

GEOTRACES Pre-Proposal for US Pacific 2013 Cruise

Total Dissolved Cobalt and Cobalt Speciation

Mak Saito – Associate Scientist

Marine Chemistry and Geochemistry Department

Woods Hole Oceanographic Institution

We propose to conduct the total dissolved cobalt and cobalt speciation measurements for the South Pacific GEOTRACES section. Cobalt is an important micronutrient that is required in the biosynthesis of vitamin B₁₂ (cobalamin) and is found in the catalytic center of metalloenzymes such as carbonic anhydrase. Its abundance in the euphotic zone of the open ocean is often extremely low: typically less than 100pM and often in the 10's of pM. Previous studies have found high concentrations of dissolved cobalt within the oxygen minimum zones of the Atlantic and Pacific and correlations of total dissolved cobalt with both oxygen (inverse) and nitrous oxide. These observations imply that sedimentary sources and/or remineralization processes are creating regions of enhanced cobalt concentrations within these oxygen minimum zones. The planned Peru-Tahiti GEOTRACES cruise track will cross transition from the high productivity areas of the Peru Upwelling (and its oxygen minimum zone) to the highly oligotrophic areas of the South Pacific gyre, providing a sharp contrast in biological communities. The eukaryotic algae, which dominate the Peru Upwelling environment, appear to be able to substitute cobalt for zinc and cadmium. In contrast, the oligotrophic gyres have large populations of marine cyanobacteria that are not currently known to substitute cobalt and zinc. A detailed study of cobalt in the South Pacific and Peru Upwelling region in the context of the full suite of GEOTRACES parameters will provide insight into the geochemical and biochemical processes that influence cobalt distributions.