American Mineralogist, Volume 68, pages 646–648, 1983

BOOK REVIEWS

GEOLOGY AT M.I.T. 1865–1965 Vol. II, DEPARTMENT OPERATIONS AND PRODUCTS. By Robert R. Shrock. M.I.T. Press, Cambridge, Massachusetts, 1982. xxvi + 762 pages + 14 appendixes. $45.

The first volume (over 1000 pages) of this work, published in 1977, consisted essentially of biographical sketches of the first fifty-three professors of geology at M.I.T. This second volume records in the greatest detail the activities and accomplishments of these professors and their supporting staff during the one hundred year period. The book is divided into twenty-five chapters each of which is essentially complete in itself. This method of presentation is helpful to the reader in giving a self-contained account of a given subject. However, it leads to much repetition of material presented in Volume I as well as in other chapters of Volume II and adds many pages to the text. A detailed outline of CONTENTS as well as lists of ILLUSTRATIONS and APPENDIXES enables the reader to locate quickly desired information. These are supplemented by two indexes: a SUBJECT INDEX and a NAME INDEX. In the latter, reference is made to the names of nearly 2000 persons mentioned in both volumes who in some way, even though very minor, were connected with M.I.T. geology from 1865–1965.

Chapter 1, INTRODUCTION, gives in chronological order the major events and people responsible for shaping geology at M.I.T. From the inception of the Institute, instruction was given in geology. This is not surprising for William Barton Rogers, a prime mover in its organization and first president, was a geologist. The history is considered in quarter century intervals. The first begins in 1865 with William Rogers as Professor of Geology giving instruction in the Department of Practical Geology, Mining, and Metallurgy. In the second and third quarters notable changes took place under the leadership of Jaggar, Lindgren, Shimer and Mead. These men not only directed the course of geology at M.I.T. but had a profound impact on the science of geology of their times. The fourth quarter ends with the retirement of Shrock as head of the department, a position he held for fifteen years. It was during his administration that the name of the department was changed from Geology to Geology and Geophysics. This change in name conformed with shift in emphasis that had taken place in both instruction and research; that is, away from traditional geology toward geophysics.

Chapters 2–24 treat in detail various aspects of M.I.T. geology. But for one interested in obtaining an overall picture of geology at the Institute during its first century, most of the pertinent information is given in the introductory chapter and Chapter 25, SUMMARY.

For readers of the *American Mineralogist* special mention should be made of Chapter 17, mineralogy and crystallography at M.I.T., written by Martin J. Buerger. From the very beginning of M.I.T., mineralogy was an important subject of study. At first, as "Descriptive and Determinative Mineralogy; Use of the Blowpipe", it was taught as part of Chemistry but in 1871 was transferred to Geology and Mining Engineering. Until 1910 mineralogy was primarily directed toward the identification and practical use of minerals. The subject was greatly stimulated in 1900 with the appointment of Charles H. Warren as Instructor of Geology and was given further impetus by the appointment of Waldemar Lindgren as Department Head in 1912. As the foremost economic geologist of his time, Lindgren attracted many graduate students, some of whom had a major interest in mineralogy. After Warren left M.I.T. in 1922, Lindgren had a succession of his students appointed to teach mineralogy: Joseph L. Gillson, 1922; Walter H. Newhouse, 1923; and Martin J. Buerger, 1928. Although Buerger's consuming interest was in crystallography, he continued to teach mineralogy until 1950 when he turned it over to one of his former students, William H. Dennen. Following a brief summary of the first 60 years of mineralogy at M.I.T., the remainder of Chapter 17 is an autobiographical account of the development of crystallography during the Buerger years from 1925 to 1975.

Although Professor Shrock devoted ten years to the writing of this two volume work, he modestly states that he does not consider it a complete and finished history of M.I.T. geology during the Institute's first century. However, he has left little for the future historian to add.

C. S. HURLBUT, JR.
Harvard University

MINERALS OF CALIFORNIA. By H. Earl Pemberton. Van Nostrand Reinhold, New York 1983. vii + 591 pages. $29.95.

Early "catalogues" of mineral species found in California were compiled by W. P. Blake (1866) and H. G. Hanks (1884, 1886) and were published by state agencies that were predecessors of the present California Division of Mines and Geology. In 1914 appeared the first edition of *Minerals of California* by A. S. Eakle, covering occurrences of 352 species. The most recent of five subsequent editions of *Minerals of California*, by J. Murdock and R. W. Webb, published as Bulletin 189 by the California Division of Mines and Geology, appeared in 1966 and covered 602 species.

