MEMORIAL OF CHARLES PALACHE

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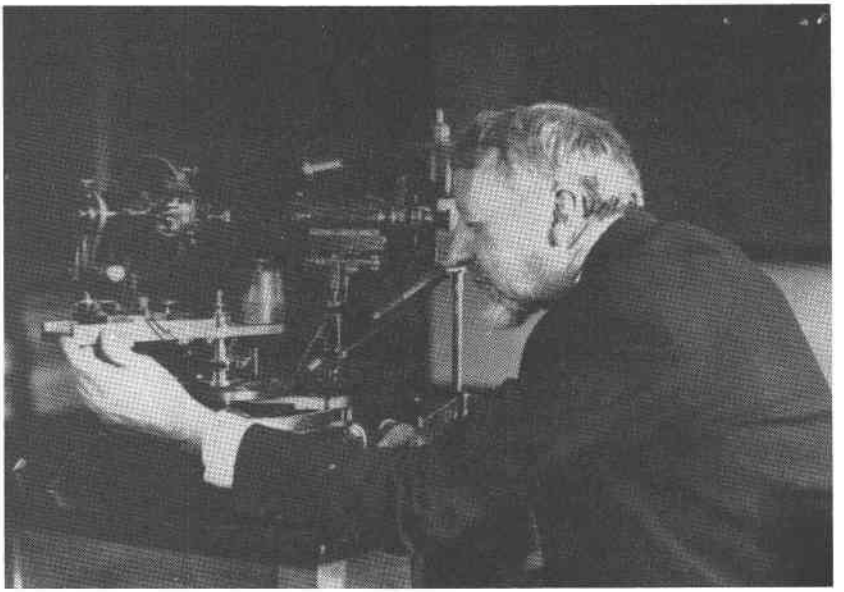
Charles Palache was born July 18, 1869, and died December 5, 1954, in the eighty-sixth year of his age. One of the most eminent crystallographers and mineralogists of the world, he lived in a period of revolutionary developments in mineralogical science.

Palache's ancestors belonged to a group of Sephardic Jews who at the end of the 15th Century were exiled from Portugal to Holland. Much later one family migrated to Jamaica where Charles Palache's grandfather, John, headed a plantation. For political reasons he abandoned that home in 1834, put his wife and three daughters on a ship sailing for New York, but died before he could follow them in the next boat. Three months later Palache's father, James, was born in New York City. Lured by reports of gold in California, James left his home at the age of fifteen to serve as cabin boy on a schooner rounding Cape Horn. He landed in San Francisco in 1849. There, established as a merchant, he married Helen D. Whitney, who had traveled from her home in Green Bay, Wisconsin, in a caravan of seven covered wagons. Their son, Charles Palache, was a sensitive boy who at an early age evidenced an intense interest in nature and collected objects of natural history. Palache graduated from Berkeley High School, and entered the University of California in 1887. He elected the four year course in mining, since in its content there was more natural history than in any other, and graduated at the top of his class. Andrew C. Lawson was appointed Professor of Geology in his senior year, and Palache returned the following year to assist Lawson in mineralogy and to study for the doctorate, which he received in 1894. Lawson, himself at the start of a long and distinguished career, was a stimulating teacher and it is to him that Palache credited the inspiration that took him from a career in mining into mineralogy. At first Palache's interests were in field geology and petrography, and with Lawson he did the field work for the first geologic maps of the San Francisco Peninsula and the Berkeley area.

In 1894, Palache left for a year of study abroad, first to work under Ferdinand Zirkel at Leipzig, where T. C. Walker and Bundjiro Koto were fellow students, and then to study with Paul Groth and Ernst Weinschenk at Munich. Other American students working in Groth's laboratory at the time were T. A. Jaggar, A. B. Peck and A. S. Eakle. The winter in Munich was a happy and busy one; and it is recorded in Palache's journal that "the museums were good, the theatre excellent

and there was opera all winter costing students next to nothing." A turning point in his life came the following spring, when he visited Heidelberg. Here he took courses in petrography under Harry Rosenbusch and Alfred Osann, and was introduced to morphological crystallography by Victor Goldschmidt. Palache threw himself with enthusiasm into the study of crystals, and laid the foundation for the work he pursued so vigorously for the next fifty-five years.

