



Paul A. Witherspoon

PAUL A. WITHERSPOON

1919–2012

Elected in 1989

“For pioneering achievements in geothermal energy, underground storage, hydrogeology, and the flow of fluids in fractured and porous rocks.”

BY R. ALLAN FREEZE, IRAJ JAVANDEL,
AND SHLOMO P. NEUMAN

The hydrologic community lost one of its most charismatic leaders with the death of PAUL A. WITHERSPOON on February 10, 2012, in Berkeley, California. He passed away from complications brought on by Parkinson’s disease. He was 93.

Paul was a dynamic and influential research leader in hydrogeology for more than 50 years. Working from his base at the University of California, Berkeley (UC Berkeley) and later from the Lawrence Berkeley National Laboratory (LBNL), he made significant contributions to the understanding of the flow of fluids in porous media and fractured rock, and he applied his findings to a diverse set of societally important issues, including the development of geothermal energy, use of underground gas storage, and siting and design of nuclear waste disposal facilities. In all these spheres of interest he emphasized the need to marry theoretical studies and field testing. He was especially passionate about the need for large-scale, in situ, underground experiments to guide and corroborate the predictions of theoretically based numerical models.

This tribute was published in *Eos, Transactions American Geophysical Union* 93(31):304, July 31, 2012. Reproduced with permission of John Wiley & Sons, Inc.

Perhaps even more importantly, he was an inspirational mentor for many years to a large number of graduate students and postdoctoral fellows who went on to develop successful research careers in their own right. His circle was always populated by students and colleagues from around the world, and he reveled in their diverse cultures. To enter Paul's orbit was to experience a stimulating mix of high intelligence, deep curiosity, and love of life.

Paul was born on February 9, 1919, in Dormont, Pennsylvania. His father was a civil engineer who worked for a time for the Carnegie Coal Company, and Paul took his first trips underground into coal mines with him. When Paul was in high school, his father started a small cable tool drilling company to drill for natural gas, and Paul often worked on the rigs. These early experiences had a direct and lasting influence on his choice of career.

Paul graduated from the University of Pittsburgh in 1941 with a BS in petroleum engineering and then worked for eight years in various capacities for the Phillips Petroleum Company in Oklahoma, Texas, and Kansas. In 1949, at the age of 30, he enrolled at the University of Kansas, and completed his MSc in petroleum engineering physics in 1951. Shortly afterward he accepted a position as head of the petroleum engineering division of the Illinois State Geological Survey in Champaign. The survey offices were on the University of Illinois campus, and for the next five years, while working full time for the survey, he pursued a PhD in the university's department of geology. His doctoral work was directed by the eminent clay mineralogist Ralph Grim, whom Paul credited as his role model in scientific life.

Paul joined the faculty in UC Berkeley's Department of Mineral Technology in 1957. Declining enrollments in petroleum engineering prodded him toward research on a broader suite of geological engineering topics, especially those involving groundwater issues.

His experience with leaky cap rocks in underground gas storage projects led him to recognize the importance of aquitards (units of lesser permeability than aquifers) in hydrogeological

systems sooner than many of his colleagues. His early research into the hydraulics of aquifer-aquitard systems was a precursor to issues that would soon arise in connection with contaminant transport problems, geothermal energy production, land subsidence, and nuclear waste isolation. In 1971 he organized a seminal meeting at the Asilomar Conference Grounds, California, that was the first conference to bring attention to the role of aquitards in groundwater flow systems.

In 1977 Paul became the first director of LBNL's Earth Sciences Division, while maintaining a dual appointment with UC Berkeley, where he taught until 1989. At LBNL he and his team made major contributions in geothermal reservoir engineering, numerical modeling of flow through fractured rocks, large-scale field and laboratory testing of flow and transport parameters, and the integrated assessment of the thermohydrologic and hydromechanical couplings between the flow field, stress field, and heat field in subsurface environments.

LBNL's Earth Sciences Division also became heavily involved in the development of viable methodologies for underground nuclear waste disposal. Paul and his team took the lead American role in an international research program at the Stripa Mine in Sweden, a project that provided the first comprehensive studies of flow and transport in fractured rock at depth. On the home front, Paul regularly offered his expertise to the US Department of Energy in its assessment of the proposed nuclear waste site at Yucca Mountain, Nevada.

Paul was widely honored for his work. In 1976 he received the O.E. Meinzer Award from the Hydrogeology Division of the Geological Society of America (GSA), in 1989 he was elected to the National Academy of Engineering, and in 1990 he was awarded the Robert E. Horton Medal (now the Hydrologic Sciences Award) from the American Geophysical Union. He also received GSA's George Burke Maxey Distinguished Service Award in 1996.

In addition, Paul's colleagues and graduate students honored him with three memorable research conferences at LBNL on the occasions of his sixtieth, seventieth, and eightieth birthdays. Each conference not only provided a wonderful

opportunity to catch up with friends and former coworkers but also turned into an important venue for scientific exchange that led to highly regarded published proceedings.

Paul is survived by his wife Elizabeth and daughters Kathy and Claire. He was predeceased by son David, who was killed in a car accident in 2006 at the age of 57.

Readers can learn more about Paul in his own words in a 2007 videotaped interview posted on the website of the International Association of Hydrogeologists (<http://time-capsule.ecodev.ch/>). The association also published a biographical article based on the interview (*Hydrogeology Journal* 16:811–815, 2008).