BOOK REVIEWS


This book comprises the papers presented at a discussion meeting held April 7-8, 1976 and organized jointly for the Royal Society and the Mineralogical Society in celebration of the latter Society's centenary. It has also been published as Phil. Trans. R. Soc. London, A. 286, pp. 235-638, 1977. The papers are as follows:


The quality of the organizers and the reputation of the authors have resulted in the production of an outstanding volume which has much of interest for anyone working in mineralogy and related sciences.

BRIAN MASON
Smithsonian Institution


Sedimente und Sedimentgesteine is the third edition of the second volume of a three-volume series that summarizes the entire field of sedimentary petrology. This second volume was published in German in 1970 and part of it in English in 1974 (see book review of English edition in Am. Mineral., 61, p. 343, 1976). It has now been republished in its original German version with, however, an important addition: a complement section in the back of the book updates part of the subject through 1975.

This volume deals with sandstones, shales, conglomerates, carbonates, evaporites and authigenic minerals, and cyclic sedimentation. It is divided into seven chapters. The first chapter, Exogenous Cycle, and Chapter 2, Principles of Nomenclature, are very brief. They set the stage for what is to follow in subsequent chapters. The third and fourth chapters (Sandstones, Conglomerates, and Breccias, and Siltstones and Shales) are an extensive treatment of terrigenous sedimentary rocks. Chapter 5 (Carbonate Rocks) discusses particles, classification, diagenesis, and environmental indicators. Chapter 6 (Sedimentary Rocks of Mostly Chemical and Biological Origin) includes evaporites, silica, phosphates, iron and manganese rocks, ores, haematite, pyritic rocks, and coal. Finally, Chapter 7 (Cyclic Sedimentation), a brief chapter, discusses vertical sequences.

The complement section at the end of the book, consisting of 46 pages of text, a bibliography and an index (a total of 38 pages) updates the subjects of sandstones, conglomerates, and carbonates.

This book has been written for the graduate student and for research workers and geologists in industry. From personal experience I know that the previous German edition made a great impact on students of geology and on professional geologists in German-speaking countries. The authors state in the preface that this soft-cover edition is meant for students.

This comprehensive and competently written and researched book is scholarly, well-organized, and well-documented; the subject is logically presented.

Gerald M. Friedman
Rensselaer Polytechnic Institute


This compilation represents the fruits of the labor of the Commission on Ore Microscopy, organized in 1963 to establish standards for reflectance measurement and to publish modern quantitative data on the reflectance and micro-indentation hardness of

As the subtitle indicates, this is not a monograph on carbonatite–nephelinite volcanism in general. It is essentially a geological description of a small area (60 km x 60 km) on the shore of Lake Victoria, western Kenya, which is remarkable in its close association of six separate ijolite intrusions, eight carbonatite intrusive centers in various stages of denudation, several styles of fenitization and extensive nephelinite-phonolite volcanism. These magmatic events range from Oligocene to Recent in age. Some of the complexes (Rangwa, Ruri, and Homa Mountain) are known to students of carbonatites through the earlier investigations of Pulfrey, Saggerson and McCall, while neighboring centers in Uganda described by Davies, King and others (Sukulu, Tororo, Bukusu, Butiriku, Budeda, Elgon, Kadam, Napak, and Toror) belong to the same petrographic province but are not included in this study. Surely there are few areas in the world, if any, better suited to an appraisal of the relationship between carbonatite and nepheline magmatism.

Several authors have contributed to this volume. They were members of a research team from Bedford College, London (B. A. Collins and A. L. Findlay) and Leicester University (M. J. Le Bas, M. C. G. Clarke, J. A. Dixon, A. M. Flegg, and D. C. Rubie) who did the field work over a six-year period, 1963-1969. D. S. Sutherland collaborated on Homa Mountain. M. J. Le Bas took up the task of compiling the results, mainly from five Ph.D. theses which may otherwise have remained unpublished, and did so very skillfully. Contradictions and inconsistencies which may have existed have been removed and the reader is presented with a coherent story. Descriptions of field relations and petrography can be very tedious, yet provide essential facts: this has been relieved by dividing the book into a series of 24 short chapters, some very short indeed, each headed by a brief abstract. The style of writing is lucid and the text is well illustrated, mostly by maps at different scales. This device obviated the necessity of a large map covering the whole area, presumably also cutting down publishing costs; it would have been interesting to learn whether a colored map exists elsewhere.