Palache returned to California in the fall of 1895, and in December a letter came from John E. Wolff offering him a small job as his assistant



Professor Charles Palache working at the Goldschmidt two-circle goniometer. Photographed in 1936.

at Harvard. Wolff, Professor in the then newly organized Department of Mineralogy, and Curator of the Mineralogical Museum, succeeding Josiah P. Cooke, was one of a group of Harvard geologists that included William Morris Davis, Nathaniel S. Shaler and Josiah D. Whitney. Wolff's interests were primarily in petrography and in the year after his retirement in 1922 the instruction and research in this field was taken over by Esper S. Larsen, Jr., who with Palache constituted the Department for many years. Palache was named Assistant Professor of Mineralogy in 1902, Professor in 1910, and Professor Emeritus after his retirement in 1941.

Morphological Studies

In his chief field of work, morphological crystallography, Palache brought himself and the Department of Mineralogy to a pre-eminent position in research on the external geometry of crystals. There is scarcely a crystallized mineral that he did not investigate. He introduced the first Goldschmidt two-circle goniometer into the United States, in 1896, and elaborated this method in a series of papers that with later amplifications by his students are standard references. The present general use in America of two-circle goniometric methods in the characterization of crystallized substances derives largely from his work.

Palache's publications deal chiefly with systematics and descriptive matters, and it is through the work of his students that we see the keen and stimulating interest he had in the genetic and interpretive aspects of mineralogy. His published papers, over 150 in number, include classical studies of the morphology of calcite, azurite, the gold tellurides, the lead oxyhalides, and definitive investigations of numerous less common minerals. His studies of calcite culminated in 1943 in a critical review of the morphology of this species that surpasses the early works of Bournon, Zippe and Irby. His study of the tantalizing mineral calaverite, done in cooperation with Martin Peacock and Victor Goldschmidt, is a masterpiece of the art of crystal measurement and projection. Peacock began the study of crystallography under Palache in 1926, and returned as Research Assistant to him over the period 1932–1937. A brilliant man, with a gift for conciseness in style and rigor in presentation, he gave to Palache a kindly affection and shared with him both a love of music and skill at the carpentry bench.

Palache's published studies are only a small part of the crystallographic work that he accomplished. In one project the available morphological data for all minerals was critically re-examined, recalculated in Goldschmidt's scheme of presentation, and tabulated on filing cards. This modern version of Goldschmidt's *Winkeltabellen* was not brought to full completion, however, partly from the realization that the new x-ray methods of study would in many instances necessitate a description different from that based on morphological grounds. There was further the growing realization, emphasized in the Harvard laboratory by Harry Berman, that the features of minerals were not isolated matters but should be described in context with the chemical composition and the crystal structure. Berman, the nearest to a son that Palache had, went to Harvard in 1924. He was versed in modern chemistry and physics, which Palache was not, and became a powerful stabilizing influence in the laboratory. Berman installed the first x-ray equipment at Harvard in 1933. The purely geometrical point of view of earlier years, that at times

yielded ornamentations of morphological crystallography bordering on numerology, became realistic and broadly based.

The preparation of the 7th edition of Dana's System of Mineralogy was started in 1937 under Palache's leadership. He gave close attention to the problems of organization and computation of the crystallographic data, with the help of C. W. Wolfe and Peacock, and the files of the Dana contain a large store of measurements and computations that came from his hand. Although he did not prepare any of the manuscript, his counsel and factual knowledge contributed greatly to the progress of the work.

Crystals had a deep significance to Palache. In their morphology he seems to have found almost an element of mysticism, a response to the facets of a crystal seen in glittering progression in the quietness of a goniometer room, that revealed a self-contained system of order in a random world. The resolution of this order in terms of atoms and forces did not attract him. The full impact on mineralogy of the new x-ray and physical techniques came midway in his career. As a scientist he welcomed and used the knowledge thus brought of the ultimate structure of crystals, yet this new understanding terminated a traditional approach to the constitution of crystalline solids, one followed in mineralogy for a century and more, and destroyed for him the wonders of a thing unknowable and long sought.

