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Memorial of Edgar Theodore Wherry
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Dr. Edgar Theodore Wherry, Honorary Life President, fourth President and Charter Member of the Mineralogical Society of America, and Co-founder and first Editor of *The American Mineralogist,* died May 14, 1982, in Philadelphia at the age of 96. After a long and unusually productive career, he left some 420 published papers, books, and monographs as a legacy for future workers. His was a career remarkable for its breadth and distinguished by high levels of achievement in no less than three widely different, yet curiously interwoven, fields of science: geology–mineralogy, chemistry–crystallography, and botany–ecology. His influence in botany extended far beyond professional scientific circles. It seems fair to say that few scientists of his stature have played a greater role in the advancement of the natural sciences through public enlightenment.

He was a born teacher, a dedicated writer and editor, and a wise counselor and friend to a host of interested layman, as well as a driving force in numerous scientific and horticultural societies having large, if not dominant, lay memberships. Wherry was not content with *teaching* the layman the pleasures of botany. He *involved* him in his lifelong twin crusades: (1) the introduction of long-neglected native plants into American gardens and (2) the cultivation of rare and endangered plant species as a means of insuring their survival. At the start of the latter mission, Wherry was some 40 years ahead of his time.

Wherry's drive to share his interest in science with the public appears to have been instilled in him at an early age by his attendance at lectures of the Wagner Free Institute of Science in Philadelphia. It found expression some years later in the organizational and editorial policies of the fledgling *American Mineralogist* which was, at its inception, dependent for survival upon the subscriptions of interested amateurs. During the long years of his retirement, his public interests took up more and more of his time; nevertheless, he continued to publish results of his original research until as late as 1979.

In answer to a request from the American Fern Society, Wherry prepared some five years before his death a two-page autobiography that was published in the *Fiddlehead Forum*, the newsletter of the society, in 1982. Characteristically, those autobiographical notes made no mention of the many high offices he had held, nor of the many honors that had come his way. The notes are of particular interest in that they summarize what Wherry considered to be his most significant contributions to each of the three fields of science in which he had been active. Passages enclosed by quotation marks in the following summary were extracted from that autobiography.

Dr. Wherry was born September 10, 1885, in Philadelphia. His father, Albert C. Wherry, the owner of a small printing shop, was descended from Welsh Quakers who left England in 1718 to settle in southern Pennsylvania. His mother, Elizabeth Seiler-Doll, was the daughter of a German-Swiss toy merchant. He attended Friends Central School in Philadelphia, and in later life credited that institution with inspiring his interest in nature, particularly in minerals and wildflowers. His attendance at lectures at the nearby Wagner Free Institute of Science instilled in him a "fascination with chemical experimentation" and he "decided to become a chemist." After graduating from secondary school near the head of his class he was awarded a 4-year college scholarship and chose the University of Pennsylvania. He completed a major in

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chemistry and was granted a Bachelor of Science degree in 1906. By that time, however, Wherry's interest in geology–mineralogy, latent since his early school days, had taken over, and with the assistance of a Harrison Fellowship he went on to obtain a Ph.D in those subjects from the University of Pennsylvania in 1909. While a graduate student, he helped defray expenses by working part time as chemical analyst for the C. G. Davis Company of Philadelphia. From 1909 to 1913 Wherry taught mineralogy at Lehigh University, Bethlehem, Pa. In the summer of 1910, he studied crystallography with Victor Goldschmidt at Heidelberg, Germany. In 1913, Wherry accepted an appointment as Assistant Curator of Minerals at the U.S. National Museum, Smithsonian Institution, in Washington, D.C. The following year he married Miss E. Gertrude Smith and "built a house on a wooded hill in Chevy Chase, Maryland." In 1917, Wherry transferred to the Bureau of Chemistry of the U.S. Department of Agriculture and assumed the newly created title of "Crystallographer." He later became Principal Chemist with that institution before leaving in 1930 to become Associate Professor on the staff of the Botany Department of the University of Pennsylvania. He taught botany and ecology for 25 years, and retired in 1955 at the age of 70 to become Professor Emeritus. In his earlier retirement years, he returned to the university to teach courses in elementary botany and poisonous plants to pre-veterinary students, as well as courses in plant ecology. As a testament to his unquenchable interest and energy, two monographs and two of the three comprehensive field guides that bear his name were completed after his official retirement.

