Hybrid Rocks

Selected Works: Granites and Migmatites. J. J. SEDERHOLM. Wiley, New York, 1967. vi + 608 pp., illus. $50.

Migmatites and the Origin of Granitic Rocks. K. R. MEHNERT. Elsevier, New York, 1968. x + 394 pp., illus. $26.

In 1907, in the first of the "Selected Works . . . ," Jakob Johannes Sederholm introduced the term "migmatite" to designate macroscopically composite rocks formed by the injection of igneous material into a metamorphic host. Thus the term originally had a genetic as well as a descriptive connotation. Currently, the name is used rather widely, in a chiefly descriptive sense, to apply to any composite rock which consists of both igneous-appearing and metamorphic constituents. The igneous-appearing component may be igneous, metamorphic, or a combination of these; it may have been injected as magma, have been introduced as a tenuous fluid, or have arisen essentially *in situ* as the result of partial melting or of some nonmagmatic process or processes.

Migmatites may be formed in marginal zones of igneous intrusions or in "metamorphic" zones of the high-temperature, high-pressure type which are generally thought to exist relatively deep within the earth's crust. Within the latter zones there appears to be no sharp distinction between metamorphic and igneous processes. Therefore many migmatites afford fine opportunities to investigate relationships between processes that involved solid state reconstruction in the presence of fluids and processes that involved at least some silicate liquid (melt). It is chiefly because of this that Sederholm considered "granites" and Mehnert covers "granitic rocks" in conjunction with migmatites.

Nearly all migmatites are difficult, if not essentially impossible, to describe adequately with commonly employed petrographic terms. Most may be characterized better by such subjectively descriptive phrases as "complexly intermingled," "wildly veined," and "psychedelicately mixed" (attention is directed to the following figures: Sederholm, pp. 94 and 354 and map following p. 96; Mehnert, pp. 10 and 11), but these, of course, are of little value in scientific descriptions, and several additional terms have therefore been introduced. Most of them, however, have genetic implications, so the proliferation of terms has led mainly to misunderstanding and controversy. Note, for example, that one and the same outcrop might, depending upon the observer's experiences and prejudices, be designated by as many as 16 different names (agmatite, anatectic breccia, arterite, chorismite, diabrochite, ectexite, ectinitic breccia, embrechite, entexite, granitized breccia, injection breccia, intrusive breccia, metatexite, migmatite, rheomorphic breccia, and venite).

As has been noted, the collection of Sederholm's papers includes the classic 1907 paper in which migmatites were first named and described. The book also contains six outstanding papers published between 1923 and 1934. Each of the papers includes data, interpretations, and concepts about migmatites and associated rocks. Although it is difficult to find fault with this group of papers by a man whom the reviewer has venerated for nearly two decades, it must be said, in all fairness, that an extraction of only certain parts of each of the papers would probably have had a much greater and more widespread impact. Among other things, such selectivity probably would have put the price of the book within a range which would have made possible a larger distribution.

Mehnert's book focuses attention on problems relating to the nomenclature of migmatites. He also briefly considers a few of the numerous ways whereby modern laboratory data and techniques may be utilized in the resolution of some of the problems related to the origins of migmatites and granitic rocks. Unfortunately, he has omitted a few of the truly noteworthy discussions that deal with these rocks—for example, the suggestion of C. E. Wegmann that highly metamorphosed rocks which are macroscopically homogeneous but are on some smaller scale composite should be included in considerations relating to migmatite genesis. An especially disconcerting aspect of this book is the way certain facts and interpretations which were originally presented in English have become distorted, apparently as a result of translation from English into German and thence back into English. Petrologists who are acquainted with Mehnert's fine German papers will, because of such errors, look forward to the publication of a German version of the book.

In any case, it is gratifying that migmatites have finally been treated in some details in readily available books. These rocks are not even mentioned in most textbooks, and with the dearth of coverage in most libraries, it has been far too easy for teachers simply to ignore them—especially since most migmatites also do not fit into any one of the categories of the almost universally used tripartite rock classification (igneous, sedimentary, and metamorphic). As a consequence, a large percentage even of geology students have never been introduced to migmatites, despite the fact that they constitute a notable portion of the earth's continental bedrock. These two books are likely to be added to several libraries which would find it difficult to justify the purchase of the foreign periodicals in which most papers about migmatites have appeared. As a result, many future students may gain an increased appreciation of petrology—not only because they will learn about migmatites but also because, in so doing, they will become cognizant of the too often overlooked fact that the usually employed rock classification is largely a simplifying stratagem of pedagogy.

RICHARD V. DIETRICH
Virginia Polytechnic Institute, Blacksburg

Perspective on Mathematics

Mathematics and Logic. Retrospect and Prospects. MARK KAC and STANISLAW M. ULAM. Praeger, New York, 1968. x + 170 pp., illus. $5.95.

This book is one of a series commemorating the bicentennial of the *Encyclopaedia Britannica*. Its title, which suggests a study of the interrelationships of mathematics and logic, is misleading. The book is actually a survey of mathematics, together with general methodological remarks. Due attention is given to logic as an area of mathematics, but it is not especially stressed.

The authors present their material by drawing on examples from all major areas of mathematics. Among the topics they discuss are proofs of impossibility (with special reference to geometrical constructions), elementary probability and measure theory, linear algebra, braid theory, Gödel's incompleteness theorem, and game and information theory. Although nonmathematicians may find the book difficult going in places, it should be understandable to most people with scientific training.

Kac and Ulam have produced an ex-