

GRANTEE: **CALIFORNIA INSTITUTE OF TECHNOLOGY**
Division of Geological and Planetary Sciences
Pasadena, CA 91125

GRANT: **DE-FG07-96ER14700**

TITLE: **Aquifer Transport of Th, U, Ra, and Rn in Solution and Colloids**

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Preparations have been made to collect groundwater samples from the unconfined Pleistocene aquifer on Long Island, N.Y. from wells at Brookhaven National Laboratory. Dr. Jan Naidu of the Brookhaven Safety and Environmental Protection Division has been intimately involved with the groundwater monitoring program at the site for many years, and has provided us with detailed information regarding site hydrogeology, groundwater chemistry, and monitor well locations and construction. In consultation with Dr. Naidu, a series of wells have been chosen for sampling that extend over a distance of ~5000 feet along a single flow path, with estimated water ages of up to ~20 years. Since the recharge area for these waters has been the source of low levels of tritium (and possibly ^{90}Sr) contamination, there has been considerable interest in the hydrogeology and chemistry of the area, and all information gathered at the site will be provided to BNL staff. Groundwater sampling is planned for the autumn of 1997. At this time, aquifer materials will also be obtained from the drill core repository of the USGS office in Long Island, where Mr. Henry Ku has indicated that material will be available for our use.

As a complement to our studies of U and Th series nuclides, the sampling plan is being extended to include analysis of He isotopes. Concentrations of ^4He are expected to largely reflect the time-integrated recoil production by decay of the U and Th series nuclides, without losses due to adsorption or decay, and will be compared to ^{222}Rn concentrations, which provide recoil rates over short time periods. The concentrations of ^3He due to decay of contaminant ^3H in these waters will also be measured, and a comparison between the measured concentrations and that produced in the waters since the time of recharge will provide an indication of whether gas losses have occurred. Arrangements have been made to collaborate in this phase of the research with Dr. David Hilton of Scripps Institute of Oceanography, who has extensive experience in measuring He isotopes in hydrological systems. Dr. Hilton has agreed to provide the necessary field equipment for sampling and will conduct the laboratory analyses of He isotope concentrations.

The Edwards Aquifer has been identified as the second area for study. The Edwards limestone consists of regions of oxic and anoxic conditions that are

reflected in the host rock mineralogy and so the distribution of U and Th series nuclides. Dr. Ruth Deike of the USGS has conducted a detailed petrological and chemical study of cores from test wells in both oxic and anoxic waters (USGS Water Resources Investigation Report 87-4266, 1991) and has provided us with the suite of samples that she has studied, for investigation into the distribution of U and Th as well as into mineralogical properties affecting radionuclide transport in these rocks. Field work will be conducted in the Edwards subsequent to these studies.

An important component of the investigation is the measurement of colloid-bound nuclides in the water samples. In the autumn of this year, Dr. Per Andersson of the Swedish Museum of Natural History will be visiting our laboratory for several months. Dr. Andersson and his colleagues have been conducting a series of experiments on natural waters using a range of ultrafiltration techniques to separate U and Th, and we hope to benefit from his expertise utilizing these techniques for colloid separations.

Dr. Aude Tricca, a recent Ph.D. graduate in aqueous geochemistry from the University of Louis Pasteur of Strasbourg will join the group on 15 July 1997 and will be devoting full time activities to the Sample Analysis Program laid out in the plan above.