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GEOTRACES Peru-Tahiti section: Measurement of ^{7}Be as a Tracer of Upper Ocean Processes

One of the stated goals of GEOTRACES is to create a unique opportunity for exploration and discovery by determining the distributions of novel TEIs that have received little attention to date. I propose to make measurements of one such species, the naturally occurring radioactive isotope ^{7}Be, which will provide important biogeochemical rate information pertinent to TEIs that will be measured during the US GEOTRACES Peru to Tahiti transect in 2013. Be-7 is a tracer that, because of its half-life (53.3d), allows the study of processes occurring over seasonal timescales. This timescale is critically important to studies of biological production, nutrient regeneration, and atmospheric deposition, to name a few. However, it has been one that is difficult to approach because of the lack of oceanographic tracers suitable for integrating processes over this temporal range. Recent advances in sampling and analytical techniques, coupled with a better understanding of the behavior of ^{7}Be in ocean biogeochemical cycles present us with an opportunity to fully utilize this tracer. The work proposed here will address key tasks formulated within the GEOTRACES Science Plan:

1) ***Provide realistic estimates of the underlying transport processes influencing measured TEI distributions***. We will use ^{7}Be as a tracer of physical processes, which redistribute biologically active species. Be-7 survives in the water column even as reactive species are being removed by biological processes and provides a measure of physical processes such as mixing and upwelling; given quantitative knowledge of the circulation, mixing and ventilation of the water masses within which TEIs reside allows an assessment of the time- and space-integrated *in situ* biogeochemical behavior of these elements.

2) ***Improve methods for quantifying the atmospheric deposition of TEIs:*** We will use measurements of ^{7}Be in the surface waters and in the lower atmosphere along the cruise track to provide estimates of the atmospheric input of relevant TEIs into the upper ocean.

Sample requirements: Vertical profiles, at ~ 8 depths, of ^{7}Be will be collected by pumping, with a deck-mounted centrifugal pump, 400–700 L of seawater from various depths down to ~200m. This shipboard operation has been authorized by GEOTRACES: "Following the precedent of the Atlantic section, proposals may be submitted to collect samples from underway pumping systems as well as from over-the-side pumping systems while on station (*US GEOTRACES Guidelines)".* This operation can be run independently of other shipboard operations. **We will be able to provide an abundance of water rapidly to other investigators in need of large sample volumes.**

Berth Requirements: We require a single berth. I request my own technician as he has been deeply involved in the development of our protocols and is therefore extremely familiar with what is required here. Our samples would require several hours (~7) of dedicated time but not on a daily basis. Our technician is quite capable (he has a PhD) and will be available to provide assistance on many other operations on those days that he is not sampling for me.

Anticipated collaboration and synergies: I am collaborating with W. Landing; with his aerosol measurements we will provide estimates of the atmospheric input of relevant TEIs to the ocean. This will benefit the entire community. Likewise, my parameterization of physical transport processes that I provide will be critical to PIs wishing to model the biogeochemical behavior of their TEIs. I will also be working with P. Lam and K. Buesseler to estimate ^{7}Be flux (if any) through the water column.