Statement of Interest for GP15 - Pacific Meridional Transect

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Role of dissolved and particulate hydrogen sulfide as a strong ligand for trace metals

In most GEOTRACES cruises to date, trace metal complexation by organic ligands such as siderophores has been examined. However, for metals such as Fe, Zn, Cu, Ni, and Hg hydrogen sulfide (largely bisulfide at the pH of seawater) is an inorganic ligand that has conditional stability constants for these metals that is equal to or exceeds those of organic ligands. Significantly, it is found in the surface ocean at 0.1-1 nmol/L, produced via the abiotic hydrolysis of dissolved carbonyl sulfide and by all phytoplankton as part of assimilatory sulfate reduction to make sulfur amino acids. With respect to the latter, it has been found that increasing free Zn and Cu concentrations increases hydrogen sulfide production, leading to the hypothesis that H_2S production can be a metal detoxification pathway. Interestingly, photosynthetic cyanobacteria such as Synnechoccus and Trichodesmium make the most H_2S and these have very specific needs for metals such as Fe, Ni, and Zn. Thus, a study of dissolved and particulate H_2S cycling through the widely varying biological and metal regimes that will be encountered on this transect, along with parallel studies of metal speciation, particularly of Fe, Cu, Zn, and Hg, offers an unprecedented opportunity to verify, or refute, the importance of hydrogen sulfide in surface ocean trace metal biogeochemistry. This work would require one berth, 12’ of bench space, and 2L of sample from special casts of the ODF rosette in the upper 200m (i.e., as part of the Th and pigment sampling) and surface sampling fish to allow determinations of total dissolved sulfide (free + metal complexes) and free sulfide ($H_2S+HS^-+S^{2-}$) depth profiles; Supor filter splits from the McLane pumps would allow determinations of acid volatile (e.g, FeS, ZnS) and chromium reducible (e.g., , HgS, CuS) sulfide. We would closely collaborate with trace metal, particularly the Hg, Cu, and Fe, groups examining speciation. Sampling would occur at all Full and Super stations.