About fifteen years ago H. Earl Pemberton undertook to continue the work of Murdoch and Webb. His "Supplement to Bulletin 189—For 1965 through 1969" was published as No. 2, vol. III of *The Mineral Explorer*, Bulletin of the Mineral Research Society of California in October, 1969. Tentative arrangements were made for the California Division of Mines and Geology to publish the next edition of *Minerals of California* to be prepared by Dr. Pemberton and work towards this end was carried on for several years. However, after the retirement of the late Ian Campbell as Chief in 1969 and removal of the headquarters of the Division from San Francisco to Sacramento during the governorship of Ronald Reagan the emphasis of activities in the Division changed drastically and state support for publication of further editions of *Minerals of California* was withdrawn.

Fortunately, Dr. Pemberton continued his work finally leading to the commercial publication of the present volume. This is far more than a revision of the earlier editions. It covers the occurrences of 736 terrestrial mineral species plus 5 species found in meteorites in California. The minerals are grouped under the major classifications—elements, sulfides, *etc.*, with each group presented generally according to the geochemical classification system of Kostov (1968). Fleischer's 1980 Glossary of Mineral Species was used for determining the validity of species. For each the name, chemical formula and, in some cases, crystal system and relation to other minerals are given. Occurrences are listed alphabetically by counties and literature

0003–004X/83/0506–0646$0.50

references or sources of information are given for every occurrence. Great care has been given to the designation and description of localities, most of which are defined in terms of the Land Office system or of geographic coordinates. There are 109 small maps showing the locations of mineral deposits. Some of these serve for just one locality but a dozen or more localites are indicated on most of the maps, a few are small-scale geologic maps. There are 126 photographs assembled from many sources. Some show localities of historical interest, most are previously unpublished and represent specimens in various private and public collections; many are SEM photographs, not all designated as such. 107 crystal drawings, mostly reproduced from the literature, span a period of nearly ninety years from cinnabar (Melville and Lindgren, 1890) to hungchaoite (Erd and others, 1979).

Most species are treated individually but others have been treated in groups based either on classification, *e.g.*, natrolite, mesolite, scolecite and thomsonite, or on association, *e.g.*, taramellite, muirite, verplanckite and traskite. The bibliography includes about 1800 references covering the literature exhaustively from 1849 to 1981. The few minor blemishes in the book, such as the faulty listing of greigite in Alpine County and the designation of a drawing of a crystal of garrelsite from Utah as representing material from California, may be attributed to the failure of the publishers to provide adequate editorial assistance.

This volume is far superior to any of the previous editions of *Minerals of California* and is one of the finest regional mineralogies known to this reviewer. It should be in the hands of everyone, professional or amateur, who has occasion to deal with mineral occurrences in California.

A. PABST
University of California, Berkeley

INTRODUCTION TO SMALL-SCALE GEOLOGICAL STRUCTURES. By Gilbert Wilson. George Allen and Unwin, Ltd., London, U.K., 1982. 128 pages. Cloth-$20.00, Paper-$9.95.

In keeping with an apparent policy of the publishing company, this book is short, easily read, inexpensive, and developed for the "field geologist". The intended reader is described on page 1 and again on page 111 as a "non-specialist", the "ordinary field geologist". Although the label sounds curiously demeaning, the aspiration is laudable; however, there are several problems in presentation. First, much of the basic material is available in good structural geology textbooks. The "non-specialist" may find a more comprehensive treatment preferable, particularly in light of revised and new structural texts due on the market in the near future.

The assumed background and the level of presentation is variable. For example, the discussion of Stress and Strain (Chapter 2) is extremely general and avoids any discussion of second rank tensors to generate the stress ellipsoid. The distinction between stress and strain is not strongly defined and the list of external variables affecting material response is notably lacking an appreciation for temperature. Yet in Chapter 3 the reader is immediately confronted with symmetry concepts as applied to deformed rocks without definition of basic fold terminology. By p. 12, the reader is involved in the intricacies of Sander's kinematic axes, and being asked to appreciate that these ideas apply to simple shear. While caution is voiced regarding the use of "kinematic" axes and "tectonic transport" directions (p. 13), there is a general reference and use of "b" versus "B" axes which will probably leave many geologists confused. By the end of Chapter 3 the author has laid the groundwork of domain analysis in polyphase folded terrains. Chapter 4 returns to very basic material concerning primary and secondary structures with particular emphasis on bedding plane slip in flexural slip folding.

