Submarine groundwater discharge to coastal oceans: Implications for paleoceanography

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Neodymium (Nd) isotopes are commonly used to trace ocean circulation and mixing of water masses and for paleoceanographic studies on a wide range of time scales, i.e., glacial-interglacial time scales to million year time scales. However, a number of unresolved questions remain concerning the oceanic Nd budget, which consequently limit our ability to confidently interpret the geochemistry of Nd in the modern oceans and, perhaps more importantly, read the paleoceanographic Nd isotope record. These unresolved questions chiefly reflect the uncoupling of Nd isotope ratios and Nd concentrations in the oceans (i.e., the so-called "Nd paradox") and the relatively poor constraint that currently exists with regards to the magnitude and isotopic composition of Nd fluxes to the oceans. In order to reconcile the Nd paradox, an additional, "missing Nd flux" has been proposed; this flux, in addition to the atmospheric and effective riverine Nd fluxes, balances the oceanic Nd budget and also preserves the inter-oceanic differences in Nd isotopic ratios. Preliminary analysis suggests that the globally averaged submarine groundwater discharge (SGD) flux of Nd to the oceans is of the same magnitude as the missing Nd flux, and, equally important, has the same isotopic composition. In order to test this hypothesis, data on groundwater Nd concentrations and isotope ratios from aquifers in hydrologic contact with the oceans are required. Therefore, a primary goal of this project is to assemble a data base of Nd concentrations and isotope ratios for groundwaters from a range of locations that discharge to the coastal oceans.

During the 10 week period, participants will gain experience with:

1) Sample and geochemical data collection from field sites located along the coast in Florida, Louisiana, and Rhode Island

2) Formulating and testing scientific hypotheses

3) Laboratory analysis, data interpretation, and presentation of these data

The student should have taken a year of university chemistry and have an interested in environmental sciences. The student will be involved in field sampling of groundwaters from a number of coastal field locations with Johannesson and her graduate students, be involved in collecting field geochemistry data, and participate in sample analysis in Johannesson's laboratory.