

## 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 "psychedelicly 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.

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## 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-

citing and illuminating panorama of their subject, rather than a conglomeration. Their lively style and constant sense of interconnection make the treatment of each example a vivid lesson relating in some way to larger topics. Themes such as complex numbers and groups are woven through the material in a way which illustrates nicely how underlying structures can appear in widely separated areas of mathematics. By often following their presentations of well-known results with unsolved problems arising from them, the authors manage to keep their material from appearing too settled and fixed, and succeed well in presenting a picture of mathematics as it appears to a working mathematician.

Although not useful as a source or reference volume, this book is a valuable contribution. It provides a perspective and distance which most modern scientists must struggle to obtain, and does this with grace and good sense. The philosophical points to be found in it will probably not strike the mathematician as remarkable, but they are refreshingly sound in comparison with the oversimplifications often made by philosophers when speaking of mathematics. And the authors' suggestions concerning what may be in store for mathematics, especially as regards the use of computers and of ideas from the life sciences, are thought-provoking and worthy of consideration.

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## Farbwerke Hoechst

**A Century of Chemistry.** ERNST BÄUMLER. With contributions by Gustav Ehrhart and Volkmar Muthesius. Translated from the German edition (1963). Econ, Dusseldorf, 1968. xi + 365 pp., illus. Available for limited distribution from Donald Morgan Associates, 36 West 56 Street, New York 10019.

This is a translation of a festschrift published by the Farbwerke Hoechst AG. vorm. Meister Lucius & Brüning to commemorate the firm's 100th birthday. Those familiar with this company's earlier anniversary volumes and various histories of the I.G. Farbenindustrie will find little that is new as the story is retold of the firm's meteoric rise to preeminence among dye and pharmaceutical manufacturers and its subsequent participation in the formation of

the I.G. trust. However, since the anniversary year, and probably stimulated in part by the preparation of this book, a series of "Documents from the Hoechst Archives" have been published. These splendidly edited publications represent a pioneering effort in company history disclosure whose public relations value exceeds considerably that of the anniversary volume under review here.

The main theme of this book is the resurrection of the Hoechst company from the disaster of World War II. Aside from the enormous task of rebuilding antiquated or destroyed plants, of reestablishing markets and capital, of reassembling and providing for a work force, of catching up with American and British scientific and technical advances in order to market a broad range of chemical products, of switching from coal tar to petrochemicals as the chief source of organic raw materials, the men of Hoechst had also to contend for over six years with American occupation authorities determined to shatter the former I.G. Farben combine into the smallest possible pieces. How the Germans finally succeeded in limiting the fragmentation to three major successor corporations (Hoechst, B.A.S.F., and Bayer) and how they fought each other over the industrial pieces makes interesting reading. One cannot peruse this success story without being impressed again with mankind's toughness and ability to rebound from disaster quickly especially when, as in Germany, the surviving population still possesses a vast accumulation of skills, of disciplined habits, and of high material aspirations.

Since it is always illuminating to observe how others experienced certain well-known events, many will read with profit Hoechst's view of the commercial synthesis of such products as penicillin, insulin, Salvarsan, ammonia, acetylene and its derivatives, dispersion and reaction dyestuffs, polyvinyl acetate and chloride, cellophane, Nylon, Perlon, polyester fibers, and many others. The closing chapter makes some revealing comparisons between the managerial philosophy and financial posture of the company today and before World War I; but its apologetic and defensive tone vis-à-vis the critics of big business seems to this reviewer of questionable necessity and certainly an inappropriate way to close a festive volume.

One can hardly expect objectivity in such a work or extensive discussion of failures or unpleasant topics (such as the firm's relations with the Nazis), but

the reader should have been spared numerous and lengthy repetitions, mediocre to outright incomprehensible translation, and an astonishing profusion of typographical and technical errors (such as a reference to a graph which was left out of the English version of the book). Though hardly an unqualified success at public relations, this beautifully illustrated book does offer the public a fine overview of the chemical industry's historic development and of its ever changing and proliferating products and processes. Professionals in this industry will discover here and there in the chapters points of view and facts that will be new to them and that invite further reflection.

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## Actions of Drugs and Subjects

**Behavioral Pharmacology.** TRAVIS THOMPSON and CHARLES R. SHUSTER. Prentice-Hall, Englewood Cliffs, N.J., 1968. xvi + 297 pp., illus. \$14. Prentice Hall Psychology Series.

Behavioral pharmacology is a first-generation discipline. It was born in the mid-1950's after the introduction of the tranquilizers revolutionized the treatment and management of behavioral disorders. Now it has its first text. It is a book of only 229 pages (excluding appendices and bibliography), and its chief weaknesses stem from its brevity. However, it is successful in enough ways to make it worth recommending to anyone wishing a first look at this field. Thompson and Schuster address themselves to graduate and postdoctoral students who have backgrounds in either pharmacology or psychology and who have been inadequately prepared in the other discipline. This book tries "to provide a systematic introduction to the principles and techniques of experimental psychology and the principles of pharmacology as they are applied in behavioral pharmacology."

The authors divide their book into three main sections. First, a 65-page introduction to pharmacology sets out some of the basic principles of this field, sketches the theory of neuro-humoral transmission, and lists some of the drugs that are of behavioral interest. The authors then devote about 70 pages to the principles that underlie the experimental analysis of behavior. This section seems to me the least satis-