MEMORIAL OF WILLIAM E. FORD

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Professor William Ebenezer Ford died on March 23, 1939, in New Haven, Connecticut, at the age of sixty-one. His sudden, unexpected death came as a profound shock to his colleagues at Yale University, for although he was on leave because of heart attack he had announced that he was beginning to feel better and was planning to return to his duties later in the spring. The son of William Elbert Ford and Caroline Aby (Bishop) Ford, he was born in Westville, a suburb of New Haven, Connecticut, on February 18, 1878. He prepared for college in the schools of New Haven and entered the Sheffield Scientific School of Yale University in 1896. He took the course in chemistry, which then required only three years (later, during the reorganization of the University in 1919 lengthened to four years), and graduated in 1899 with the degree of Bachelor of Philosophy.

He was then appointed assistant in mineralogy to Professor Samuel L. Penfield, of the Sheffield Laboratory of Mineralogy, Yale University, and he continued his studies in mineralogy and crystallography. Ford was indeed fortunate to have come under the guidance of Penfield, a kindly mentor and versatile, productive investigator. In his graduate years Ford published three papers jointly with Penfield and three independently. Two independent papers deal with the establishing of the chemical composition and formulae of two difficultly analyzable minerals—dumortierite and axinite, and the third paper announces the discovery and description of a new mineral—the copper telluride, rickardite. After receiving the degree of Doctor of Philosophy in 1903 he was appointed instructor in mineralogy, and in 1906 was advanced to the rank of assistant professor of mineralogy. In that year occurred the untimely death of Professor Penfield, who was cut off in the full tide of his productivity, and Dr. Ford became his successor. Mineralogy was a required subject in the Sheffield Scientific School at that time, and this requirement necessitated a large amount of routine teaching: the laboratory course in determinative mineralogy had an attendance of 100 to 150 undergraduates; furthermore, crystallography and descriptive mineralogy were taught to classes of 40 or 50. In addition two advanced courses were given to graduate students. In spite of these heavy duties, much research was accomplished. In 1909 Ford assisted Edward S. Dana in preparing the Second Appendix to Dana's System of Mineralogy, and as time went on he became more and more immersed in the task of revising, rewriting, and keeping up to date the several Dana works on mineralogy—the Manual, the Textbook, and the System. With a fine

William E. Ford
1878–1939

loyalty, he submerged his own individuality in keeping alive these books.

In 1920 Ford was appointed professor of mineralogy and was made a member of the Governing Board of the Sheffield Scientific School, and served in these positions until his death in 1939. In the fall of 1920 he married Mary Treat Jennings of Rochester, New York, a marriage that proved to be ideally happy. They particularly delighted "to go down to the Cape," to spend the vacations in their much-loved cottage on Cape Cod; and in later years when Ford was giving all his spare time to the revision of Dana's System he preferred to do his scientific work there.

Among the more notable of Ford's contributions to mineralogy were his papers dealing with the influence of chemical composition on the optical properties of isomorphous groups of minerals. Characteristic of these studies is the principle now regarded as almost axiomatic that chemical composition, optical properties, and other physical properties should all be obtained on the same specimen. The forerunner of these studies was his paper in 1910 on "The effect of the presence of alkalies in beryl upon its optical properties." A correlation between content of the alkali oxides (Li_2O, Na_2O, K_2O, and Cs_2O), specific gravity, and optical properties was definitely established.

A more ambitious study was that on the amphiboles, published in 1914. A series of eleven analyses of amphiboles had been made by Dr. F. C. Stanley under the guidance of Professor Penfield, and constituted one of the few series of authoritative analyses made up to that time. These analyses, mineralogists should recall, established that hydroxyl is a constituent part of the amphibole composition long before *x*-ray analysis re-affirmed it. "In studying the literature of the last twenty-five years," Ford remarked, "it is surprising to find in how few cases both an analysis and an optical description of the same amphibole have been recorded." Therefore Ford logically completed the investigation of the amphiboles begun by Penfield and carefully measured their optical properties. With this data and that of seven other analyzed amphiboles, Ford discussed the correlation between chemical and optical properties. It was fundamental work on a complex problem, and as is well known, in spite of the immense amount of work that has since been done by many other investigators, the amphiboles have not yet been completely set in order.

