

Letter of Intent to Participate in the GEOTRACES N-S Pacific Section

Project Focus: ^{227}Ac distribution in Pacific Waters as a Constraint on Mixing and Mass Transport of Solutes

Principal Investigator

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Research Goals:

^{227}Ac (22 year half-life) has been identified as a parameter of interest for the Geotraces program. Its value lies in the potential insight it should have as a tracer of mixing and transport, particularly if coupled with analysis of ^{228}Ra (6 year half-life) and the remaining isotopes of the radium quartet (^{226}Ra , ^{224}Ra , ^{223}Ra). The primary sources of these isotopes will be benthic inputs, with some geothermal inputs as well. These isotopes should be detectable within up to 2 km from the bottom, and during the first Pacific Cruise, excess ^{227}Ac was observed more than 1000 km west of the EPR. Concentration fields can be combined with estimates of regional benthic inputs to estimate mass transport rates. The advantage of having multiple radiogenic tracers with different half-lives allows construction of models that can assess both horizontal and vertical components of transport.

Sample Requirements:

Both ^{227}Ac and ^{228}Ra can be measured based on their sorption of Ra from large volumes of water (500-1500 liters) onto acrylic fibers impregnated with MnO_2 . This proposal will focus on doing the long counts and multiple cartridge analyses needed to measure Ac, in anticipation that others will be funded to measure Ra isotopes. Isotope sampling can be done in situ, in coordination with deep pumping to obtain particulates. Plans for large volume pumping for deep stations assume that two casts with 8 pumps each will be needed. One cast with 8 pump depths will be sufficient for shallow stations, although it is unclear how strong the signal of excess ^{227}Ac may be in shallow waters. In addition, samples of near-surface sediments (ideally at least 3 g of solid phase) are needed to estimate the concentration and sorption of ^{227}Ac and ^{210}Pb that are needed to model the likely benthic input of ^{227}Ac .

Berth Requirements:

Assuming the deep pumping and on-board radium program is funded, we anticipate that the ^{227}Ac collections can be carried out with a minimum of additional effort, as it should require only addition of a second collection cartridge to the pumping system. Analyses can be done after samples are returned to shore. Thus, we do not anticipate needed additional berthing beyond that required to support the pumping and radium analyses.

Anticipated Collaborations and Synergies:

We are coordinating this proposal with a separate proposal that will be submitted by Moore and Charette, focused on deep pumping and analyses of Radium isotopes. We anticipate that the results will be of value to other investigators who will be doing analyses of sub-thermocline waters and need to constrain transport rates to establish solute dynamics. We also expect to coordinate with those funded to analyze waters and sediments for the ^{231}Pa parent of ^{227}Ac .