The Mineralogical Museum

Palache's most lasting and most important contribution to the development of the Harvard Department of Mineralogy, and a great service to mineralogy in general, was in building the Mineralogical Museum to its present position as the leading research and exhibit collection of minerals in the world. When Palache first came to Cambridge, a few days before Christmas in 1895, it was to assist Wolff in arranging the mineral collection. Palache lived for a year in a small room in the University Museum where, armed with a rifle, he guarded the premises.

The collection he came to had started in 1784 and in 1895 contained about 55,000 specimens. Wolff continued as Curator until 1922, when he retired and Palache took charge both of the Department and of the Museum. The collection grew rapidly by field collecting, exchange and purchase. The great private collection of A. F. Holden, comparable in quality and extent to the collections of Roebling and Bement, was acquired by gift in 1913. This was followed by very large funds given by A. F. Holden in 1922 and by J. E. Wolff in 1940 for the care and increase of the Museum. Much of the income from these gifts was diverted into the general funds of the University and only a small amount remained for minerals.

Beginning in 1904, Palache gradually built a definitive collection of the minerals of Franklin, New Jersey, and acquired together with a mass of other material the Hancock collection and, jointly with the U. S. National Museum, the Canfield collection. His monographic study of the mineralogy of the Franklin ores, published in 1935 by the United States Geological Survey as Professional Paper 180, is a landmark in American mineralogy. The work at Franklin was part of a lengthy association with the Geological Survey that included field studies in 1901 in the Bradshaw Mountains in Arizona and mineralogical studies in 1906 and 1919–1921 in the Lake Superior copper district.

Palache first became seriously interested in the mineralogy and paragenesis of the pegmatites of New England in 1912 although he had earlier described with C. H. Warren the pegmatite pipes of the Quincy granodiorite. In the summer of that year he collected in the pegmatites of Maine and New Hampshire, and secured the fabulous find of purple apatite at Mount Apatite near Auburn, Maine. During the next 20 years he collected, with the assistance of students and of F. A. Gonyer, extensive suites of material from pegmatites throughout New England, in part by leasing operations at important localities. This material served as the basis of important studies by himself and his students. Among these publications was Landes' well-known paper of 1925, "The paragenesis of the granite pegmatites of central Maine." Pegmatite mineralogy was strongly emphasized in Palache's course on mineral paragenesis, but he also was keenly interested in other types of mineral occurrence and it is a pity that only a small part of his store of knowledge in this field was ever published.

There were numerous other collecting activities, both at home and abroad. In 1922 he participated with R. A. Daly, F. E. Wright and G. A. Molengraaff in an expedition to South Africa, where he obtained a wealth of secondary zinc, copper and vanadium minerals. In 1924 he made a productive trip to localities in Norway and to Långban, Sweden, where the Flink collection was secured. In 1926 he went to Madrid for the XIV International Geological Congress, and to Lisbon, where he acquired the Bello collection of Portuguese minerals. Earlier, he had visited Russia for the VII International Geological Congress in 1897, and he traveled to Alaska in the Harriman Expedition of 1898. In 1935, Palache visited Vienna to purchase 900 superlative specimens from the Karabacek collection, a transaction remembered to this day in Austria. Another large acquisition was the Ahlfeld collection of Bolivian minerals, purchased jointly with the National Museum. The collection of meteorites, originally acquired from J. Lawrence Smith in 1883, was increased as opportunity offered. Palache prepared a new catalogue of this collection, and described five new meteorites.

Numerous publications stemmed from these accessions, and a vast amount of research material remains untouched. There were many indirect yields from the collection. L. C. Graton paid tribute to Palache for his essential aid in assembling the reference collection of polished sections of ore minerals in the mining geology laboratory, that formed the basis of the works of J. Murdoch, C. M. Farnham and M. N. Short in this field. Palache published joint descriptions with others of 17 new mineral species including the last two rock-forming minerals to be recognized, lawsonite and pumpellyite. Lawsonite was originally found by Palache and F. L. Ransome when as students at the University of California they went on a collecting trip to the glaucophane schists of the Tiburon Peninsula. Palache prepared a description of lawsonite in 1894 while working under Groth in Munich, and correspondence brought out that Ransome was working on the mineral in California; both had independently selected the name lawsonite, and a joint description was published in the *Zeitschrift für Kristallogie und Mineralogie.* Palacheite, named after him in 1903 by Eakle, was soon discredited as a variety of botryogen.