Alkaline complexes are striking for their similarity despite their diversity of rock types. Many old acquaintances from Alnö, Fen, Spitskog, Oka, Iron Hill, and Magnet Cove are met again here in Kenya. Features that appear to be somewhat exceptional are the high abundances of melanite garnet in some of the ijolites and of wollastonite in urtite. Melilite shows interesting compositional differences in different rocks (uncompaghrite, turjaite, melilitite, olivine-melilitite). This is ascribed to temperature differences during crystallization and to metasomatism. Although no particular attention is paid to mineralogy, compositional data based on microprobe analyses of the rock-forming minerals are dispersed through the text. Among the less common minerals mentioned are nosean, monazite, eucolite, cebolite, bastnaesite, synchysite, and gärtzenite. Strontium isotope ratios and Rb, Sr, Ba, Zr, Nb, Y analyses of twelve representative rock samples are included, but the detailed discussion of the geochemistry is deferred for publication elsewhere. In an appendix 20 major oxide chemical analyses are given (most of them new).

The author has been able to draw up a detailed sequence of events between 22 and 1 m.y. ago, based on numerous K-Ar age determinations. What it amounts to is a repetition of the sequence ijolite (or melanephelinite)–carbonatite, with minor eruptions of phonolite. The fenitization effects associated with each phase could be better distinguished than in most other localities because they are not superimposed. Ijolite is magmatic, not an ultramafite. The formation of nepheline syenite is ascribed to reaction between ijolite magma and its fenitized wall rock: an interesting hypothesis apparently supported by the field evidence. The carbonatites are considered to belong to a crystallization differentiation series between 600° and 100°C in the order sÖvite–alvite–ferrocarbonatite–alvite. Structurally the most remarkable feature in the area is the spiral-shaped system of carbonatite cone-sheets on Homa Mountain; however, no attempt is made to explain the mechanism by which it was formed.

There are a number of proofreading errors (e.g. diamontiferous on p. 3, 4, 7, 8, 10; divine for olivine on p. 97; transposition of lines at top of p. 216; chadocrysts on p. 218; Na2O for Na2O on fig. 14.14; no scale on figs. 14.1 and 17.2 and incomplete legend on fig. 17.2). What is “ankeritic calcite” (p. 107)? More incomprehensible are the references (p. 9, 11) to a Kimberley-Pretoria (South Africa) carbonatite-nephelinite–kimberlite province of Mesozoic age. The “simplified classification” of carbonatites offered on p. 37 is not really new except for the introduction of the term ferrocarbonatite. This is useful and could be extended to include ferrosövite and ferroberforsite; dolomitic carbonatite may not be important in East Africa but certainly occurs elsewhere.

In the last two chapters the relevant literature is reviewed and a genetic hypothesis formulated. A fundamental distinction is made between olivine-poor nephelinites which characterize the carbonatite association and olivine-rich nephelinites associated with basaltic provinces. With regard to carbonatite the author favours the derivative “egg” rather than the “hen” concept but concludes, with
most recent observers, that there are "carbonatites and carbonatites" if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlitic carbonatite is to be included. He considers volatile-rich alkaline ultramafic magma (carbonated metatites) if so-called kimberlite...
The chapter concerned with the structure of diamond is a concise history of the arguments that have raged concerning the correct assignment of symmetry to the diamond. Also discussed is the hexagonal modification of diamond—lonsdaleite. Interestingly, Orlov accepts Skinner's (1957) average value for the cell dimension of diamond over that obtained by Lonsdale (1947) and Wright (1965). The latter authors used a Kossel line X-ray diffraction technique that has inherently greater accuracy than that used by Skinner.

In discussing the presence of chemical elements in diamond a glaring omission is the absence of any discussion regarding sulfur. This section would also have been improved by some form of table listing the various elements, their concentrations, and varietal diamond types.

Considerable discussion is given to the presence of N, in diamond. Since this element is the major impurity in most diamonds and also appears to govern many of the physical properties, such discussion is reasonable. However, at the present time the most recent studies generally agree that the platelets in type la diamonds are not due to N,. Where the N, is and what constitutes the platelets is a major problem in the physics of diamond.