Much of the terminology used in this book does not reflect current fundamental thought. For example, there is considerable effort among structural geologists to describe fabrics and folds without implicit genetic connotations. This is fundamental and necessary to avoid needless arguments about the facts and clearly define interpretation. Throughout this book, however, terms such as "fracture cleavage", "strain-slip cleavage" and "flow-cleavage" are common (*i.e.*, title of Chapter 7). In addition, the liberal use of stress concepts such as tension to describe strain features such as fractures (preferably extension fractures) creates an unwarranted interpretative picture (see Chapter 5). Again on p. 41, the author implies stress understanding from fabric development. "Thus, in a series of strata, should the movement or stresses be concentrated in one or more particular zones... one finds that there the cleavage is more strongly developed than elsewhere." High strain does not necessarily equate to high stress. There is a curious view of recrystallization on p. 32, "As the limit of relief by folding is approached, the rock-mass as a whole becomes more and more rigid, and if recrystallization occurs this rigidity may be still further increased." On p. 65 recrystallization is equated with "work hardening". Current rheological concepts based on careful transmission electron microscope study of deformation mechanisms has revealed that dislocation interaction is the principal mechanism for "strain hardening" while recrystallization is a recovery mechanism, which reduces the stored strain energy in a rock (See short summary, Tullis, *et al.*, 1982). Dynamic recrystallization is a ductile mechanism and tends to reduce the slope of a stress-strain curve. In discussing "Fracture cleavage" and associated crenulation cleavage, the author indicates that they are related to shear and symmetrically distributed about the axial planes of folds (p. 32). Then in the chapter (7) dealing with these fabrics the author states that "strain-slip cleavage commonly coincides with the axial planes of chevron folds" and that "the mechanism of formation of fracture cleavage is now considered to be similar to that of flow- or slaty-cleavage" (p. 51) and fundamentally related to flattening. The "non-specialist" will find these contradictions confusing and will not appreciate recent evidence strongly arguing for flattening (Gray and Durney, 1979).

While the author pleads for understanding of purpose (p. 111) in the "over-simplication (of the) subject, and sins of omission..." this reviewer feels that several significant and basic aspects should have been included in this book. Surprisingly, the discussion of strain is weak, particularly the omission of strain studies related to slaty cleavage. In fact, there is no mention of the resurgence of interest in slaty cleavage by workers such as Geiser (1975); Altermann, *et al.* (1975); and Beutner (1978, 1980). The role of flattening associated with fold development is only briefly discussed in Chapter 7.

In spite of these shortcomings this book provides some interesting perspectives. Throughout the text there are historical notes about the development of various concepts. For example, the initial observations regarding primary structures and sedimentary facing are discussed in a footnote on p. 17. There is good historical coverage of Riedel fractures, cleavage terminology in Europe and America, and boudinage and mullion terminology. Interesting field observations from the Alps, Scotland and

0003–004X/83/0506–0647$0.50

Wales add valuable data for unfamiliar readers. Finally, Chapter 13 is a short but interesting attempt to integrate small scale features into what Wilson has previously described as an "ideal" orogen (Figs. 2–4 and 13–2a). This exercise takes the reader back into the maze of "a" and "b" lineations, but does provide some interesting ideas regarding the role of confining pressure, stress orientations, strain rates, and temperatures in the development of regional fabrics. Along this line, for example, field data is supplied to indicate the depth (confining pressure) necessary for cleavage development (p. 41–42).

To summarize, this book is not a particularly good choice for the "non-specialist". The coverage of current ideas is incomplete and terminology imprecise. The results for such a reader would be to inherit conceptual and communication handicaps. However, for the more experienced reader, this book provides some valuable historical insights and basic data.

KENT C. NIELSEN
The University of Texas at Dallas

Alterman, I. B., Maxwell, J. C., Powell, C. McA., and Geiser, P. A. (1976), Slaty cleavage and the dewatering hypothesis—discussion and reply. Geology, 4, 789–794.

Beutner, E. C. (1978) Slaty cleavage and related strain in Martinsburg Slate Delaware Water Gap, New Jersey. American Journal of Science, 278, 1–23.

Beutner, E. E. (1980) Slaty cleavage unrelated to tectonic dewatering. Geological Society of America Bulletin, 98, 171–178.

