

Memorial to Harold Edwin Malde (1923–2007)

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Harold E. (Hal) Malde, distinguished U.S. Geological Survey (USGS) Quaternary geologist, died of leukemia on 4 November 2007 in hospice near his Boulder, Colorado, home. He was born Harold Johnson in Reedsport, Oregon, on 9 July 1923, but at the age of five was adopted by Emil and Bessie Malde of Portland, where he grew up and where he graduated from high school in 1941. He attended Willamette University for one year, 1941–1942, and then enlisted in the wartime U.S. Navy as an aviation cadet. He earned his pilot's wings and officer's commission at Pensacola, Florida, in January 1944, subsequently lost an eye in a flight accident, and was retired for physical disability in January 1945. Hal returned to Willamette, majored in mathematics and chemistry, was elected student-body president, and graduated magna cum laude in 1947. He moved to Harvard as a graduate student in mathematics, but contact with geology professor Kirk Bryan convinced him to change his major. He transferred, briefly, to the University of Oregon and then to the University of Colorado for 1948–1951.



Hal began working for the USGS on surficial geology of the Denver region while a graduate student and was hired full time by the survey in 1951. He rapidly gained experience in diverse types of surficial and bedrock geology during his early survey years by working with established geologists in Nevada, Arizona, Utah, Montana, Tennessee, and South Carolina (where he first became a project chief, studying phosphate deposits).

Next came a little-interrupted decade, 1955–1965, as project chief, studying the late Neogene geology of the western Snake River Plain, Idaho. A major product of this period was Hal's discovery and documentation of the effects of a gigantic late Pleistocene Snake River flood as glacial Lake Bonneville (which filled the basin that now contains shallow Great Salt Lake) overflowed, and rapidly downcut, its rim. This work, reported comprehensively in his 1968 USGS monograph, earned him the 1970 Kirk Bryan Award of the Geological Society of America. He mapped much of the western plain, studied its bounding structures, documented the complex Quaternary history of volcanism and lake formation, and defined geomorphic and volcanic processes. He contributed to the development of the late Neogene paleomagnetic time scale that provided critical early confirmation of seafloor spreading.

Hal also did much subsequent work in the Snake River Plain, but with major interruptions for other part- and full-time assignments. He mapped the glacial geology of two Connecticut quadrangles, and studied the interplay of surficial processes and human activities in northern New Mexico. During 1973–1982 he was deeply involved in investigations of geologic and environmental factors in nuclear-facilities risk assessments, oil-shale development, and reclamation

potential of coal lands in the western states, including Alaska. He was a major contributor to four comprehensive advisory studies, published by the National Academy of Sciences, on these subjects. He was on various relevant committees of the academy, the National Research Council, and the Department of the Interior, and he made many related presentations to national and state legislative and professional groups. Hal's Snake River work was not further interrupted after 1982, and he studied early Pleistocene lava dams, impounded sediments, diversions of the river by volcanism, and capture of the river by Hell's Canyon. His summary account of evolution of the Snake River Plain was published as his 1991 GSA Decade of North American Geology paper.

Hal made geologic studies, cooperatively with archaeologists from various academic institutions, of many archaeological sites in the western United States and, most extensively, from 1964 to 2004, of the apparently very ancient site at Hueyatenco, Valsequillo reservoir, Puebla, Mexico. To the great surprise of Hal and his coworkers, volcanically derived strata that enclose well-crafted bifacial stone implements, found in situ directly adjacent to darkly and solidly permineralized bones of extinct Pleistocene mammals, were independently dated by collaborating scientists by uranium-series, fission-track, and, with less precision, tephra-hydration methods as about 250,000 years old. Rich assemblages of freshwater diatoms, including many extinct forms, yielded a compatible age bracket of 80,000–400,000 years. Reports on this work by Malde and associates include those of 1969 and 1981 listed below, which also reference papers by the dating specialists. No human bones have been found at the site, but the artisans presumably were related to *Homo erectus*, known in Africa, where similar artifacts of slightly greater age are documented, and in Eurasia. Several darkly mineralized, thick-browed human skull fragments found near Guadalajara, Mexico (geologic context and age unknown), were specifically likened by anthropologists to *H. erectus* on the basis of distinctive measurements. Although *erectus*, of course, could have crossed from Asia to North America with other Pleistocene mammals during interglacial periods, the skull fragments nevertheless were assigned to dissimilar modern *Homo sapiens* to accord with dogma that no humans reached North America before *sapiens* arrived about 20,000 years ago. (Twenty years or so ago, the accepted limit was 12,000 years.)