The above outline sets forth in sequence the separate stages in the evolution of a remarkably diversified scientific career that recognized no fences. How and why Wherry's career evolved as it did will be the subject of the discussion that follows.

Wherry's published contributions to geology–mineralogy number 103, of which 45 were written for the *American Mineralogist* over the years 1916–1938. His indispensable role in the establishment of the *American Mineralogist* in 1916 was described by the writer in the 50th Anniversary Volume commemorating the founding of the Mineralogical Society of America and will not be repeated here (*The American Mineralogist*: its first four years: Amer. Mineral., v. 54, nos. 9–10, p. 1233–1255, 1969). By the time he had received his doctoral degree, Wherry had already published 18 papers. Of these, the majority were descriptive and aimed at the predominantly lay audience that read the *Mineral Collector*, the predecessor of the *American Mineralogist*. The list included, however, a paper on "The Newark copper deposits of southeastern Pa.," published in 1908 in *Economic Geology*, in which he pointed out the resemblance of those copper deposits that were emplaced in Triassic sandstone to the Permian red-bed copper deposits of the western United States. Also included in the early list of publications were two valuable papers of lasting interest, co-authored by W. H. Chapin, on the determination of boric acid in vesuvianite and in insoluble silicates, published in the Journal of the American Chemical Society in 1908. Hillebrand and Lundell (second edition 1953) considered Wherry and Chapin's method to be *the* method for boron determination in silicate minerals and noted that Allen and Zies in 1918 had tested the method very fully and found it to be "far superior to other methods."

Wherry's doctoral dissertation "concerned the geology, mineralogy, and chemistry of igneous rocks of Triassic age southwest of Reading, Pennsylvania including the first known occurrence of basalt in the state." His interest in the Triassic continued during his years at Lehigh when he served summers as a Junior Geologist of the U.S. Geological Survey assisting Dr. Florence Bascom of Bryn Mawr in the mapping of the geology and mineral resources of the Quakertown–Doylestown district, Pa.–N.J. His work resulted in co-authorship with Bascom of U.S. Geological Survey Bulletin 828 (1931), to which he contributed a section on sedimentary rocks and part of a section on structure. In other shorter papers, he described mineral relationships, silicified wood, and two new fossil plants from the Triassic as well as the relations of the Triassic rocks along their northern border in Pennsylvania. His final words on the Triassic were published as late as 1941, when he contributed a section on Triassic life to B. L. Miller's "Geology and mineral resources of Bucks County, Pennsylvania," a Bulletin of the Pennsylvania Geological Survey.

Upon his appointment as Assistant Curator at the U.S. National Museum, and the commencement of his duties as Editor of *The American Mineralogist*, the emphasis of his studies turned more and more towards mineralogy. He was by that time a skilled mineralogist proficient in the use of the microscope but still an inveterate collector. He later was to say that the finding that gave him the most pleasure as a mineralogist was his discovery of the first occurrence of carnotite in the eastern United States at Mauch Chunk (now Jim Thorpe), Pa., in 1909. The different aspects of that discovery were written up in *Science* (1909), in the *American Journal of Science* (1912), and in U.S. Geological Survey Bulletin 580 (1914).

Over the years, Wherry contributed basic data on the optical and chemical properties, paragenesis, and occurrence of a host of minerals. The list includes scapolite, carnotite, wolframite, beraunite, axinite, allophane, fuchsite, tyrolite, bornite, glauberite, rhodochrosite, siderite, fischerite–wavellite, merrilite, thaumasite, alunite, psilomelane, titanite, mimetite, diaspore, pyrolusite, monazite, chalcopyrite, sulfo-salt minerals, crocidolite, chlorite, talc, thomsonite, halloysite, and leverrierite. With E. S. Larsen he described the new mineral beidellite. The new mineral wherryite, was named in his honor in 1950. Dr. Wherry was one of five eminent American mineralogists of the day singled out by Professor E. S. Larsen, Jr. for particular thanks for assistance, during his compi-

lation of the classic reference volume "The microscopic determination of the nonopaque minerals."