The largest chapter (V) is concerned with the morphology of diamond. This is perhaps the major research topic of Orlov and a previous book he wrote was on this topic. In this chapter he answers some of the Russian criticisms of his previous work.

In reviewing previous work Orlov is generally objective, but in other aspects a considerable amount of subjective thought is presented as fact. For example, many mineralogists would be hesitant to accept that green spots on diamond are the result of diffusion by elements into the diamond. Orlov's dismissal of an origin by proximity to radioactive minerals is not altogether in keeping with geological evidence. Also, the absence of reference to many non-Russian pioneers of kimberlite and diamond work is inexplicable. Typical of this is the reference to Vladimirov et al. (1976) concerning the use of the diopside-enestatite geothermometer and the Al2O3-enestatite geobarometer. Undoubtedly Boyd (1973) and MacGregor (1973) should have been credited. Also, when discussing the separation of mineral inclusions in diamond into two parageneses little note is made of the first observation of this division by Meyer and Boyd (1968, 1969, and 1972).

One or two other errors have crept in. For example, the American, Kimberlite, and Black Lick kimberlites (not Ick as in the text, p. 160; also Sinkanks not Sinkansas) are northeast of the Prairie Creek Kimberlite, Arkansas and not south. Where are the reports of recent diamond-bearing kimberlites in Spain (p. 161)? Not all kimberlites in Africa are Mesozoic (p. 162), and the presence of diamonds in kimberlite dikes has been known for a considerable time, and not just recently as stated on p. 163. Also, phylrites are hardly "strongly metamorphosed" (p. 165).

However, I would be remiss to harp on the errors and inaccuracies in the text and not praise the author for his excellent compilation of data and facts regarding diamond. It is probable that further works on the physics, chemistry, and mineralogy of diamond will rely heavily on this text as a source reference. For this reason, as well as the general readability and the author's wide knowledge of the Russian diamond literature, I recommend this text for anyone interested in diamond research.

HENRY O. A. MEYER
Purdue University


See reviews of volume III/7, parts a, b, e, and g (Am. Mineral. 59, 1142; 61, 344; 61, 817). Part f extends the coverage to 4079 oxycompounds of Cr, Mo, W, Mn, Tc, Re, Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, and Pt (not including simple oxides or hydroxides, which were covered in part b). For each compound the formula, space group, cell dimensions, cell content, and observed specific gravity, and if available) structure type, crystal form, and refractive indices are given. The data content per page is high, but the price of the volume is a severe limitation on possible purchases.

BRIAN MASON
Smithsonian Institution


This book presents a new and simplified method for the orientation of single crystals, based on the direct comparison of Laue patterns with Laue diagrams plotted by a computer. It is intended for solid-state physicists, crystallographers, mineralogists, and other scientists who are engaged in materials science involving crystal orientation. Chapter 1 is a survey of the main properties of periodic structures. Chapter 2 discusses diffractions by crystals in terms of Bragg's Law, and outlines the intensity calculation used in the computer program. Chapters 3–5 describe the crystal structures of the elements and of the most important RX and RXX compounds. The plotting program is given in Chapter 6 and the orientation of single crystals is treated in Chapter 7. Chapter 8 (plots of Laue patterns of the elements) forms the bulk of the book (p. 76–349), followed by Chapter 9, RX compounds (p. 350–380) and Chapter 10, RX compounds (p. 380–429). This book should be especially useful to metallurgists and other scientists working on elements and alloys.

BRIAN MASON
Smithsonian Institution


This book has been sponsored and subsidized by the Mineralogical Society of Pennsylvania, a largely amateur group of mineral collectors; the Society previously sponsored The Mineralogy of Pennsylvania, 1922–1965, by Arthur Montgomery (reviewed in Am. Mineral., 56, 364, 1971). After a brief introduction, and a useful section on mineralogical nomenclature, the main part of the book consists of an alphabetical listing of 56 species, ranging from
acanthite to violarite. For each species the following data are provided: locality, host rock, collector, identifier, literature references, and references to the species in selected textbooks and handbooks. Thirteen of the species have been found on burning culm (refuse) banks at anthracite mines in NE Pennsylvania. This is a very useful publication for anyone interested in regional mineralogy, and for those wishing to collect in Pennsylvania.