The archaeological and anthropological community has mostly reacted to the documentation of the great age at Valsequillo with incredulity and with speculation that the dates, by independent methods, investigators, and laboratories, are all bad, or that the sediment is reworked with younger artifacts despite its rich diagnostic assemblages of well-preserved fragile diatoms and its stratigraphic continuity in an old section. Hal's last paper (2007, submitted) refuted such conjectures in detail, and no contradicting evidence has been documented.

As a result of his Valsequillo work, Hal was an invited member of the National Academy of Sciences' Paleoanthropology Delegation to the People's Republic of China in 1975. His voluminous archaeological-site records, from the United States as well as Mexico, have been archived by the Denver Museum of Nature and Science.

Hal received the USGS Meritorious Service Award in 1979, with the citation particularly honoring his work with hazards and reclamation. He was active in a number of the dozen scientific organizations to which he belonged. He was a fellow of both GSA and the American Association for the Advancement of Science. GSA activities included associate editorship of the *Geological Society of America Bulletin* and chairmanship of the Quaternary Geology and Geomorphology division, and he was a councilor of the American Quaternary Association. He led dozens of field trips for professional groups and was a frequent reviewer of manuscripts and proposals by others. He retired from the USGS in 1987 as a senior research geologist, but continued geologic activities, in part, as a survey emeritus volunteer for another five years. He

prepared his final Valsequillo paper, with co-authors, in 2006. A symposium honoring his work and memory was presented at the 2008 annual meeting of GSA in Houston, Texas.

Hal's superb photographs illustrated his geologic reports. Beginning in the 1960s, he took field photographs to document landscape changes. He repeated many historical photographs, and he marked his own photo points so that he or others could repeat the photographs later. Several of the publications listed below are among those wherein these photographs were published. He repeated in 2000 many Chaco Canyon, New Mexico, photographs he took in the 1970s, and also pictures taken earlier by others, and provided the photographs and an extensive Chaco Culture National Historical Park report to the National Park Service.

Hal was a master of darkroom techniques and made exhibition prints of natural subjects from his large-format black-and-white negatives. After his retirement, he combined his photographic and environmental interests and began 19 years of volunteer service by providing photographs to the Nature Conservancy. He photographed more than 600 conservancy preserves in all 50 states and donated more than 20,000 high-quality photographs, mostly 35 mm color transparencies, to the national organization, its state and local affiliates, and its preserves. Many of these have been published. He mastered digital-darkroom techniques and continued, until almost the end of his terminal illness, to make and distribute exhibition color prints of conservancy sites. The conservancy gave Hal its highest recognition, the Oak Leaf Award, in 1993. A crowded memorial gathering at the Colorado Conservancy building (wherein are displayed many of his photographs) in Boulder in December 2007 celebrated his life.

Hal is survived by his wife of 53 years, Caroline (Carrie) Elizabeth Rose Malde, their daughters Melissa Ruth Malde and Margaret Jean Malde Arnosti, and Margaret's husband Donald and their children, Nicholas, Nathan, and Elizabeth Arnosti. Hal and Carrie participated actively in community environmental and societal matters. Hal was deeply involved in the successful campaigns for preservation of open space in the Boulder Greenbelt and the rest of Boulder County, and his photograph of children playing in front of the red-sandstone Boulder Flatirons was the poster image for those campaigns.

Hal greatly enjoyed outdoor activities, travel, and classical music (especially operas and concerti). When his daughters were young, the family went on many camping trips throughout the western states, as well as weekend explorations in Mexico when he was doing field work there. Later international travels by Hal and Carrie included Europe, Costa Rica, Patagonia, and New Zealand. He was very knowledgeable about politics and was a committed liberal and pacifist. As he became less active, he read extensively and watched news, movies, and sports on television.

Hal Malde was an uncommon man of total integrity who backed his commitment to environmental concerns with lifelong effort and dedication. My wife and I met him in 1952, when he and I worked on the USGS Great Smoky Mountains Project. He was a close and valued friend ever after, both while we were together in the Denver office for most of our survey careers and after our retirements.

This memorial incorporates much information provided by Carrie and Melissa Malde and from materials left by Hal. Virginia Steen-McIntyre provided references for the Valsequillo endeavor. The following bibliographic items are among Hal's almost 100 scientific reports and geologic maps (not counting his many abstracts, reviews, and administrative reports).

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