Palache was a connoisseur of minerals. He could evaluate the worth of a specimen as representative of a locality or type of occurrence; he knew the subtleties of crystal habit, color, association and size that distinguish a fine specimen from a good one; he was a keen judge of the factors that determine the aesthetic and scientific values. And, of course, he was a master at that virtually lost art, sight identification. Palache took a keen delight in a beautiful specimen, yet with sober deliberation he would yield any specimen to the dissecting chisel and hammer if new knowledge could be obtained. He took painstaking care in the arrangement, cataloguing and labelling of the collection to make it convenient for use by the investigator and the student. Palache's lectures were enlivened by anecdotes of his personal experiences with other mineralogists or of his visits to famous mineral localities. His students and assistants soon learned of his great knowledge and love of minerals and inevitably became imbued with his interest and spirit of research. The laboratory work was thorough and emphasized the direct examination of specimens. His successive course assistants in the earliest years were A. S. Eakle, C. E. Lord, Hoyt S. Gale, H. O. Wood, R. W. Richards, H. E. Merwin, R. E. Somers, W. G. Foye and A. Wandtke, all of whom went on to distinguished careers.

Palache played an active part in the organization and later development of the Mineralogical Society of America. The Society was first organized on December 30, 1919, in a meeting in the mineralogical lecture room at Harvard. Palache became President of the Society in 1921,

Honorary President in 1950, and was the first recipient of the Roebling Medal in 1937. In the words of Edward H. Kraus, the Roebling award was presented to " . . . America's foremost mineralogist, and one of the stalwarts of the Society, whose publications during a period of 40 years have covered a wide range of subjects and have contributed signally and enduringly to the advancement of our science." Palache's acceptance was a delightful account of his friendship with Colonel Roebling and of the circumstances through which he brought the Roebling endowment to the Society. Palache was loath to have the relatively large number of contributions from himself and his students and associates impose upon the limited resources of the journal of the Society. This brought the issuance of five independently financed Harvard numbers of the journal, including the Palache *Festschrift* of 1938, that supplemented the normal contributions of the Department.

The distinction of Palache's career brought him many honors. Aside from his recognition by the Mineralogical Society of America, he was a member of the National Academy of Sciences, the American Academy of Arts and Sciences, President of the Geological Society of America in 1937, and corresponding member of the Geologiska Föreningen, Stockholm. He was an Honorary Member of many societies, including the Sierra Club, the New York Academy of Science, the Mineralogical Society of Great Britain, the Royal Geological Society of Cornwall, and the Société Géologique de Belgique. In 1941 he was given an honorary LL.D. by the University of California. He was an associate editor for many years of the *Zeitschrift für Krystallographie* and of the *American Journal of Science*. Palache encouraged the efforts of the amateur mineralogists, and was voted an Honorary Member of both the Boston Mineral Club and the New York Mineralogical Society.

In his office and laboratories Professor Palache seemed to many to be stern in attitude and almost forbidding in appearance. He was not easy of approach, although an effort always was rewarding, and he rarely was familiar in his relations with students or his associates. These characteristics may have stemmed from an acute and strongly disciplined shyness and sensitivity. Certainly he was a modest and considerate person, whose kindnesses were unobtrusive. At home he was a relaxed and charming host. He derived great satisfaction from symphonic music, a taste dating to concerts at the Gewandhaus in Leipzig heard as a student. His personal reserve was easily penetrated by discussions of music or through his interest, maintained over the years, in ornithology. Palache married Helen Markham in 1898, and he is survived by three daughters. It was a pleasant privilege to visit his home or his summer place at Jaffrey, New Hampshire. Vigorous in body and mind to the end,

he died at his home near Charlottesville, Virginia, to which he had moved from Cambridge a few years before.

Such was the nature of the man, and of his work. Shortly before his death, in conversation with Reginald A. Daly, a friend and associate over many years, Palache remarked that his life had been fruitless—but this is a feeling given in great times, to great men.

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