**Brian Mason**  
Smithsonian Institution


Having been an appreciative user of this book since the first edition appeared in 1941, I opened this sixth edition with keen anticipation. Yes, it is considerably thicker than the fifth edition, and I looked eagerly in the index for such recently-described minerals as pyroxferroite and tranquillityite. They were not there! Comparison with my copy of the fifth edition then revealed that this so-called sixth edition is an exact photocopy of the previous edition, save for the substitution of sixth edition for fifth edition at various places in the Preface, and a new title page. The additional thickness results from the use of a different grade of paper. So if you already have the fifth edition you don't need the sixth. However, if you don't have the fifth edition, then the sixth provides a comprehensive listing of all well-characterized minerals up to 1969, including the reference to the first describer and the year of description, the chemical formula, symmetry, cell dimensions, cell contents, and short explanations of the structure type.

**Dennis Eberl**  
University of Illinois  
at Urbana-Champaign

**CLAYS AND CLAY MINERALS IN NATURAL AND SYNTHETIC SYSTEMS.** By Bruce Velde. Elsevier Scientific Publishing Company, P. O. Box 211, Amsterdam, The Netherlands, and 52 Vanderbilt Ave., New York, NY 10017, 1977. 218 pages, 50 figures, 3 tables, 418 references. $25.50.

This book attempts to present a general outline of clay petrology. Both clay minerals and zeolites are included. In general the approach is to plot the compositions of natural clays on composition diagrams, such as the ternary diagram $M^+R^+\cdot 2R^+\cdot 3R^2+$ and then to draw tie lines between compatible phases. Compatibility under given $P-T$ conditions is inferred from phase relations found in hydrothermal experiments and from natural associations. The hope is that the phase diagrams thus constructed can be used to describe clay mineral petrogenesis.

This synthetic approach implies that the synthetic and natural assemblages used to construct the diagrams were at equilibrium. How do we know they were at equilibrium? The author offers two practical criteria: (1) for synthesis experiments run between $200^\circ$ and $400^\circ$C, run times must be at least one month; and (2) for natural minerals, neoformed phases are probably stable, whereas detrital clays frequently represent conditions found at the source area. Using these criteria the author feels it is possible to establish the “effective stability” of an assemblage even though the assemblage may not represent a true thermodynamically stable equilibrium.

The author cautions that the phase diagrams may not be correct; and the reader may well beware, since the approach ignores reaction kinetics. From the reviewer’s experience, a run time of one month is often insufficient to approach equilibrium. For example, measured rate constants suggest that a $K$-beidellite starting composition would take 6 years to approach the probable equilibrium assemblage of illite, kaolinite, and quartz at $260^\circ$C and 2 kbar pressure. With such sluggish rates, the path of the reaction becomes important. The use of metastable phases formed after one month of reaction along this path leads to incorrect diagrams.

A second criticism concerns the use of the coordinates $M^+R^+\cdot 2R^+\cdot 3R^2+$ to represent clay systems. Such a simplification does not distinguish between different layer interlayer cations, and interlayer chemistry has recently been found to be an important variable for describing clay petrogenesis. Finally, it would have been interesting had the author used thermochemical approximations to help delineate reaction boundaries. On the other hand, we are warned that “… the intent of this essay is not perfect symmetry nor total rigor. …” The approach is practical, whereas a more rigorous approach of similar scope may not be possible.


According to the preface the author’s intent is to “introduce the uninitiated reader to a rapidly growing branch of geology without a lengthy initial treatment of classical thermodynamics” and “that the reader will be able to use this book as a workshop manual for the subject.”

The book consists of seven chapters: Introduction and definitions, Standard states activities and fugacities, Multicomponent solids and fluids, Geothermometry and geobarometry, Silicate melts, Behaviour of trace components, Estimation of thermodynamic data, Thermodynamic properties of gas (Appendix). Most chapters end with a summary, problems, and solutions to the problems. The text is reproduced directly from typescript on a rather poor-quality paper.