In a paper that in many respects anticipated modern ionic theory of crystal structure (*American Mineralogist*, 1922), Wherry reviewed the then-current theories of isomorphism with respect to the plagioclase series. He concluded that only an atomic volume approach to isomorphism gave an adequate explanation of the data. Unlike any of the other theories then prevalent, it accounted for the molecular volume relations, the essentially nonreplaceability of aluminum by iron and the limited isomorphism of orthoclase and carnegieite with anorthite-relationships that Wherry considered to be fundamental to an understanding of isomorphism in plagioclase. Wherry noted that the X-ray diffraction studies by W. L. Bragg had shown that sodium atoms and aluminum atoms occupied approximately the same volume as calcium and silicon, respectively. On the other hand, the potassium atoms of orthoclase and the two sodium atoms of carnegieite occupied more space than the displacement of the calcium ions could provide. To emphasize the central role of aluminum in the isomorphism, Wherry wrote the formulas for albite and anorthite as $NaAl(Si_3O_8)$ and $CaAl(AlSi_2O_8)$, respectively. The paper aroused considerable discussion. Wherry's conclusions were strongly criticized by R. W. G. Wyckoff, who held that Wherry's interpretation required a close-packed arrangement of atoms, a requirement that Wherry denied, and that Bragg's view of the constancy of atomic volume was untenable. Wyckoff argued that the precision of the X-ray determinations then available was not sufficient to establish constancy of volume, and in any case the evidence indicated that a given element commonly exhibited widely different atomic volumes depending upon the nature of the particular chemical combination in which it was involved. The later recognition that silicate crystallization is basically ionic and that the ions of a given element may exist in more than one coordination state has tended to reconcile the separate viewpoints. In short, the passage of time has demonstrated that Wherry's pioneering effort was a significant step forward in the evolution of modern concepts of isomorphism.

Wherry's ingenuity came to the fore in his design and use of a micro-spectroscope that permitted the identification of minerals under the microscope by their absorption spectra. In the first of two papers (Smithsonian Miscellaneous Collections, 1915) the setup was described and the results of absorption tests on some 200 minerals were reported. Of those minerals, one third were found to have distinctive spectra. In a later paper (*American Mineralogist*, 1929) he divided the more important diagnostic spectra into four groups according to source elements: (1) cerium earths, neodymium and praseodymium; (2) yttrium earths, samarium and erbium; (3) uranous uranium; (4) uranyl uranium. He presented absorption data for each group as it applied to minerals of the appropriate composition. Later, J. B. Mertie was to find Wherry's technique of particular help in his studies of monazite distribution in the southeastern United States.

Wherry considered his most significant contribution to geology–mineralogy to be his demonstration in 1917 that certain bentonitic clay beds in the Pierre Shale were derived from widespread volcanic ash, thereby accounting for their continuity and their value as horizon markers—a new concept at the time. Thereafter, he continued studies of clay minerals in cooperation first with E. S. Larsen, Jr., and later with C. S. Ross.

Wherry's growing reputation as an optical mineralogist led to his appointment in 1917 as "crystallographer" by the Bureau of Chemistry of the U.S. Department of Agriculture, the first time such a title had been conferred by the United States Government. His principal duty was to determine the optical and crystallographic properties useful for identification of synthetic organic compounds, particularly of types, such as alkaloids, that occur naturally in plant tissues. Those studies opened up a new frontier in the identification of organic substances. Between 1917 and 1921, in part in cooperation with various organic chemists, Wherry produced 16 papers describing the optical properties of specific organic compounds, or series of organic compounds, most of which were published in the Journal of the American Chemical Society. However, Wherry was not one to allow his broad scientific interests to be restricted by the walls of a chemical laboratory.

