

## Memorial of Benjamin F. Leonard III, 1921–2008

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Benjamin Franklin Leonard III, at age 87, passed away peacefully at his home in McCall, Idaho, on September 5, 2008. Ben had a long and distinguished career at the U.S. Geological Survey, where he established himself as an accomplished field geologist and an internationally recognized expert in ore microscopy.

Born in Dobbs Ferry, New York, on May 12, 1921, Ben spent much of his early life in the eastern United States, graduating from Hamilton College in 1942 (B.S.), a salutatorian and member of Phi Beta Kappa, and then Princeton University in 1946 (M.A.) and 1951 (Ph.D.), where he was a member of Sigma Xi.

Ben's geologic career began as a field assistant to Allen Heyl in the summer of 1942 for the Geological Survey of Newfoundland, mapping igneous and metamorphic rocks and magnetite deposits. His U.S. Geological Survey career began as a field assistant in 1943 to A.F. Buddington, doing regional geologic mapping and studying magnetite deposits in New York (for which he mapped about 1000 square miles of the St. Lawrence County magnetite district in the northwest Adirondacks) and Pennsylvania, and copper deposits in New Jersey and Pennsylvania while still a graduate student at Princeton University. His graduate studies on the ore deposits in the St. Lawrence County magnetite district culminated in his doctoral dissertation, later published by the U.S. Geological Survey as Professional Paper 377, considered to be the major treatise on the district.

His transition to the western U.S. started ca. 1951, when he and his wife Eleanor (Vandy) moved to Golden, Colorado, and Ben became a member of the Minerals Branch at the U.S. Geological Survey in Lakewood. With his Ph.D. fresh in hand he began full-time work on Survey projects including continued research in the St. Lawrence County magnetite district. Ben's field research soon expanded to mining districts in Colorado, where in the early 1950s he worked on uranium deposits in the Colorado Front Range. However, he soon turned his attention to his beloved central Idaho where decades of study followed. His work on the Idaho batholith and metamorphic roof pendants of the Yellow Pine–Big Creek area resulted in several publications whose topics ranged from regional mapping, to neotectonics, and to ore microscopy.

Readily recognizing when additional expertise was necessary, he initiated joint cooperative studies, including some of the earliest U–Pb zircon isotopic work, with Tom Stern, in the Idaho batholith region; similarly, with Jim Erdman he investigated the use of metals in plants as an exploration tool near the Red Mountain gold deposit, Idaho. Much of the work in Idaho was done on horseback, utilizing 8-horse pack strings, often with the



assistance of his wife. When hired horses became too expensive, he assembled his own pack string for the Survey, and he grew to love the animals, not only riding them but also looking after them. Ben approached horsemanship as he did everything else—with a determination to excel. His lifelong interest in Idaho continued even after his formal retirement, giving his time to mapping and geologic work in the Snowdon Wildlife Sanctuary.

Beyond his skills as a field geologist, Ben was a master petrographer and a world-recognized authority on the microscopic identification of ore minerals; despite his being nearly blind in one eye, his color perception and ability to distinguish faint anisotropism was exceptional. His expertise in the field of ore microscopy led to his tenure as Vice Chairman of the International Commission on Ore Microscopy from 1982–1986. He was very discerning regarding new equipment (often preferring the older, 1950s vintage Leitz monocular ore microscopes), and he methodically and critically evaluated the optical performance of each manufacturer's new wares. As technology changed, Ben teamed with colleagues to produce software that allowed the computerized matching of reflectance data to aid in the identification of unknown ore minerals.

In 1962, he established the ore microscopy laboratory at the Denver Federal Center; this facility served the research and educational needs of the region for nearly four decades. Ben established in this laboratory a world-class collection of ore minerals and their polished sections, many from mines no longer accessible. In the microscopy lab that he so fastidiously maintained, these samples were the heart of the ore microscopy classes. Detailed records of each ore mineral were carefully

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maintained in his incredibly neat handwriting, as was every other facet of operating the lab—going back to invoices for supplies ordered in the 1960s!

