

any importance only one page is shown in facsimile in the present edition. The rest of the text is reproduced on the left hand pages while the translation appears on the following pages. The last six pages are devoted to algebra, chiefly relating to quadratic equations, and, in closing, the author states that he "wished to set down the things which are necessary and familiar in this kingdom." The formula near the bottom of page 37 is not clearly stated. Professor Smith's name is a sufficient guarantee that the work is in an attractive form.

G. A. MILLER

UNIVERSITY OF ILLINOIS

*Introduction à l'étude pétrographique des roches sédimentaires.* Par M. LUCIEN CAYEUX. Mémoires pour servir à l'explication de la carte géologique détaillée de la France. Paris: Imprimerie Nationale 1916. Quarto, 1 vol. text, pp. viii + 524, 80 figures; 1 vol. LVI plates.

It is a curious fact that although Sorby, the father of modern petrography, was especially interested in sedimentary rocks, those who followed him, with the exception of a small but persistent succession of workers in his own country, almost abandoned them in favor of the igneous rocks. The author of the book under review has elsewhere suggested that this was perhaps due to the lure of greater mystery in the igneous rocks and to the lack of knowledge, before the *Challenger* expedition, about the sediments of today. The reviewer has always been inclined to attribute the preference for the study of igneous rocks to their greater and more obvious diversity, which made it easier to find something new in them and gave them a greater esthetic attractiveness. Whatever the cause the present work will be the most powerful influence that has yet been brought to bear in changing that tendency. Indeed, in French-speaking countries Cayeux's influence is already very manifest. If the beauty of the sedimentary rocks has been considered inferior the enthusiasm of the author will surely correct that impression.

The work marks an epoch in its field and is written with a breadth of view worthy of the fundamental importance of the sedimentary rocks in the interpretation of the history of the earth. The author not only stands alone in the extent and thoroughness of his monographic investigations in this field, but as the successor of Élie de Beaumont, Fouqué and Michel-Lévy at the Collège de France he is, so far as the reviewer knows, the only person occupying a chair devoted entirely to the teaching of the petrology of sedimentary rocks. On his inauguration the name of the chair he occupies was changed from "Chair of the Natural History of Inorganic Bodies," to "Chair of Geology," but it might well have retained its old name, for as he says in his inaugural address, "The science of the sedimentary rocks is and will remain for us a *natural history of the ancient and modern sediments*." It is the treatment from this point of view and the enthusiasm and wide personal experience which the author brings to it that gives to a book which one might expect to find dry and technical a freshness, interest, and charm that make it fascinating reading. Furthermore, the book is so full of original observations drawn from the writer's many years of study that no student of sedimentary rocks, be he petrographer or merely stratigrapher, can afford to leave it unread.

The work is divided into two parts. The first deals with methods of analysis of sedimentary rocks, the second with the diagnostic characters of the constituents, which fall into two groups—the minerals and the remains of organisms.

The first part is refreshingly free from pedantry or love of technique as an end in itself, though the artist's pleasure in some refined and delicate method often finds expression. Methods of handling rocks of different types according to their induration or susceptibility to attack by acid are discussed, but the possible complexity of the procedure appropriate to any individual rock and the need of adapting the methods used to the particular rock and to the object of the investigation are pointed out. Quantita-

tive results are sought, but the difficulties of obtaining them are recognized and the usefulness of quantitatively expressed results that may not be accurate in themselves but still may permit of valuable comparison with one another, is admitted. The reader feels throughout no impulse on the part of the author to fix standards but merely that desire to give help, out of his own rich but painfully accumulated experience, which led him to prepare the book. Any one who comes to this book for a rigorous method that will enable him to turn out orthodox studies of sedimentary rocks will be disappointed, but those who want to help in advancing the borders of knowledge about this subject will find guidance and inspiration. The methods of analysis are grouped under three heads—physical, microchemical and chromatic. The physical analysis includes different processes sometimes grouped in this country under mechanical analysis, and the preparation of thin sections which in dealing with weakly bound sedimentary rocks often calls for special methods. The demonstration of the ease of application and delicacy of microchemical analyses is one of the outstanding features of the book. Under chromatic analysis the author discusses various methods of staining. In the discussion of all these methods he selects, weighs, evaluates and contributes on the basis of his own experience, without attempting any formal completeness.

Perhaps Cayeux's greatest achievement is the interest he is able to give to his discussion of the minerals of sedimentary rocks, of which of course he considers only the more common, both essential and accessory. It is in this part of the book that his treatment of the subject as natural history is illustrated in the most novel and interesting way. The individual mineral is to the author a record of environments—of the environment in which it originated and of those through which it subsequently passed—and it therefore contributes to the reconstruction of the history and geography of the past.

The last part of the book deals with the remains of organisms as constituents of the

rocks. Needless to say, specific determinations of organisms are not the purpose of a treatise on petrography. But here, too, the problem of past environment as recorded by the remains, both as remnants of once living organisms and as mineral substances, is the object of study. This part therefore deserves the attention of paleontologists as well as of petrographers and stratigraphers.

Vivified throughout by the author's own experience the work must lack that perfect completeness that would assure it against being found defective in the treatment of some special topics or methods that may be in favor with individual readers. But every reader will surely be glad to accept these omissions for the sake of the vigor and readability that go with them. American petrographers, for instance, will be struck by the absence of any discussion of the use of liquids of known indices of refraction in the determination of minerals. But as compensation they may profit by adopting some of the elegant microchemical tests described, which have the advantage that they can often be applied directly to the thin section and do not require the disintegration of the rock. Likewise the suggestions given on pages 305 to 309 for the determination of minerals by their general appearance may be a valuable antidote to the habit into which the devotee of "index liquids" is likely to fall, of resorting to his liquids in blind routine, just as the man with the slide rule habit gets out his machine to find the product of  $2 \times 2$ .

The physical quality of the book is worthy of its subject matter, and it is a fact for contemplation and an honor to the fine French scientific spirit, exemplified by the entire work, that it bears the date 1916.

MARCUS I. GOLDMAN

U. S. GEOLOGICAL SURVEY

#### SPECIAL ARTICLES

##### NOTES ON THE OCCURRENCE OF GAMMERUS LIMNAEUS SMITH IN A SALINE HABITAT

THE capacities of various organisms for withstanding relatively wide ranges of environmental conditions has received considerable