

Statement of Interest for *U.S. GEOTRACES Pacific Meridional Transect*

Dissolved and particulate barium isotopes

Tristan J. Horner (Tristan.Horner@whoj.edu), Woods Hole Oceanographic Institution

I propose to investigate the dissolved and particulate behavior of Ba (barium)—concentrations and isotope compositions—along the GP15 Pacific Meridional Transect. The marine geochemistry of Ba isotopes sits squarely at the intersection of biogeochemistry and large-scale advective processes and is thus of particular relevance to several GEOTRACES objectives. I propose to examine the following:

1. Diagnosing internal cycling versus interfacial and subsequent mixing processes

Stable isotope distributions of bioactive elements (e.g. $\delta^{30}\text{Si}$, $\delta^{114}\text{Cd}$, $\delta^{15}\text{N}$) may be used to distinguish the influence of particle-mediated ‘internal cycling’ processes—such as authigenic precipitation, export, and remineralization—from those occurring via those sourced from large-scale circulation (e.g. hydrothermal- or freshwater input, lateral advection). Dissolved Ba isotope data would provide independent tracing of the input and mixing of Ba sources to the ocean, complementing measurement of Si, Zn, and ^{226}Ra distributions.

2. How does the relationship between Ba (isotopes) and export productivity vary across distinct oceanographic settings (e.g. upwelling, oligotrophic, sub-Artic HNLC)?

Ba removal from seawater is primarily driven by formation and export of particulate BaSO_4 (barite) crystals. These crystals are hypothesized to form in Ba- and sulfate-rich particulate microenvironments that develop during microbial remineralization of organic matter and settle to the seafloor by transiting through the BaSO_4 -undersaturated water column.

3. Compare authigenic Ba fluxes with those of ‘soft’ metals within OMZs

Barite formation in particulate microenvironments is not necessarily $[\text{O}_2]$ dependent. Thus, BaSO_4 formation—and its attendant Ba isotope composition—will provide a baseline for comparison with isotope distributions measured for other ‘soft’ metals such as Cd, Zn, or Cu, which are hypothesized to precipitate from seawater (as sulfides) in low-oxygen settings.

Anticipated collaborators | The Ba isotope data I propose to obtain will complement many other parameters measured during the cruise. Specifically, Ba isotope compositions will aid interpretation of silicic acid, Si isotope, Zn, Zn isotope, and ^{226}Ra measurements—all tracers that share similar vertical distributions to Ba—by independently diagnosing advective versus biogeochemical cycling within the ocean interior.

Sample requirements | Dissolved Ba isotopes can be measured on 5 mL of seawater, which I propose to obtain by merging sample requests with nearby investigators at WHOI (or MIT; e.g. for Co, Pb, Ra, Th). Particulate Ba isotopes could be measured on a 1 cm^2 ‘punch’ from large volume filter samples (PES side) subsampled at sea.

Berth requirements | No berths are requested.