The authors’ approach is somewhat parochial. Except for the graphite-diamond equilibrium, virtually all of the worked problems involve only binary or multiple oxide phases. There are, unfortunately, no examples of problems concerned with aqueous equilibria or of reactions involving both silicates (or oxides) and sulfides, not problems involving changes in oxidation state, i.e., $fO_2$ dependence. There is only a miniscule discussion of calorimetry. This reviewer found the chapters on silicate melts and trace components the most useful.

Several factual errors were noted. Among the more blatant are:

- p. 23. $C_p$ does not approach a constant at high temperatures, $C_v$ does. Equation 1.27 is only a rough approximation to the behaviour of $C_p$ at high temperatures.

- p. 25. Example 1 is bound to confuse the student. It starts out with
During the past decade, interest in ophiolites has increased enormously. The rocks of “Steinmann’s Trinity” have been known for many years as a field association of serpentinite, diabase-dolerite, and chert. The advent of plate-tectonic theories in the 1960’s coincided with renewed studies of ophiolite assemblages at classic localities such as the Troodos complex in Cyprus, the Papuan ophiolite in New Guinea, and the Vourinos complex in Greece. These studies reinterpreted the ophiolite assemblage as representing allochthonous blocks of oceanic crust thrust onto continental rocks by crustal plate interactions. More recent field studies and international conferences (The Penrose Conference on Ophiolites in 1972 in the western United States and the Symposium on Ophiolites in Moscow in 1973) have produced new and valuable information and achieved some consensus among geologists as to the definition and general origin of ophiolites. The publication at this time of the book Ophiolites by R. G. Coleman is a noteworthy event, coming at a stage of critical transition from broadly descriptive studies to more detailed and problem-focused studies that must characterize the next stage of geologic research on ophiolites.

The general style and presentation of the subject is attractive and very readable with considerable balance in subject matter. There are chapters on igneous and metamorphic petrology, ore deposits associated with ophiolites, and the geologic character, plate tectonics, and emplacement tectonics of ophiolites. The book concludes with a lucid presentation of the complex geologic, tectonic, and petrologic nature of four examples: the Bay of Islands, Troodos, Semail, and Papua ophiolites.

Throughout the book, there is a general absence of dogmatism regarding the subject. This is emphasized in the subtitle for the book: Ancient Oceanic Lithosphere? The author repeatedly reminds us that there are no examples of ophiolites currently being obducted onto plate margins and that the arguments for ophiolites representing oceanic lithosphere must be by analogy. Likewise, he is careful to point out the many gaps in our knowledge on the chemical and physical properties of ophiolites, the serious problems associated with metamorphism and alteration of many of the rock units, and the difficulty in finding critical contacts in many areas as a result of structural complications. He does, however, clearly lead us through his own carefully considered conclusions, some of which will be disputed by other specialists on ophiolites. These include the following: the ophiolite assemblages are polygenetic and the tectonized peridotite at the base of the sequence cannot represent the refractory residue left from the melting event that produced the overlying gabbros and lavas. The peridotites are, however, the residua of much older partial melting and deep-seated metamorphism. The younger gabbros are comagmatic with the sheeted dikes and lavas, a conclusion that is based on geochemical similarities despite the scarcity of well-exposed contacts between gabbro and sheeted dikes or of field relations showing dike sequences clearly intruding the deeper levels of gabbro. The composition of the parent magma for the gabbro–diabase–lava sequence has not been determined. The author argues forcefully that pervasive metamorphism and alteration of bulk composition prevent a successful chemical classification of ophiolites based on our present understanding of the compositions of the sheeted dikes and lavas. He rejects the idea of a separate spilitic magma type, and on the other hand he accepts the idea that plagiogranite rocks are true igneous differentiate of gabbro. I do not concur with his tentative acceptance of the idea that high-aluminum low-chromium chrome in peridotite indicates high-pressure equilibrium, whereas low-aluminum high-chromium chrome represents a low-pressure equilibrium. This is clearly not the case in Canyon Mountain,
High-aluminum chromite occurs very near the gabbro-peridotite contact and, by analogy with oceanic crust models, at a depth of only about 6 km. High-aluminum chromite also occurs within the cumulate gabbro section in the Bay of Islands ophiolite in Newfoundland, which also is not of high-pressure origin.