During the years 1917–1922, Wherry continued his editorship of *The American Mineralogist*, the last three years under the flag of the Mineralogical Society of America. Wherry resigned in 1922 after seven years at the helm to become fourth President of the Society in 1923. His Presidential Address to the Society was entitled "At the surface of a crystal." It presented a model for crystal growth in which the building blocks were "polyhedral domains" whose principal faces become oriented perpendicularly to the lines of force along which atoms, or molecules, are attracted to each other. In this address, Wherry disputed the generally accepted infallability of etch figures as an indicator of internal structural symmetry and pointed out some figures that are otherwise difficult to interpret, may simply be a reflection of the attractive forces between the atoms at the crystal surfaces and those of the solvent used.

In 1924, Wherry initiated a publication policy for *The American Mineralogist* that has continued to the present day. He issued a "Classified list of minerals described or discredited during 1921," and published a follow-up list in 1927.

As early as 1913, Wherry had become Editor of the Section of Mineralogical and Geological Chemistry of *Chemical Abstracts*, and he continued in that post until 1938. During that 25-year period he wrote some 250 of his own papers but still found time to abstract, and make generally available, the work of a host of other scientists. In 1938, the year in which he resigned that editorship, he

made his final contribution to mineralogy with the publication of "A note on the interpretation of etch figures," fittingly in *The American Mineralogist*.

It was more or less inevitable that Wherry's interests in mineralogy–geology, chemistry, and botany–ecology should come to a common focus in the study of soils. His investigations of clay minerals provided a bridge between the rocks and the soils derived from them. His studies of soils in turn led him to inquire into the nature of the controls that soil composition exerted upon the distribution of plant species and to an ever-increasing specialization in botany–ecology.

The changes did not come about overnight. In his autobiographical notes, Dr. Wherry recalled that in 1902, at age 17, while on a mineralogical–geological field trip to Pink Hill, a well-known serpentine barrens in Pennsylvania, he was struck by the profuse growth of the pink-flowered moss-phlox that gave the hill its name, as well as by the absence of the phlox from neighboring terrains of different lithologies; he wondered what peculiar attraction the soils developed on serpentine might have for the phlox. Later, beginning in 1920 while he was with the Bureau of Chemistry, he was to pioneer the study of soil pH and devise field methods for its determination by means of various color indicators. The working out of the complex controls that soil pH exerted upon plant association was to occupy his attention for much of the long botanical career that lay ahead. Those investigations made a fundamental contribution to plant ecology as well as to horticulture, and stand as his most enduring monument in those fields.

Meanwhile, 30 years after his initial encounter with the moss-phlox of the serpentine barrens, Wherry returned to the problem of the serpentine soils and their peculiar flora. In an early contribution to geobotanical prospecting, Wherry (1932) compared the chemical composition of the ash fractions of the moss-phlox and of five other species of plants from the serpentine barrens with the chemical compositions of the ash fractions of the same species from forested areas of the Atlantic Coastal Plain, remote from outcrops of serpentine. Among the six species selected were representatives of four important classes of plants. Wherry found a very large increase in MgO in the ash from all species that had invaded the serpentine barrens, as well as less systemmatic, but locally large, changes in K_2O, SiO_2, CaO, and Fe_2O_3. The principal acid-soluble chemical constituents and pH of the soil attached to the roots of certain of the specimens were also determined. Aside from a very large increase in MgO and Fe_2O_3 assignable to particulate serpentine in soil of the serpentine barrens, the chief difference was found to be in pH; the pH ranged from 6.0 in the soil of the serpentine barrens to 5.0 in the soil of the Coastal Plain forests. Wherry's early interest in phlox grew with the years and culminated in his publication in 1955 of a monograph on the genus Phlox, much of it the product of his own painstaking research; it remains to this day the definitive treatise on the subject and a much consulted reference. Wherry considered the monograph on phlox to be his most significant contribution to plant taxonomy.

