

## **Letter of Intent to Participate in the GEOTRACES Arctic Section**

**Project Focus:**  $^{227}\text{Ac}$  distribution in Arctic Waters as a Constraint on Mixing and Mass Transport of Solutes

**Principal Investigator**

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**Research Goals:**

$^{227}\text{Ac}$  (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  $^{228}\text{Ra}$  (6 year half-life) and the remaining isotopes of the radium quartet ( $^{226}\text{Ra}$ ,  $^{224}\text{Ra}$ ,  $^{223}\text{Ra}$ ). The primary sources of these isotopes will be benthic inputs. Both isotopes can be measured near boundaries using large samples. 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  $^{227}\text{Ac}$  and  $^{228}\text{Ra}$  can be measured based on their sorption of Ra from large volumes of water (500-1500 liters) onto acrylic fibers impregnated with Mn. 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 would be done in situ, in coordination with deep pumping to obtain particulates. Plans for large volume pumping for deep stations are based on assuming that two casts with 8 in situ pumps each will be needed. One cast with 8 pump depths will be sufficient for shallow stations.

In addition, samples of near-surface sediments (ideally at least 3 g of solid phase) are needed to estimate the concentration and sorption of  $^{227}\text{Ac}$  that is needed to model the likely benthic input of this isotope.

**Berth Requirements:**

Assuming the deep pumping and on-board radium program is funded, we anticipate that the  $^{227}\text{Ac}$  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 Buessler, Moore and Charette, focused on deep pumping and analyses of U-series isotopes, including radium. 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 do  $^{231}\text{Pa}$  analyses, the parent of  $^{227}\text{Ac}$ , on waters and sediments.