Students of ophiolites will find the book especially valuable for its focus on the principal areas of needed research. One cannot help but be made aware of the repeated observations that field relationships in many areas remain poorly known, that geochemical studies on complete sequences have not been published, that systematic mineralogical studies of sheeted dikes have not been made, and that cyclic units and compositions of cumulus phases have not been worked out in the cumulus sections of gabbro. The authoritative manner in which the author has outlined the present status of research on ophiolites should help to influence and mould the course of investigations over the next several years. Some of this needed data is beginning to appear in studies completed too late to appear in the present volume. Some examples include the careful study on the internal structure of the Troodos ultramafic rocks by R. P. George, the petrologic studies on the Bay of Islands by John Malpas, the study of the seismic properties of the Bay of Islands ultramafic rocks by N. I. Christensen, and the current work on the Semail ophiolite by Ian Gass and J. D. Smewing and by C. A. Hopson, E. H. Bailey, and R. G. Coleman himself. As a guide for future studies of these rocks, Ophiolites is an invaluable book for careful reading and consideration. It also serves as an excellent introduction to the subject for the student as well as for the general reader.

Benjamin A. Morgan
U.S. Geological Survey
Reston, Virginia


The original edition of "Dana's Manual" was written in 1848 by James Dwight Dana. The fact that the present edition is the 19th testifies both to the continuing popularity of the book, and to the willingness of various authors, namely William E. Ford (13th and 14th editions), Cornelius S. Hurlbut, Jr. (15th through 19th), and Cornelis Klein (19th) to keep it up to date.

The character of the book may be due to this continued process of revision: it is comprehensive, rather than intensive. Virtually every subject pertinent to mineralogy is discussed, including history of the science, traditional morphological crystallography, X-ray crystallography, crystal chemistry, physical and optical properties of minerals, systematic mineralogy (according to Dana's classification), an introduction to petrology, and determinative tables for hand-specimen identification of minerals. Naturally, with a coverage this broad, no single subject can be dealt with at length. Instructors who use the book as the basis for an introductory course will probably desire to supplement it in their favorite fields. Nevertheless, the authors have managed to present and explain most of the important concepts in each field. The writing is concise and understandable, and illustrations are generally clear and useful although a few of them contain too much detail.

Besides considerable reorganization and rewriting, the 19th edition differs from the 18th chiefly in the addition of descriptions of the crystal structures of individual minerals. The lack of such up-to-date, concise descriptions has been a serious deficiency not only of introductory textbooks, but of reference works of mineralogy. The descriptions are accompanied by illustrations which are good on the whole, considering the limitations of two-dimensional representation of structures. This edition also includes a section on phase equilibria. The crystal-chemistry section has been expanded and a table of ionic radii added.

Although updating of the book has been commendable, a few sections still retain some obsolete material. The discussion of external forms in the crystal systems is perhaps overly exhaustive, and probably not many will use the blowpipe and chemical tests in an age of readily available X-ray and optical techniques. A short section on determination of crystal structures has been added, but it is doubtful if anyone could obtain from this book a clear idea of the process of finding the unit-cell shape, size, and contents, and atomic arrangement of an unknown crystal. Space groups are discussed, but there is no mention of how they are determined, or how they are used in determining and describing crystal structure.

Dana's Manual will undoubtedly continue to be a popular introductory text, and a valuable reference for geologists and amateur mineralogists.

Eric Dowty
Princeton University


This nicely printed and bound volume contains sixty-two of the papers presented at a three-day conference held in Karlovy Vary, Czechoslovakia, in the fall of 1976. Most of the papers are in English (mainly very good English), a few are in German and Russian, and one is in French. This conference was the seventh in a series of triennial conferences which aim at bringing together clay mineralogists and petrologists from Czechoslovakia and neighboring countries; in 1976 there was a sprinkling of participants from further afield including two (J. L. White and myself) from the USA. It is interesting to see the growth of this triennial meeting since 1964 as judged by the size of the Conference volumes: 1964, 135 p; 1967, 145 p; 1970, 160 p; 1973, 414 p; and in 1976, 497 p. Evidently clay mineralogy prospers in east European countries as well as in west.

