

Short-lived U-Th Series Radionuclides and Large Volume Pump Management

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1) Research goals and relevance to the overall objectives of the section

We plan to submit a proposal Feb 15th for Pacific GEOTRACES with a focus on the shorter lived U/Th series (^{234}Th , ^{228}Th and all 4 Ra isotopes), which are ideally suited to study the sources and sinks of TEIs on time and space scales that are required to interpret lateral and vertical distributions of the TEIs in this basin. We will also propose to undertake the large volume in situ pump (LVPs) management responsibilities. We have considerable experience with these tracers and LVPs, including our leading the GEOTRACES intercalibration of these isotopes and participation in the GEOTRACES Atlantic cruises.

2) Sample requirements

The sampling effort requires small volume samples from the CTD (4L ^{234}Th), larger volumes from surface pumping (for Ra isotopes), and large volume samples for vertical profiles of dissolved & particulate ^{228}Ra and ^{228}Th . For the large volume radionuclide samples, we would attach a single Mn cartridge to the LVP flow path after filtration. We would be analyzing the cartridge for Ra and Th isotopes, and at least part of a particle filter (of about 500L equivalent) for ^{228}Th and ^{234}Th . For radionuclides alone, we do not need specialized pumps or trace metal clean sampling. Equipment built up for the Atlantic GEOTRACES cruises (pump filter holders, Mn cartridge housings, flow meters and specialized plumbing for McLane pumps) will be reused at significant savings to the project.

In addition to the water collected using standard CTD/Rosette casts, two casts with 8 in situ pumps each will be needed, one shallow (6hrs) and one deep (9-10 hrs, and only at stations where the bottom exceeds roughly 1000-2000 m); therefore most full ocean depth stations will have a 16-depth profile for large volume particulates and radioisotopes.

3) Berth requirements

We expect this effort will require a minimum of 3 berths, and includes personnel responsible for pump maintenance and deployment as well as on board processing and counting of the short-lived ^{234}Th and $^{223}\text{Ra}/^{224}\text{Ra}$ isotopes. As for particle sampling from the LVPs, we are assuming a separate group will be responsible for preparation and distribution of the filters used for TEIs and other radionuclides and that they will contribute 1-2 additional persons to help with pump logistics. We have found this combination of water sampling, large volume pumping, and on board detection of short lived Ra and Th isotopes, allows for the most efficient use of wire time and berths required for collection of these 6 isotopes.

4) Anticipated collaboration and synergies with PIs studying or requiring:

- a) TEIs involved in upper ocean particle scavenging and removal processes or particle aggregation/disaggregation;
- b) Particle export (vertical plus horizontal) and remineralization in the mid-water column;
- c) Particle exchange rates in buoyant hydrothermal plumes;
- d) Boundary sources and exchange rates on short and intermediate time scales (days-months);
- e) Terrestrial sources of TEIs including submarine groundwater discharge; and,
- f) Diapycnal mixing rates across the thermocline or in the benthic boundary layer.