results which does not equal that generated by the most abundant redox pair. Chapter 3 contains an interesting discussion of sulfur geochemistry. However, the following iron-sulfur section endorses conclusions not supported by the post-1965 work of R. A. Berner or D. T. Rickard, among others. Thus, Stashchuk unconvincingly argues for the existence of Fe_2S_3 and for stable ferric sulfides in sediments.

Chapter 4 examines conditions of formation of iron minerals during sedimentation and diagenesis. Thermochemical justification is presented for the essential absence of siderite in marine sediments. On p. 90, Stashchuk argues, "The formation of magnetite and siderite from ferric hydroxide (in marine sediments) should prove possible only under more reducing conditions than those for the formation of sulfides." Examination of Eh-pH diagrams for iron species shows this sometimes is, and sometimes is not, true. On p. 91, as elsewhere, some of the author's thermochemical derivations are built on false premises. For example, he calculates an ion charge balance after dissolving FeS in pure water and ignores HS^-.

The text is relatively free of grammatical errors, although one wonders if some of the overly general statements might not have been created by translation. Obvious errors include the statement on p. 19, "ferric oxide in solution," a missing pH label on Figure 22, and repeated misspellings of greigite. Also, Klein and Johnston (misspelled Johnson) are cited on p. 97 but never referenced.

In short, the book is an interesting historical account of Russian research on the determination of redox conditions in modern and ancient sediments; contains a useful critique of much of the previous work in this area; and includes many measurements of Eh and related properties of sedimentary waters not generally available to non-Russian workers. On the negative side, the price of the translation must be seriously weighed against the value of its content. The book's errors are serious enough to mislead a reader unfamiliar with the thermochemical concepts used. Those concepts, as derived in Chapter 2, have been better presented in books such as Garrels and Christ's *Solutions, Minerals and Equilibria.*

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STEREOGRAPHIC PROJECTION OF CRYSTALS: AN ELEMENTARY INTRODUCTION AND PRACTICAL GUIDE FOR STUDENTS. By Robert Johnston. Scottish Academic Press, Edinburgh and London, 1973. 48 pages. Paperback. £0.75.

This nicely printed and illustrated manual is, unfortunately, much too brief and restricted in scope for most potential users. The spherical and stereographic projections are introduced with the aid of photographs of a wire model. The wire model seems an admirable teaching device, and some readers might wish to reproduce it. The photographs, however, communicate less effectively than equivalent line drawings. The Wulff net is briefly described, and step-by-step instruction for the construction of ten projections given. Common rock-making minerals such as zircon, olivine, and feldspar are used as subjects for these exercises. Two twinned crystals are projected. Although the presentation is admirably clear and simple as far as it goes, there are serious flaws. Many topics of importance to some users of such a manual have been omitted. No construction is given for small circles other than those concentric with the primitive circle, or traceable from the Wulff net, nor are such circles discussed. The internationally accepted system of angular coordinates, φ (phi) and ρ (rho) are not used or mentioned. No mention is made of the possibility of rotating the projection other than about its center. Miller indices are used only for faces or their poles on the projection, and no use is made of form symbols or zone-axis symbols. The names for point groups are not the generally accepted Modified Groth names: pyrite, for instance, is referred to the Didodecahedral Class. Although extraction of symmetry is mentioned, no specific illustrations of the finding of symmetry elements, notation for symmetry, or symmetry symbols are given. A brief bibliography is supplied.

HENRY E. WENDEN
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List of Books Received

ADVANCES IN MOLTEN SALT CHEMISTRY. Vol. 2. Edited by J. Braunstein, Gleb Mamantov, and G. P. Smith. Plenum Press, New York, 1973. xi + 259 pages. $20.00.

BLACK HOLES. Lectures delivered at the Summer School of Theoretical Physics of the University of Grenoble with grants from NATO and the Commissariat a l'Energie Atomique. Edited by C. DeWitt and B. S. DeWitt. Gordon and Breach Science Publishers, New York, 1973. xii + 552 pages. $32.50.

DIE ENTSTEHUNG DER GESTEINE: EIN LEHRBUCH DER PETROGENESE. By Tom. F. W. Barth, Carl W. Correns, and Pentti Eskola. Springer-Verlag, Berlin, New York, 1970. 422 pages.

EXPERIMENTAL AND NATURAL ROCK DEFORMATION/EXPERIMENTELLE UND NATURLICHE GESTEINSVERFORMUNG. Edited by P. Paulitsch. Springer-Verlag, Berlin, New York, 1970. 525 pages, 148 in German. $25.90.

FROZEN FUTURE: A PROPHETIC REPORT FROM ANTARCTICA. Edited by Richard S. Lewis and Philip M. Smith. Quadrangle Books, New York Times Book Company, New York, 1973. xv + 455 pages. $12.50.

GLOBAL EFFECTS OF ENVIRONMENTAL POLLUTION. Edited by S. Fred Singer. Springer-Verlag, New York, 1970. xii + 218 pages. $12.00.

HIGH TEMPERATURE OXIDES. Vol. 1. Magnesia, Lime, and Chrome Refractories. Edited by Allen M. Alper. Academic Press, New York, 1970. 358 pages. $17.00.

HIGH TEMPERATURE OXIDES. Part IV: Refractory Glasses, Glass-Ceramics, and Ceramics. Edited by Allen M. Alper. Academic Press, New York, 1971. 254 pages. $16.50.

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