

MEMORIAL TO CHESTER KEELER WENTWORTH 1891-1969

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Chester K. Wentworth, Fellow of The Geological Society of America since 1923, died in Hilo, Hawaii, on January 6, 1969, after several years of illness. He is survived by his widow, Juliette Oliveira Wentworth, and by two sons by a former marriage, Robert and Gordon. Another son, Thomas, was killed in France in 1944.

To those who knew Chester it will come as no surprise that before his death he had prepared a comprehensive survey of his career for the use of his biographers. It is the logical result of his systematism and, though he probably would not have admitted it, also of his thoughtfulness. It has been of great aid in preparing his Memorial.

Chester Keeler Wentworth was born in Aspen, Colorado, on May 7, 1891, one of five children of Frank Louis Wentworth and Anna Maria Keeler Wentworth. His parents were of New England stock, and in 1893 the family returned to Connecticut. After three years in Waterbury, they moved to the paternal family seat at Winsted, where the elder Wentworth began work on the first of several novels and histories based on his experience in the silver-mining camps of the west. Perhaps the greatest boon from these endeavors, so far as Chester was concerned, was the typewriter used for the writing. It became available to Chester at the age of six, and the familiarity with the machine that he gained at that time stood him in good stead in the tremendous amount of writing he himself did in later years.

To support his family, Chester's father was forced to take on many jobs other than writing: machinist, installing and repairing stoves, selling household gadgets, candy making, and carrying the mail on a rural route, as well as running the farm on which they lived. Chester grew up in an atmosphere of versatility, from which he certainly drew much of his do-it-yourself attitude, his mechanical ability, and his interest in writing.

In grammar school Chester had already developed an interest in science and mathematics, demonstrating for himself the law of the pendulum and certain algebraic principles. His excellent work in school led his teachers to encourage him to prepare to go to college, but just before he was 15 his mother died. His father, who himself had no

college education, was not sympathetic toward Chester having one, and instead insisted that he leave high school at the end of his second year and learn the trade of machinist. He worked for a year in a knitting mill, and then entered apprenticeship as a machinist, becoming a journeyman in 1910. In that year Chester moved to Worcester, Massachusetts, found a job as a machinist, and got married. In the evenings he completed a correspondence course in civil engineering, and after two years he got a job with a civil engineering firm, which he held for two years. However, following the death of his wife, his thoughts of college returned. Although he had not finished high school, he pleaded his case with President E. C. Sanford of Clark University, and at 23 was allowed to enter Clark as a special student. He did well, taking first honors in a freshman class of 40. But he was discontented at Clark because he was getting no geology, and at the end of his second year he decided to transfer to the University of Chicago.

Chester's interest in geology had started with a collection of rocks and minerals that his father brought back from Colorado. In grammar and high school his teachers encouraged the interest. One of them took several boys on field trips to mines and quarries, and encouraged Chester to put into order a mineral collection owned by the school. He took on this task with characteristic energy and enthusiasm, spending several months learning to identify the minerals. When he was forced to drop out of high school, he continued studying geology, both in books and in the field. Among other things, he made four round trips of about 40 miles each on his bicycle to read the new Chamberlin and Salisbury three-volume *Textbook of geology* at the library in Waterbury. In the summer of 1914 he made an amateur geological excursion to the Lake Champlain region, and in 1915 he studied the region around Winsted. Although he was still without any formal training in geology, in the fall of 1914 he took the U.S. Geological Survey examination for geologic aide. To the surprise of many, he passed. In 1916 he took a summer course in geology, and then was offered and accepted a job with a Geological Survey party working on a coal investigation in Wyoming and Montana. He also spent the summer of 1917 on the Survey job, and during these two field seasons there began an interest in the shapes of pebbles that later resulted in several published papers on that subject.

Chester graduated from the University of Chicago with an A.B. degree in geology in June 1918. The First World War was on. He was already a member of the Naval Reserve, and had been working part-time on a Navy project as an instrument maker for the famous physicist, A. A. Michelson. In September Michelson was transferred to Washington, D.C., and Chester went with him. He got out of military service in December, and immediately returned to the University of Chicago for graduate work.

In May 1919 Chester accepted a full-time appointment with the U.S. Geological Survey, working on coal deposits in southwestern Virginia. In September 1920 he went to the University of Iowa as a graduate student and Research Assistant. In the summer of 1920 he married Mildred Porter, but the marriage lasted only until 1925, when they were divorced.

