**Dissolved and Particulate Th and Pa**

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We wish to measure dissolved and particulate concentrations of $^{230}$Th, $^{232}$Th and $^{231}$Pa at each of the full-depth stations planed for the Peru-Tahiti transect.

For dissolved nuclides, we will generally require 5 liter samples of filtered seawater collected by the standard Niskin rosette at each depth. Selected bottles will be sampled in replicate, using smaller volumes, for quality control. Two berths are requested for this sampling, which can be shared with the Nd isotope-REE group as it is for the Atlantic GEOTRACES section. These people will be prepared to take responsibility for filtering water from the Niskin rosette for other investigators as needed, and these people will be prepared to assist others in sampling from the Niskin bottles.

We will request aliquots of filter material from *in situ* pumps to provide particles from about 150-200 liters, assuming that others will be funded for *in situ* pump work.

Our proposed scientific objectives are consistent with the GEOTRACES Science Plan:

1) We propose to examine the impact of boundary scavenging and lateral mixing on the distributions of dissolved $^{230}$Th and $^{231}$Pa. The conceptual model of boundary scavenging suggests that insoluble chemicals like Th and Pa are removed from the ocean preferentially at margins, where high biological productivity enhances removal by generating an abundance of particle surfaces that adsorb the trace elements and isotopes. Our preliminary results from the NW Pacific and from the NE Atlantic do not exhibit the lateral gradients in dissolved Pa and Th that would be expected from the traditional boundary-scavenging hypothesis, indicating that this hypothesis requires further testing. We propose to use the high biological productivity of the Peru upwelling system to test for preferential removal of Th and Pa in regions of high biogenic particle flux. Using partition coefficients estimated for other trace elements, the results from our study of Th and Pa can be extended to constrain the removal rates of other key trace elements.

2) We will exploit the natural gradients of particle composition across the section to investigate the intensity of chemical scavenging, as well as the fractionation between Th and Pa, to particle chemistry.

3) Fe and Mn oxyhydroxides that precipitate from hydrothermal solutions scavenge insoluble trace elements from seawater. We propose to compare concentrations of dissolved Th and Pa within vs. outside the EPR plume to estimate the enhancement of scavenging of these nuclides by plume particulates. As with objective (1) above, rates constrained using Th and Pa isotopes can be extended to other trace elements using measured partition coefficients.

4) $^{232}$Th is mentioned in the GEOTRACES science plan as a potential tracer for mineral aerosol sources of TEIs. We are currently exploring the feasibility of using the combination of $^{232}$Th (dust source) and $^{230}$Th (radiogenic) to constrain rates of trace element supply to surface waters by mineral aerosols. If our results from the NW Pacific and the NE Atlantic support the feasibility of this approach, then it will be employed on the Peru-Tahiti section as well to constrain supply rates of trace elements. We propose to collaborate with the aerosol group on this topic.