US GEOTRACES Peru-Tahiti Section
Letter of Intent

Collaborative Research: The organic complexation of dissolved iron, copper and cobalt, and total dissolved cobalt

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1) Research goals and relevance to objectives of the section
We will propose to determine the organic complexation of dissolved iron (Fe), copper (Cu) and cobalt (Co) using competitive ligand exchange-adsorptive cathodic stripping voltammetry (CLE-ACSV), as well as total dissolved Co using ACSV following UV-oxidation. Complete depth profiles from all full and super stations will be analyzed for Fe and Co speciation and total dissolved Co, while Cu speciation will be restricted to half of the profiles (all depths) to allow for the application of multiple analytical windows in the Cu speciation studies. The incorporation of multiple analytical windows for Cu speciation will facilitate intercomparison of Cu data with previous studies, including the recent North Atlantic transect.

Fe and Cu are key trace elements identified by the GEOTRACES Science Plan. Both of these elements are heavily influenced by complexation with organic ligands. These ligands appear to control the solubility of Fe and the bioavailability of Cu in the oceans. There is very little data published for Fe or Cu speciation along the planned Peru-Tahiti transect and minimal data from below 1000 m in the entire basin. Co is an important micronutrient that is often depleted and strongly complexed in the photic zone, and has been found to have greater abundances in oxygen minimum zones. The oxygen minimum zone and strong biological gradients in the Peru-Tahiti transect would be valuable in assessing biological influences and sedimentary sources. In addition, this work will provide further training to an accomplished graduate student and contribute to the development of new investigators trained in GEOTRACES protocols.

2) Sample requirements
For Fe speciation: 500 mL, all depths of full and super stations
For Cu speciation: 1 L, all depths of every-other (half) full and super stations
For Co speciation: 60 mL, all depths of full and super stations

3) Berth requirements
Ideally, we would like 3 berths for the analyses. While freezing Fe speciation samples tested well in the Atlantic as a storage technique for these samples, the Peru-Tahiti section will include particularly sensitive samples from the oxygen minimum zone and hydrothermal region. We believe it would be most prudent to analyze metal speciation in these samples shipboard. Similarly for Co, we have observed cobalt speciation to be sensitive to storage alteration effects in oxygen minimum zones. While we are developing a preservation system that uses gastight bags, we feel it is necessary to continue to ground-truth the system with fresh sample analysis for this important cruise track.

4) Anticipated collaboration and synergies
In collaboration with Ana Aguilar-Islas, we will propose to analyze the organic complexation of Fe and Cu in seawater leaches of aerosol samples collected. We will also collaborate with groups funded for total dissolved Fe and Cu concentration measurements, as these totals are a necessary input for our speciation analyses.