Chester took his M.S. degree in 1921, and his Ph.D. in 1923, both at the University

of Iowa. It was during his time as a student at Iowa that Chester's unusual combination of aptitudes led to the achievement for which he is most widely known – the Wentworth scale for the classification of clastic sedimentary rocks. Later, in collaboration with Howel Williams, he proposed a similar scale for the classification of pyroclastic rocks. One delightful story has come down to us from Chester's comprehensive examination for the doctorate. One of the examiners asked him whether volcanic ash was an igneous or a sedimentary rock. Characteristically, Chester took this in stride, with the immediate answer, "It's igneous on the way up and sedimentary on the way down."

Perhaps it was the question on volcanic ash that led him to accept a Bishop Museum Fellowship from Yale University. At any rate, he spent 1923-1924 in Hawaii on this fellowship, working mostly on the islands of Oahu and Lanai. The work led to two Bulletins of the Bishop Museum: *The geology of Lanai*, and *The pyroclastic geology of Oahu*.

Returning from Hawaii, Chester taught for a year at the University of Iowa and part of a year at the University of Virginia, and worked for brief intervals for the Kentucky and Virginia Geological Surveys, and the U.S. Army Corps of Engineers, the latter on the examination of dam sites. In December 1927 he married Edna Clark in Washington. In May 1928 he became Associate Professor of Geology at Washington University in St. Louis. The summer of 1929 he spent studying the ash deposits of the Island of Hawaii, the results of the work being later published as a Special Report of the Hawaiian Volcano Observatory. The summers of 1930, 1932, and 1933 were spent in studies of dam sites and related mineral resources in the Missouri River Basin for the Corps of Engineers. In the summer of 1931 he traveled down the Yukon River, studying glaciers and glacial deposits, on an expedition financed jointly by Washington University and the National Research Council. One of his main interests was the comparison of glacial and ice-jam cobbles with striated cobbles along some rivers in the southern United States that had been considered to be of glacial origin.

Late in 1933 Chester was appointed geologist for the Honolulu Board of Water Supply, and from his arrival in Honolulu until his retirement from that position in May 1951 his efforts were directed primarily to a detailed study of the geology and ground-water resources of the Honolulu area. Between 1934 and 1942 he and his assistants made a detailed geologic map of the leeward side of the Koolau Range in the Honolulu-Pearl Harbor area, often using ropes to work down the faces of the numerous high cliffs. From 1942 on, his work was largely on the nature and dynamics of the Ghyben-Herzberg lens of the Honolulu artesian system. His principal contributions in this area relate to the growth of the brackish transition zone at the base of the lens, and to "bottom storage" resulting from the delayed response of the base of the lens to changes in the head.

Not even such a big job as the investigation of the Honolulu ground-water resources could absorb all of Chester's interest and restless energy! His other studies and activities ranged widely, from marine erosion and bench-forming processes, the chink-faceting of pebbles, glaciation on Mauna Kea, and dikes in the Koolau Range, to the making of camping equipment (he was proud of his skill with a sewing machine) and

various household and laboratory gadgets, and the grinding of telescope mirrors. Still feeling the need to demonstrate for himself various fundamental mathematical and physical principles, Chester investigated the theory of probability by repeatedly tossing 1,000 pennies against the wall, one at a time, and counting the number that came up heads. Never a slave to convention, he did not hesitate to adapt his house for his own uses, cutting holes in doors for cats to go in and out, and pitching his new tent on the hardwood floor of the living room when he so desired. Chester was president of the Hawaiian Academy of Science in 1935-36, and secretary from 1944 to 1949. From 1938 to 1941 he was a member of the Hawaii Territorial Planning Board.

In September 1939 Edna left Hawaii, and in 1941 they were divorced. Later that year Chester married Juliette Oliveira of Honolulu, who then was a nematologist for the Research Institute of the Pineapple Producers Cooperative Association. For the next ten years their home was on Wilhelmina Rise, overlooking the city of Honolulu. Lovers of cats, the Wentworths already had a big collection, which in later years sometimes numbered as many as twenty. One of Chester's many ancillary activities was the keeping of genealogies of the Wentworth cats and those of their neighbors, together with a detailed record of the growth rate of the kittens, inheritance of various characteristics, and other vital statistics. He once commented that he had the data to become a good cat actuary!

During World War II Chester served as a consultant to the armed forces on water-supply problems, making two trips to the Marianas Islands for the Navy. After the war he served in 1948 as a delegate of the American Geophysical Union to the U.S. Commission for UNESCO. In 1949 he was chairman of a group of hydrologists appointed by the armed forces to adjudicate the ground-water problems created on Angaur Island by the mining of phosphates. The recommendations of the group to the United Nations were adopted.