Geiser, P. A. (1975) Slaty cleavage and the dewatering hypothesis—an examination of some critical evidence. Geology, 3, 717–720.

Gray, D. R. and Durney, D. W. (1979) Investigation on the mechanical significance of crenulation cleavage. Tectonophysics, 58, 35–79.

Tullis, J., Snoke, A. W. and Todd, V. R. (1982) Significance and petrogenesis of mylonitic rocks—Penrose Conference Report. Geology, 10, 227–230.

NOTICES

International Geological Congress Moscow, USSR, August 4–14, 1984

Papers are invited on the following three topics. Deadline: September 1, 1983.

C10.1.1. Typomorphism of minerals—Chairmen: B. Cambel, Bratislava; N. V. Petrovskaya, Moscow. Minerals as indicators of the conditions of their formation; comparative studies of minerals and mineral assemblages from different geological epochs; and experimental studies of the dependence of mineral composition and properties on the conditions of formation.

C10.1.2. New data of the crystal chemistry and structure of minerals—Chairmen: N. N. Mozgova, Moscow; A. S. Povarennykh, Kiev; H. Strunz, Berlin; B. J. Wuensch, Cambridge (Massachusetts). Crystal structure, crystal chemistry and classification of minerals; polytypism of minerals and methods of investigation; ordering and exsolution in natural solid solution series.

C10.1.3. Physics of minerals—Chairmen: A. S. Marfunin, Moscow; C. T. Prewitt, Stony Brook. Spectroscopy and electronic structure of minerals; physical properties of minerals at high pressures and/or high temperatures.

Symposia

S10.2.1. Thermodynamics of mineral formation—Chairmen: G. Haas, USA; I. L. Kodakovsky, Moscow; Y. Tardy, Strasbourg; V. A. Zharikov, Moscow District. Thermodynamics of hydrothermal mineral systems; thermodynamics of mineral systems in deep-seated zones of the Earth; thermodynamic models of magma and ore-forming systems.

S10.2.2. Fluid and Liquid Inclusions—Chairmen: N. P. Ermakov, Moscow; L. N. Kogarko, Moscow; F. Mrna, Prague. Microinclusions in magmatic and metamorphic rocks; microinclusions in hydrothermal systems; new methods and new approaches to the interpretation of data.

For more information contact: The Organizing Committee of the 27th IGC, Institute of the Lithosphere, 22 Staromonetniy, Moscow 109180, USSR.

MINTEK 50

In 1984, the South African Council for Mineral Technology, formerly the National Institute for Metallurgy, will be celebrating 50 years of growth and is organizing an international conference, MINTEK 50, to mark the occasion. To date, nearly 150 papers have been submitted for inclusion in the conference. After selection, there will be enough papers for three simultaneous sessions over the four days of the technical program. The following areas of interest will be covered in a series of technical sessions and excursions: Pyrometallurgy, hydrometallurgy, ore-dressing, physical metallurgy, mineralogy in mineral processing, mineral and process chemistry, analytical chemistry in mineral processing, control of mineral-processing plants. The aim of the Conference is to bring together those scientists and technologists whose interests are modern trends in mineral science and technology, and so the Conference will lay stress on the most recent advances in the above subjects. Those wanting to receive further information about MINTEK 50 should contact:

The Conference Secretary (C.25)
MINTEK
Private Bag X3015
Randburg, 2125 South Africa

Symposium on Alkaline Complexes—sponsored by the MSA September 16–18, 1983 in Wausau, Wisconsin

The symposium will be held at the Howard Johnson's Motor Inn and is designed to cover a wide range of aspects on alkaline complexes. The symposium is oriented towards professionals and advanced amateurs who desire an overview and primer for further study. Among the subjects to be covered will be: petrochemistry, geochemistry and mineralogy of alkaline complexes, internal evolution of pegmatite veins in alkaline complexes, important minerals and localities of alkaline complexes, and a special session on the local geology which will serve as field trip briefing. Papers will be presented by a number of eminent mineralogists and geologists September 16–17. September 18 will be a full day of field study in the Wausau and Stettin Complexes.

Participants will receive a set of lecture notes prepared by all the lecturers and others. The registration fee will be $65 to cover expenses. A banquet dinner is planned for the evening of September 17. For further information and registration contact: Al Falster, 920 McIntosh St., Wausau, Wisconsin 55401; (715)845-4473 (after 6 p.m.).