Ben was not only a scholar but also a mentor to countless students, having taught ore microscopy to a generation of Survey associates and outside students, and from 1992 to 2001, graduate students at the Colorado School of Mines as an Adjunct Professor at the Department of Geology and Geological Engineering. Earlier, in 1967, he was a Visiting Professor at the school, where he taught a graduate course in mineral deposits. In 2001, the students at the Colorado School of Mines presented him with a Lifetime Achievement Award at the annual faculty appreciation dinner. Ben was generous with his time; aside from the many students fortunate enough to have benefited from his encyclopedic knowledge of ore microscopy in formal classes, he freely volunteered his weekends to work with me (D.K.) on the finer points of ore microscopy, and also took the time to teach universal stage methods when so few were able to do so. Scientists are often remembered for their written contributions to the literature, but perhaps Ben's most lasting impact is on his innumerable students; as he himself wrote: "I believe that... my work with and for other people is more important than my personal research on ore minerals."

When he retired from the U.S. Geological Survey in 1993 he assumed an emeritus status that continued until his death. Even after his "official" retirement, Ben maintained a full time schedule at the Survey, continued to oversee the ore microscopy laboratory, and taught classes to U.S. Geological Survey personnel and Colorado School of Mines students at the Denver Federal Center for another 8 years. In 2001 he and his wife Vandy moved permanently to their former summer home in McCall, Idaho, whereupon he continued to provide consultation and assistance to U.S. Geological Survey members and others. All told, his affiliation with the Survey spanned nearly 65 years—an impressive tenure that few in that organization have attained.

Fieldwork and geology were not Ben's only interests; his activities were extraordinarily wide-ranging. Ben was, if nothing else, a Renaissance man by any definition. Music and the arts—especially English literature—were among his "pastimes." Classical music was a large part of his life, with National Public Radio being the fare in both Golden and Idaho homes. He was multilingual (French, German, Swedish, and Russian), and translated significant articles from German (including portions of Ramdohr's exhaustive treatise on *The Ore Minerals and Their Intergrowths*, Pergamon, New York, 1969) and Russian into English—sometimes for publication but often to assist monolingual colleagues.

Always the dapper gentleman, Ben was usually seen arrayed in a tie or bow tie, sport coat, hat, and an ever-present magnifying loupe. Beyond being a consummate and meticulous professional, he was substantive in his knowledge and unpretentious in his demeanor. Having described himself as a "fair hand with an ... ore microscope", and "chief cook and bottle washer" for the ore microscopy lab in Denver (and to casually mention that he "can ride some horses" in his curriculum vitae), Ben's self-deprecating demeanor (and mastery of understatement, given his well-recognized abilities) sets a positive example of humility. Ben was also congenial, often hosting, with his wife Vandy,

Easter and Thanksgiving gatherings of U.S. Geological Survey and Mines personnel for dinner at their home.

Honors were numerous, well deserved, and varied. Aside from the aforementioned election to both Phi Beta Kappa and Sigma Xi, in 1988 he received the Department of Interior's Meritorious Service Award. He discovered and described the new minerals paradocrasite and polhemusite, and co-authored papers on four other new minerals. As was only fitting after having identified and named several new minerals, a new mineral (benleonardite, a Ag-Sb sulfotelluride) was named after him in 1985 by his British colleagues (Stanley et al. 1986); moreover, he has the distinction of having an Eocene larch, *Larix leonardii*, named after him by Daniel Axelrod, University of California, Davis. Over the years, he published about 100 papers on regional geology, ore deposits, and mineralogy.

Ben was a Senior Fellow of the Geological Society of America, and a long-standing member of the Society of Economic Geologists, the Mineralogical Society of America, the Mineralogical Society of Canada, and the Colorado Scientific Society (where he served as president in 1956 and was elected an honorary member), as well as the Phi Beta Kappa Society of Fellows. He was an associate editor of the *Canadian Mineralogist* from 1976–1978.

By his time of retirement to McCall, Idaho, Ben had returned to earlier interests of the study and identification of lichens and fungi, having previously found a correlation of these organisms to geological phenomena (e.g., Erdman et al. 1985; Leonard and Rosentreter 1994), and also on account, by his own description, of "having found rocks too heavy for his rucksack."

He is survived by his wife of 58 years, Eleanor (Vandy), daughter Ruth (Kate) O'Neal, son and daughter-in-law, Bill and Terri Leonard, and three grandchildren. Those who were fortunate enough to have encountered Ben are privileged to have known him as a mentor, scholar, gentleman, and friend, and they will not soon forget him.

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