In 1944 the Wentworths began building a new home on the Island of Hawaii, on the outer rim of Kilauea Caldera. Chester did nearly all the construction work himself during vacations from the Board of Water Supply, with assistance from Juliette and occasionally from other people. A small house was built first, to live in while the big house was being constructed. It later served as a guest house, and sheltered many geological visitors to Kilauea, recipients of the Wentworths' ever-ready hospitality. Chester's construction methods were often unusual, if not unique. For instance, instead of building the two-story house all at the same time in the usual manner, he built and roofed the lower story first, then jacked the roof up in sections to build the second story under it.

Long before 1951 Chester was eager to leave Honolulu and begin his new life at Kilauea on a full-time basis. To mark the passage of time, he acquired a chain with the number of links equaling the days until his retirement. This he wore around his waist, like a belt, and every morning he cut off one link. This he often laid, as a reminder, on his boss's desk. The last link disappeared on his 60th birthday, and the next day the Wentworths moved to Kilauea.

In 1949 Chester had been appointed a W.A.E. member of the U.S. Geological Survey, and in June 1951 he started work at the Hawaiian Volcano Observatory, first on

a full-time, and later on a part-time basis. In September 1951 he started teaching physical science at the Hilo Branch of the University of Hawaii, while Juliette taught biological science. He also worked as a professional consultant on ground-water problems. After two years, he gave up teaching to devote more time to his consulting work.

Chester's work at the Volcano Observatory was diverse. He participated in the investigations of the magnitude-7 earthquake in Kona in August 1951, and the 1952, 1954, and 1955 eruptions of Kilauea. For a time he carried on magnetometer observations on a line of permanent stations established across the top of Kilauea and part way up the slope of Mauna Loa. He devised a series of optical measurements with a transit to fixed targets in the caldera area to supplement the information on tumescence of the volcano derived from tiltmeter readings and measurements of the changing widths of cracks on the caldera floor. He carried out repeated photographic surveys of the caldera and of the inner crater, Halemaumau. He built numerous devices to aid, in one way or another, the multitudinous operations of the Observatory. And, perhaps most important of all, he served as a continuum in the constantly changing professional personnel of the Observatory.

In March 1956 Chester suffered a stroke that left him partly paralyzed. Owing largely to his own dogged determination, he recovered well, and was soon able to carry on most of his normal activities. Regrettably, another stroke came in November 1962, and this was followed by others, with a gradual general physical deterioration. For the last couple of years he was almost wholly incapacitated, and required Juliette's almost constant attention. The unfailing kindness and forbearance with which she dealt with the crotchety old man smarting under the inability to do the things he had always done was a constant source of amazement to their friends.

In addition to being a Fellow of The Geological Society of America, Chester was also a Fellow of the American Association for the Advancement of Science and the American Geographical Society, and a member of Sigma Xi (president of the Hawaii chapter in 1944), American Geophysical Union, American Meteorological Society, American Statistical Association (president of the Hawaii chapter in 1950), Seismological Society of America, and Hawaiian Academy of Science. His published scientific papers number approximately 150. The list below includes only the more important ones.

Chester's work for science and the community brought him several honors during his last years. In 1964 he received the Bronze Medal of the U.S. Department of the Interior's Commendable Service Award. In 1965 the new physical science building on the Hilo Campus of the University of Hawaii was named in his honor, Chester K. Wentworth Hall. In 1968, his old friend and former fellow student at Iowa University, Harry S. Ladd, named a newly discovered seamount near the Midway Islands for him, Wentworth Seamount. The name has been approved by the Board on Geographic Names.

Chester was always full of ideas, and many of them turned out to be good. His unorthodox training and his nonconformist approach to things in general enabled him to see things differently than others did, and to make suggestions for new and better ways of doing things. His enthusiasm was always stimulating. It was, however, accom-

panied by a volubility which was well known, to himself as well as to others. One of us (Cox) worked for him at the Honolulu Board of Water Supply as a summer-time undergraduate assistant. When I left for graduate work at an eastern university he told me I could look forward to working under a faculty member who was the only member of the geologic profession who could out-talk him. This faculty member, at my first meeting with him, commented that I had already worked for the one geologist that was more talkative than he was!

Chester's criticism was always open and honest, and often valuable, but it could be very blunt, and his concern for detail was accompanied by a talent for needling his fellows regarding things that to him appeared important, but to them seemed to be minutiae. In the informal Hawaiian Dana Club, organized by the small group of Honolulu geologists and hydrologists in the late 1930s, this concern and talent was matched by equal concerns and talents in others regarding generalities. The heated discussions that resulted required the best efforts at mediation by the moderates of the group.

There is no question that this unforgettable man made lasting contributions to geology and hydrology in remarkably diverse ways. We are grateful to have known him and worked with him!

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