Willard S. Moore
Research Professor & Distinguished Professor Emeritus
University of South Carolina
Geochemistry and Chemical Oceanography

Education
B.S. Chemistry, 1962, Millsaps College
M.S. Geology, 1965, Columbia University
Ph.D. Earth and Space Sciences, 1969, State University of New York at Stony Brook
Post Doc, 1970-1971, Tata Institute of Fundamental Research, Bombay

Research Areas: The primary research of my laboratory is based on the use of naturally occurring radionuclides as tracers of geological and oceanographic processes. By measuring precisely radionuclides that result from the decay of uranium and thorium in the environment, we investigate such diverse topics as the flow of groundwater into the ocean, interactions of river water and sediments with sea water; mixing rates of the coastal ocean; hydrothermal processes at ocean spreading centers; the internal structure of minerals; the ages, rates, and processes of formation of manganese nodules; the rate of growth of corals; and sea level changes. During the past two decades our efforts have been focused on the following topics:

Groundwater Input to the Coastal Ocean*:* Submarine flow of groundwater (fresh and salty) directly into the coastal ocean had been recognized, but prior to the application of tracers, there was no means of quantifying the total flux on a regional or global scale. Now groundwater inputs are identified and quantified using chemical tracers. These tracers have high concentrations in the groundwater and low reactivity in the coastal ocean and therefore integrate the groundwater signal over a large region. To translate the tracer distribution into a groundwater flux, we must also determine the tracer concentration in the groundwater and the rate of mixing of coastal waters. If the system is in balance, the rate at which the tracer is lost by mixing offshore must equal the rate at which it is being added near the coast. By measuring the terms in this mass balance, we can establish the groundwater flux.

We use four naturally-occurring radium isotopes as tracers of groundwater flux. Here we recognize that coastal groundwaters are composed of both terrestrial freshwater and marine seawater. When applied to regional and global scales, the tracer balance equations require substantial discharge of brackish and salty groundwater, rivaling river inputs to the ocean in terms of total volume and fluxes of nutrients.

Ocean Circulation and Mixing*:* Natural radioactive tracers, especially Ra isotopes, are released into the ocean when sea water contacts sediments. This occurs within coastal aquifers, at the mouths of major and minor rivers, along the continental shelf, at the ocean floor, and at hydrothermal vents. Measurements of these tracers enable us to model the circulation of the tagged waters as they move away from the source regions and mix with waters of the ocean interior. Here, our studies have been concentrated along the coasts of the US, Brazil and China and in the mixing zones of major rivers. To study mixing in

these complex regions, we use four radium isotopes having half lives of 3.6 days, 11.4 days, 5.7 years, and 1600 years. The two short-lived isotopes decay almost completely between the shore and the edge of the shelf; the two long-lived isotopes decay hardly at all. The radium isotope distributions reveal patterns and rates of offshore mixing.

Society Membership/Professional Activities & Honors

Mercator Fellow, University of Rostock, Germany
Distinguished Scholar, Xiamen University, Xiamen, China
Distinguished Scholar, East China Normal University, Shanghai, China
Fellow, Hanse-Wissenschaftscollege, Delmenhorst, Germany
American Association for the Advancement of Science, elected Fellow 2014
American Geophysical Union, elected Fellow 2006
Distinguished Alumni Award, Stony Brook University, 2007
B. H. Ketchum Award, Woods Hole Oceanographic Institution, 1999
USC Education Foundation Award for Research in Science & Engineering, 1993
Marine Chemistry, Associate Editor 1993-present
SCOR, Groundwater Discharge Working Group 1998-2004
NAS/NRC Committee for Reference Materials in Ocean Science 2001-2002
Coastal Ocean Processes (CoOP), Scientific Steering Committee 1998-2001
NSF Future of Ocean Chemistry in the US, Steering Committee 1997-1999
Geological Society of America, Assoc. Editor, Bulletin GSA 1980-1988
Sigma Xi, President USC Chapter, 1978-79
Oceanographic Society
Geochemical Society
Explorers Club, Fellow, Chairman Greater Piedmont Chapter, 1995-1996