The topics in the present volume cover a broad spectrum. The majority can be classified under the headings of mineralogy, petrology, geochemistry, and soil science. Not surprisingly in view of the importance of the ceramic industries in Czechoslovakia, many papers deal with kaolinite and include studies of the geology of kaolinite formations, the dehydroxylation kinetics, the mechanism of dehydroxylation, hydrothermal synthesis, organic reactions, ... Three papers, which include my own introductory lecture, deal with order-disorder and polytypism in layer silicates. Any selection of particular topics for special mention must involve a personal bias, but having acknowledged this, I can now mention the interesting paper of J. J. Fripiat on the surface properties of clays, in which he reviews the relations between surface charge, surface area, and surface reactions, all of which influence (or control) many of the technological applications. The nature of the clay minerals in the cement of oil- and
gas-bearing sandstones is discussed by Kulesza-Wiewiora and
Myslinska; they point out the presence of kaolinite (dickite), illite,
and chlorite, and essentially no water-swelling minerals; the results
are correlated with the porosity of the rocks. Perhaps the most
useful comment I can make concerns this series of publications as
a whole. It has been growing now for twenty years under the editor-
ship of Professor Jiri Konta, who must be congratulated for its
progress. It opens a window to clay-mineral studies in countries
and areas which are less accessible through other channels.

G. W. BRINDLEY
Pennsylvania State University

STRUCTURE DETERMINATION BY X-RAY CRYSTAL-
LOGRAPHY. By M. F. C. Ladd and R. A. Palmer. Plenum

This text is designed to be used by a senior to first-year graduate
student class in introductory X-ray crystallography. As such it
follows rather standard development, with two beginning chapters
on symmetry theory followed by chapters on fundamental diffraction
relations with one devoted entirely to intensity relations, fol-
lowed by four chapters dealing with general aspects of crystal
structure analysis, the last of which is a review of several repre-
sentative structure analyses. Although the sequence of development is
rather standard, the emphasis placed on various aspects is not, and
this has both positive and negative results insofar as its use in
mineralogy-geology courses in X-ray diffraction is concerned.

In mineralogy curricula symmetry theory is generally empha-
sized, starting at the introductory mineralogy level, where a major
part of most courses is devoted to it in comparison with the study
of solids in chemistry and especially in metallurgy and ceramics
curricula. It is essential that students have a firm grounding in
symmetry theory through at least space groups in order to be able
to handle the kinds of X-ray diffraction problems normally en-
countered by X-ray mineralogists. Thus it is a real pleasure to see
in this text more than the usual token introductory review of
symmetry relations. A full 98 pages is devoted to the subject. The
flavor is decidedly a familiar mineralogical one, with even a brief
mention of the measurement of interfacial angles and the use of the
Wulff net. Furthermore, the remaining text makes full and ample
use of the developed symmetry theory. The mineralogical flavor is
continued in the subsequent chapter dealing with pre-structure
analysis of the crystal, where several pages are devoted to elemen-
tary aspects of examination of crystals with a polarizing micro-
scope. The treatment is only introductory to be sure, but is repre-
sentative of the consistency with mineralogical needs. One aspect
of the symmetry treatment which might cause some readers some
problems is the unfamiliar symbolism associated with many vari-
able, for example the use of $\alpha^*$ for the reciprocal of $\alpha$, but with
the exception of that example beginning students should have few
problems.

Mineralogical courses in X-ray diffraction tend to be oriented
toward either in-laboratory experience or at least practical data
interpretation, and it is in this region that many will find this text
deficient. Diffraction relations for selected kinds of instrumenta-
tion are hardly more than mentioned. Approximately four pages
are devoted to the precession and Weissenberg methods, for ex-
ample, which is barely enough to explain their general natures. The
Laue method and indexing of oscillating-crystal photographs are
given slightly more space, but these methods are not much used.

The lack of treatment of experimental techniques is carried over
into structure analysis, where the methods of measurement of
intensity data and theory for correction for various factors are only
introduced.

The sections on principles of structure analysis describe ade-
quately the necessary introductory theory. A very positive aspect
of this section is the emphasis on analyses of structures using
simple examples. The final chapter is entirely devoted to examples.
There is therefore, unfortunately, little space available for an in-
depth analysis of techniques and theory and, for example, mineral-
ologists who are often concerned with refinements of known crystal
structure would prefer other than just an introduction to the gen-
eral nature of the least-squares technique.