When Wherry and his new bride moved into their newly built house in Chevy Chase, Md., in 1914, he immediately began to realize a cherished ambition—to develop a woodland garden stocked with native plants. Among other things, the garden would provide a home for endangered species as well as a medium for habitat studies. Some years earlier, he was one of the first American naturalists to become acutely aware of the perilous prospects faced by many of our native plant species; his solution to the problem was to seek out and cultivate endangered species as a source of material for propagation and distribution, thereby insuring their survival. In later years, his missionary zeal found expression in the activities of the National Wildflower Preservation Society.

Among the rare plants that Wherry sought out, and collected, for his wild garden was the box huckleberry (a close relative of the blueberry), then known only from a single locality. It forms a colony that covers several acres in Perry County Pa.; the colony was declared a National Landmark in 1967. The box huckleberry is self-sterile and in the wild can only propagate itself by vegetative growth. On the basis of present rates of growth, the age of the colony has been estimated at 13,000 years—an age that would make it the oldest of any plant, or plant colony, presently known.

Wherry's interest in the box huckleberry eventually came to the attention of Dr. Frederick Coville of the U.S. Department of Agriculture, the botanist and horticulturist primarily responsible for developing the present large-fruited commercial blueberry from its parent, the native highbush blueberry. Coville was impressed, not only by Wherry's interest in ericaceous plants, the family to which the blueberry belongs, but also by his research into soil pH and its bearing upon plant association. A specific requirement of the blueberry is an unusually low soil pH. Coville arranged for Wherry's appointment as a "plant explorer," in which capacity he travelled extensively, obtaining data on the habitats of rare species and putting his soil pH test kit to extensive use in the process. Wherry had become a fulltime botanist.

In the late 1920's Wherry spent several field seasons studying and photographing the flora of Mt. Desert Island, Maine, as part of the initial evaluation program that led to the establishment of Acadia National Park. Wherry's book, "The Wildflowers of Mount Desert Island, Maine," sponsored by the Garden Club of Mt. Desert Island and limited to an issue of 1000 copies, soon went out of print, to Wherry's admitted surprise, and became a collector's item. Within the National Park, a garden of native plants has since been established stocked with the species described by Wherry and planted in accordance with his habitat specifications—an unexpected outcome of his studies that gave Wherry much pleasure.

Having by then earned a solid reputation as a botanist-ecologist, Wherry in 1930 accepted an appointment as Associate professor on the staff of the Botany Department of the University of Pennsylvania. The appointment left him the summers free to pursue his botanical studies in the more distant parts of the country, particularly the West and South. Two field manuals on ferns and one on wildflowers resulted from these studies, manuals that made Wherry's name a household word among the botanically inclined public throughout a large part of the Nation. Dr. Wherry's vast knowledge of the native plants of Pennsylvania, and their distribution, was utilized in the compilation of a voluminous monograph, work that went on for some 40 years. In the process, the authors estimated that close to a quarter of a million herbarium sheets of Pennsylvania plants were examined. The final product, an "Atlas of the flora of Pennsylvania," with Wherry as senior author, and J. M. Fogg, Jr., and H. A. Wahl as coauthors, was published in 1979.

In addition to holding the offices already mentioned in this memorial, Dr. Wherry at various times was President of the Washington Section of the American Chemical Society, President of the Pennsylvania Academy of Science, and President of the American Fern Society. He was also Editor of *Bartonia*, the journal of the Philadelphia Botanical Club. He organized, and was first Editor of, the Journal of the American Rock Garden Society; up to the time of his death, Dr. Wherry's name appeared on the masthead as Editor Emeritus. Three new plant species were named after him: *Tiarella wherryi* Lak., *Silene wherryi* Small, and *Dryopteris* X *neowherryi* Wagner. He was one of the founders, and the main stimulus behind the establishment of the State Wildflower Preserve on 100 acres at Bowman's Hill, New Hope, Pa. The popular "Edgar T. Wherry Fern Trail" within the preserve was developed in his honor. Wherry was also instrumental in establishing smaller wild gardens to protect endangered species on the campus of his alma mater, the Friends Central School, and on the grounds of the Arboretum of the Barnes Foundation, Merion, Pa.

