

Statement of Interest for GP17 – Ocean

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Dissolved hydrogen sulfide as a strong ligand for trace metals in the upper ocean and production of particulate metal sulfides

On the 2018 US GEOTRACES GP15 cruises we examined the concentration and speciation of dissolved hydrogen sulfide as a strong ligand for metals such as Fe, Zn, Cu, Ni, and Hg whose 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 50 – 500 pmol/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 H₂S production can be a metal detoxification pathway. Interestingly, photosynthetic cyanobacteria such as *Synechococcus* and specific diatoms like pseudo-*Nitzschia* make the most H₂S and these have very specific needs for metals such as Fe, Ni, and Zn. Thus, a study of H₂S 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, Ni, and Hg, offers an excellent opportunity to further quantify the importance of hydrogen sulfide in surface ocean trace metal biogeochemistry. This work would require two berths, 15' of bench space, and 2L of sample from special casts of the ODF rosette or GEOTRACES carousel in the upper 1200 m to allow determinations of total dissolved sulfide (free + metal complexes) and free sulfide (H₂S+HS⁻+S²⁻) depth profiles; Supor and QMA filter splits from the McLane pumps would allow determinations of acid volatile (e.g, FeS, ZnS) and chromium reducible (e.g., FeS₂, CuS) sulfide. In addition to these sulfide measurements, we will also determine pH (automated spectrometric method) and iodate concentrations (key oxidant of free sulfide). We would closely collaborate with trace metal groups determining total concentrations and chemical speciation.