Research

*Fred M. Phillips*, Professor of Hydrology

My field of scientific interest lies within the area where hydrology, geochemistry, and geology overlap. Problems I have particularly focused on include the effects of climate change on the hydrologic cycle and the influence of the hydrologic properties of geologic materials on the transport of solutes in ground water and soil water.

My favoured tools for these investigations are stable and radioactive isotope techniques. One example is the use of stable isotopes in ground water from the San Juan Basin, New Mexico, to reconstruct temperatures and ground-water recharge rates over the past 25,000 years. A similar study involves the reconstruction of lake-level fluctuations by numerical modeling of stable-isotope variations preserved in carbonate sediments laid down by Pleistocene lakes in the southwestern United States.

I have devoted much of my time to the exploration of applications of chlorine-36, a long-lived radioactive isotope of chlorine for which appropriate analytical techniques have only been perfected in the last 15 years. Some of these applications have included the dating of very old ground water (up to one million years old), tracing the movement of modern soil deposits, dating of continental evaporite deposits, and dating the surface exposure time of geomorphic features. Recently, I have been using measurements of chlorine-36 in fossil rat urine as a monitor for changes in cosmic radiation over the late Quaternary.