Another study was that of 1915 on the relations between the chemical, optical, and other physical properties of the members of the garnet group. This study established that the index of refraction and specific gravity of any garnet depend in a simple way on its chemical composition. The limited miscibility of andradite was confirmed. A recent re-examination of the problem, based on 85 new analyses made since 1915, has verified the direct relationship between chemical composition and physical properties found by Ford to exist in the garnet group.[1] The last of these studies, published in 1917, was a penetrating investigation of the calcite group, comprising calcite, dolomite, magnesite, rhodochrosite, and siderite. From the large difference between the molecular volume of calcite and those of the other four carbonates, it was thought that calcite should show only a limited miscibility with the other carbonates, whereas these others, especially the rhodochrosite, siderite, and magnesite, should be completely miscible. This theoretical expectation was well substantiated by an appeal to the chemical analyses of the actual minerals. Since the lattice of calcite does not alter in size when magnesite, rhodochrosite, or siderite enter as solid-solution components, it was inferred that the specific gravity of these components must change, e.g., pure siderite has a specific gravity of 3.89, but when it enters into calcite its specific gravity becomes 3.148. Finally, triangular diagrams were constructed to show in simple form the relations that exist between the chemical composition, specific gravities, and refractive indices of these members of the calcite group.

The increasing absorption of Dr. Ford in the task of keeping the several Dana works on mineralogy up-to-date has already been mentioned. In response to the request of Professor E. S. Dana, Ford brought out in 1912 a new edition of the Manual, the thirteenth. The Manual had first been published by James Dwight Dana in 1848, and had been revised last in 1887. It was entirely rewritten by Ford and the illustrations were vastly improved, among other things photographic plates of minerals were added, so that it was practically a new book. The chapter on petrography was omitted and the title of the book was changed back to its original form and was to be known in the future, wrote Ford, as "Dana's Manual of Mineralogy." In 1929, when the Manual had reached a total issue of 41,000 copies, a fourteenth edition was brought out.

In 1915 Ford published the Third Appendix to Dana's System, which covered the period between January 1, 1909 and January 1, 1915. In that short time 180 new mineral names had been proposed, about one-third of which appeared to be well-established species. In 1920 Ford began the great task of revising Dana's System, the sixth edition of which had been brought out in 1892 by Edward S. Dana, the son of James Dwight Dana, in the form of a monumental revision of his father's work. It soon appeared that the output of mineralogic publications had grown so large that revision of the System could no longer be encompassed by a single individual. Ford was so fortunate as to obtain the

[1] Fleischer, Michael, The relation between chemical composition and physical properties in the garnet group: *Am. Mineral.*, **22**, 751–759 (1937).

cooperation of Professor Charles Palache in assembling the crystallographic data and Professor E. S. Larsen on the optical properties of the minerals. It further became evident that if the revision of the System were to be completed within a reasonable time, the aid of a number of full-time assistants was imperative, and for this purpose the Geological Society of America in 1936 made a generous grant. Unfortunately, Professor Ford's failing health, which had undermined his strength far more than even we who were in daily contact with him surmised, eventually forced him to the painful necessity of relinquishing all share in the great enterprise. To Professor Ford it was a deep satisfaction, however, that Professor Palache agreed to take over the responsibility of supervising the work to completion.

While the work on the revision of the System was in progress, Ford brought out in 1922 the third edition of E. S. Dana's Textbook of Mineralogy. Nearly twenty-four years had passed since the previous edition had been published, so that modernizing the volume necessitated lengthening it by 127 pages. In 1932 he issued the fourth edition of the Textbook of Mineralogy, which by that time had justly become known as the Ford-Dana textbook. It had grown by 143 pages, and it included brief descriptions of 220 new species. Because the time when the revision of Dana's System would be finished still seemed far off, Ford made a special effort that the new edition of the Textbook should include all known species of minerals and well-established varieties, so that this information might be conveniently available in at least one place in the English language.

Ford was a very human personage. As a teacher, he was notably successful and often inspired an interest in mineralogy in students whose major interests were in far different fields. Because of his informality and approachability, joined with a sympathetic interest in his students as individuals, he aroused in them a warm personal esteem. He was helpful and unselfish, and he took a keen delight in the successes of his friends. In the hearts of his colleagues and of his many former students he will always live in affectionate memory.

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* In the original publication incorrectly given as J. L. Pogue.

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