MODERN PETROGRAPHY. AN ACCOUNT OF THE APPLICATION OF THE MICROSCOPE TO THE STUDY OF GEOLOGY

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GEORGE HUNTINGTON WILLIAMS

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AN ACCOUNT OF

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TO THE STUDY OF GEOLOGY

BY

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MODERN PETROGRAPHY.

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IT cannot be denied that the terms Petrography and Lithology, which only within very recent years have come to occupy a really important place in American geological literature, still convey but a vague meaning to most teachers of natural science. Many men who have devoted themselves altogether to the study of geology know little of the origin, aims, or capabilities of the youngest branch of their profession. That the scientific study of the crystalline rocks has, during the past twenty-five years, rapidly developed in Germany is a fact of which any one may easily convince himself. The perfection of its methods already vies with that in many other older departments of investigation; while the importance of its results have long since secured for it a well recognized place among the descriptive sciences. Nor has its value as an educational discipline been overlooked. Nearly all of the German universities have to-day, if not their special professor of petrography, — as may be found at Heidelberg, Munich, Leipzig, Berlin, and Vienna, — at least their regular courses of lectures on this subject, and their laboratories amply equipped for its pursuit.

It is only quite recently, however, that the importance of what the Germans have accomplished in this direction has

commenced to be appreciated in this country. When the United States Geological Survey of the 40th Parallel, under Mr. Clarence King, found it necessary to have a systematic study made of its collections of crystalline rocks, there was no American prepared to undertake such a task, and the work was intrusted to Professor Zirkel of the University of Leipzig. The appearance of the results of his labors in an admirably illustrated quarto volume, entitled *Microscopical Petrography of the Rocks of the Fortieth Parallel*, published as Vol. VI. of the reports of the survey, in 1876, first opened the eyes of most geologists in America to the new and promising field of research. Since that time the interest manifested in this line of study in America has been steadily on the increase. The geological surveys of this country are already realizing the great value of accurate petrographical studies; and if, indeed, we but compare the quantity and quality of unexplored material in America with that in Europe, we must conclude that it is here that the study of rocks is destined to reach its highest development. Much that is excellent has already been accomplished on this side of the Atlantic; but the workers are few, and heretofore there has been observable too little of the rigid scientific accuracy which comes only after years of patient labor. We are, however, heirs of the past, and it is only fair that we should profit by all the accumulated experience of our predecessors. What is above all things necessary to those entering upon a line of research so difficult and new is a careful training in what has already been discovered, that labor may not be spent in vainly working out results which have already been attained by others. To judge from the American students* who, during the past six years, have done more or less

* During the writer's residence in Heidelberg, 1880–1883, nearly one-half of all the students in the petrographical laboratory were Americans, and the proportion now is even greater.

work in the petrographical laboratories of Germany, the importance of such a training has not been overlooked; and the constantly increasing value of American petrographical work abundantly justifies the expenditure of time necessary to secure it.

Until recently, it has not been possible for a student to secure a satisfactory preparation in microscopical petrography without going abroad for it. The English language does not yet contain a satisfactory text-book* on this subject, although, as we shall see, the first idea of applying the microscope to the study of rocks originated in England.

Regular instruction in petrography has for some years past been given at Harvard and Columbia Colleges; more recently, the attempt has been made at the Johns Hopkins University to organize a petrographical laboratory, where, by lectures and practical work, graduate students of geology may secure a thorough acquaintance with all the methods and results of foreign investigators. The encouragement with which this experiment has already met seems to indicate that it fills a need. Nor are signs wanting that other American universities mean to follow this lead by introducing instruction in petrography among their courses.

In view, therefore, of the steadily increasing interest in this new branch of geological research, it has been thought that a brief account of the origin and history of microscopical petrography, as well as of some other methods of rock-investigation to which its cultivation has given rise, might

* Lawrence's translation of Von Cotta's work, *Rocks Classified and Described*, London, 1866, contains no allusion to the microscope; while the small text-book by Rutley, *The Study of Rocks*, 1879, is too inaccurate and too short to be of much use. Nor can more be said in favor of the recent translation of Dr. Hussak's book, *The Determination of Rock-forming Minerals*. The German edition of this work is not satisfactory in its arrangement or reliable in its statements, and the translation, instead of being an improvement, is rather worse than the original.

not prove unwelcome to teachers in many departments of natural science.*

The reason why petrography has so recently sprung into prominence is not because its importance was not early recognized, but rather on account of its great practical difficulties, which have only within the past two decades been successfully overcome. The fierce contests between Neptunists and Vulcanists, from which the very science of geology sprung, themselves hinged largely on different hypotheses regarding the nature and origin of crystalline rocks. The followers of each school strained every nerve to fortify their position, and the new sciences of chemistry and mineralogy were made to contribute their utmost to both sides. Much was speedily learned about the composition and mineral constituents of the coarse-grained rocks, but any satisfactory information regarding those which were fine-grained, and apparently homogeneous, eluded the search of even the most thorough and patient investigators. It was, however, about exactly this class of rocks that the discussion had been most bitter, and we can but regard with admiration the time and study which the ablest geologists devoted to them. Still, the results attained were very small. In 1815, Cordier finally

* Those desiring more detailed information on this subject will do well to consult:—

H. Fischer, Chronologischer Ueberblick über die allmählliche Einführung der Mikroskopie in das Studium der Mineralogie, Petrographie, und Palæontologie, 1868.

F. Fouqué, La pétrologie en Allemagne. Revue scientifique, 1875, No. 34.

F. Fouqué, Les applications modernes du microscope à la géologie. Revue des deux mondes, July 15, 1879.

F. Zirkel, Die Einführung des Mikroskops in das mineralogisch-geologische Studium. Leipzig: 1881.

A. Stelzner, Die Entwickelung der petrographischen Untersuchungsmethoden in den letzten fünfzig Jahren. (Isis Festschrift.) Dresden: 1885.

J. J. H. Teal, The Scope and Method of Petrography. Nature, March 12, 1885.