A tall man, Dr. Wherry in his later years was thin to the point of gauntness. Acute nearsightedness gave him an abstracted air and heightened the appearance of frailty. According to a friend and former student, Wherry's nearsightedness coupled with a somewhat peculiar "shambling" gait led to frequent falls, that were a source of concern to the uninitiated who happened to be with him on field trips. The concern was misplaced. His friends knew that after such a fall he would simply dust himself off and proceed as if nothing had happened. Quiet to the point of reserve, he was nevertheless readily approachable and helpful to any one who shared his interests. According to the former student, Wherry had a "quirky" sense of humor and on occasion would both surprise and delight his companions on field trips with a rousing selection from Gilbert and Sullivan. Considered a "loner" in his research by some botanists (less than 10 percent of his publications bear the name of coauthors) and a "maverick" by a few, he showed little or no interest in the nuts and bolts of botany as represented by such basic disciplines as anatomy, physiology, and cytology. His interests lay in taxonomy, in geographic distribution, and, in particular, in the interactions among plant species, and between plant species and their environment. He was never happier than when he was in the field.

Never a man of means, Dr. Wherry moved in directions dictated by his interests, largely oblivous to monetary considerations. Though he never said so, those who knew him well are convinced that he paid for the greater part of his nearly constant fieldwork out of his own funds. Described as "unbelievably generous" by his long-time friend and colleague on the staff of the Botany Department at the University of Pennsylvania, the late Professor J. H. Fogg, Jr., Wherry along with cofounders Sam Gordon and Harry Trudell, provided "out of pocket" the funds often needed to keep the youthful *American Mineralogist* going in times of crisis. In 1961, he donated all royalties from his newly published book, "Fern Guide, Northwestern and Midland States, and adjacent parts of Canada," a popular and still standard field manual, to the American Fern Society and rescued that organization from its perennial financial doldrums. In 1964, he added to that contribution all royalties from his "Southern Fern Guide," a handbook of more limited circulation. Earlier, in 1948, Wherry had donated all proceeds from his newly published "Wildflower Guide" to the financially struggling National Wildflower Preservation Society. To use Wherry's own words, the book became a "modest best seller."

Unfortunately, when it came time for his retirement, Wherry's outstanding generosity found less than adequate reward in the pension system, which exacted its usual penalty for failure to fit the common mold. By spreading his income-producing years over three widely different fields of employment, Wherry had been unable to build up the necessary years of service in any one field to accumulate an ample annuity. As a result, living conditions during his retirement years tended to be somewhat austere. Happily, however, his fellow plant-lovers, friends and admirers in the various plant societies that he had so richly endowed with his dedicated service, gathered round to help lighten his burdens. Up to the last few years of his life his interest in nature, and his desire to share that interest with others, never flagged.

Acknowledgments

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Dr. Wherry written by Professor J. M. Fogg, Jr., as well as a comprehensive bibliography assembled by Dr. Warren H. Wagner, Jr., of the University of Michigan. To Wagner's compilation of 404 entries, Dr. Michael Fleischer of the U.S. Geological Survey, who searched the files of *Chemical Abstracts* for bibliographic information relating to Dr. Wherry, was able to add 16 more. Special thanks are due Dr. Fleischer for his help and advice. Dr. George T. Faust, Archivist of the Mineralogical Society of America, reviewed the manuscript and made helpful suggestions. Mr. Harold F. Evans kindly supplied the accompanying photograph of Dr. Wherry, taken December 12, 1967, at the Morris Arboretum of the University of Pennsylvania, at Chesnut Hill, Pa.

Selected Bibliography of E. T. Wherry

Because of space requirements, this list includes only a very small number of the 90 short papers written by Dr. Wherry on mineralogic subjects, about half of which were published in *The American Mineralogist*. In general, the entries chosen are those to which reference is made in the text as having played a part in the shaping of Dr. Wherry's career.

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(and J. M. Fogg, Jr., and H. A. Wahl) Atlas of the flora of Pennsylvania, Morris Arboretum, Philadelphia, 390 p. (1979).