Statement of Interest: Analyses of Barium on the GEOTRACES Pacific section

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This document outlines the rationale for measuring the trace element barium on the GEOTRACES Pacific section. If funded, this work would be carried out at the W.M. Keck Collaboratory for Plasma Spectrometry (Oregon State University, College of Oceanic and Atmospheric Sciences).

Barium is a relatively abundant trace element within the ocean having concentrations generally in the nanomolar range. Ba has long garnered significant attention within the marine chemistry community in part because its distribution is similar to that of the dissolved biogenic components, most notably dissolved silicic acid and alkalinity (e.g., Chan et al., 1977). In addition, barium exhibits similarities to the radioactive element radium, leading to the idea that under certain circumstances Ba may serve as a stable analog for Ra (e.g., Chan et al., 1976). In short, barium is an element that possesses much of the character of a biogeochemically active element as well as an element that maintains the utility to trace a variety of water mass properties (e.g., Falkner et al., 1994). In addition to its water column characteristics, Ba also holds considerable promise as tool for understanding past ocean chemistry. Within sedimentary solid phases, Ba has been shown to correlate well with the flux of organic carbon (Dymond and Collier, 1996). Likewise the Ba contents in carbonate phases appear to track the water column Ba concentration (e.g., Lea and Boyle, 1989). Despite the potential shown by Ba as a tracer for a variety oceanographic processes, the application of Ba to the geologic record requires a better understanding of the chemical controls on Ba in the modern ocean (e.g., Dymond and Collier, 1996).

Analyses of Ba on the GEOTRACES section would bolster the existing Ba data set (e.g., GEOSECS) and provide information that would enhance our ability to evaluate the internal oceanographic processes that control the Ba distribution. Key features of the Pacific section include the contrasting productivity patterns and the presence of an intense oxygen minimum zone. Given its potential as a proxy for past ocean chemistry, this information would also further those development efforts.

Chan, L.H., J.M. Edmond, and B. Grant. (1977) On the barium data from the Atlantic GEOSECS Expedition. *Deep Sea Res.* 24, 613-649.

Chan, L.H., J.M. Edmond, R.F. Stallard, W.S. Broecker, Y.C. Chung, R.F. Weiss, and T.L. Ku. (1976) Radium and barium at GEOSECS stations in the Atlantic and Pacific. *Earth Planet. Sci. Letts.* 32, 258-267.

Dymond, J. and R. Collier (1996) Particulate barium fluxes and their relationship to biological productivity. *Deep Sea Res*. 43, 1283-1308.

Falkner, K.K., R.W. Macdonald, E.C. Carmack, T. Weingartner (1994) The potential of barium as a tracer in Arctic water masses. *In:* Johannessen, O M; Muench, R D & Overland, J E (eds.), The polar oceans and their role in shaping the global environment. *Geophysical Monograph Series, American Geophysical Union*, 540 pages, ISBN 0-87590-042-9, **85**, 63-76

Lea, D. and E. Boyle. (1989) Barium content of benthic foraminifera controlled by bottom-water composition. *Nature* 338, 751-753.