In general this text would find application in formal beginning-
level graduate lecture courses in X-ray diffraction, especially those
dealing primarily with crystal-structure analyses as opposed to
gometry of X-ray diffraction. The full development and use of
symmetry theory throughout would make it especially valuable to
mineralogists. However, extensive supplementary material would
be required in any course where experimental results were obtained
and interpreted. The many specific and simple examples, together
with the well thought-out and extensive end-of-chapter problems
would at the very least make this text a valuable adjunct to existing
introductory crystal-structure analysis textbooks.

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KRISTALLE—WIE SIE WIRKLICH SIND—FORM, FARBE,
FEINBAU. By Werner Lieber. Christian Weise Verlag, Munich,
West Germany, 1977. 128 p., 74 b&w photos, 54 color photos,
51 line drawings. DM 36, approx. $18.

This new, lavishly illustrated book delves into the fascinating
oddities of the mineral kingdom and explains them in a simplified
text augmented by suitable diagrams and photographs. It consists
of three major sections, the first primarily dealing with aggregates
as well as individual crystals, the second on the nature of atomic
structure in crystals and its relationships to form and properties,
and the last on color and its various manifestations and their
causes. These headings do not, however, indicate fully the scope of
each of the sections, for considerable ancillary matter is also in-
cluded. For example, in the first section appear discussions of
associations and parageneses (albeit very brief), pseudomorphs,
etch and solution marks, and bent or otherwise "distorted" crys-
tals.

The second section adheres fairly closely to its central theme of
fine structure in crystals but also includes a substantial treatment of
the confirmation of structures by X-rays, their application in
crystallographic investigations, defects, causes of "scrolled" crys-
tals in clays and serpentines, and the direct relationships of several
physical properties to structure. The third section similarly treats
more than color, giving, in addition to an excellent discussion of
color centers, material on inclusions and "sand" crystals. This last
section is remarkable for a series of splendid color photographs of
a succession of color-zoned slices taken from a crystal of Malagasy
tourmaline and accompanied by a diagram correlated to the zon-
ing.

While a list of 29 references is provided, it does not include the
outstanding work of D. P. Grigor'ev, Ontogeny of Minerals (1965)
or the popular work by W. B. Sanborn entitled Oddities of the
Mineral World (1976), both of which address themselves to the same theme. Werner's book is both handsome, beautifully and pertinently illustrated, and, even to non-readers of German, a worthwhile addition to the library.

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These volumes represent the two most recent major crystal-growth meetings. The international Boston ICCG-5 meeting was run along conventional lines with plenary and triple parallel sessions, and 92 of the 265 talks presented are included in the proceedings. At the European Zurich ECCG-1 meeting only the invited talks were presented orally, the 130 contributed papers being given in poster sessions. The proceedings contain extended versions of 28 out of the 48 invited talks.

This difference in approach leads to a significant difference in the proceedings. The ICCG-5 papers, averaging seven pages each, give brief reviews of the current state of a wide variety of areas and research topics. The ECCG-1 papers, averaging 33 pages each, give extended reviews (in much more detail than was presented at the meeting) on a more limited range of topics. There is a considerable overlap.

A number of the articles in both volumes are of direct relevance to the mineral/rock scientist. Particular examples occurring in both volumes include the detailed treatment of the capture of inclusions by Chernov et al. and the observation and simulation of step structures on NaCl crystals by Bethge et al.; the ECCG-1 reports are the more detailed. Oswald and Günter give some examples of topotactic crystallization in ECCG-1, and in ICCG-5 there is a review of natural crystallization by Sunagawa and a report by Lang on the observation of defects in diamond by cathodoluminescence topography.

Either volume would surprise the scientist who has paid no attention to the field of crystal growth for some years. There has been a maturation process occurring on many fronts. Most notable is the successful interpretation of growth processes and growth defects by a variety of computer simulations, leading to new insight into the atomic processes at work; another good example is the superbly controlled growth of large crystals, e.g., a 250 gm flux-grown yttrium iron garnet crystal (respectively Gilmer et al. and Tolksdorf in both volumes). There have been similar strides in nucleation and growth, in the application of hydrodynamics to the understanding of growth instability, and in the field of crystal characterization. It is perhaps for the overview of such developments that these books can best be recommended to readers of The American Mineralogist.

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