US GEOTRACES Eastern Tropical Pacific Statement of Interest

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Coupled arsenic and phosphorus biogeochemistry in the tropical Pacific Ocean

For the GEOTRACES Eastern Pacific Zonal Cruise we propose studying the biogeochemical dynamics between arsenic and phosphorus, in particular As "stress" as the cruise transects from the upwelling waters off Peru to the phosphate-depleted waters of the south Pacific gyre. Work to date in the North Atlantic show that arsenic speciation may be an excellent indicator/proxy for recording phosphate stress in surface waters, and data from the strong nutrient gradients in the tropical Pacific will be an excellent test of this proxy. Furthermore, As is toxic to many phytoplankton and depending on its chemical speciation can affect the abundance of many phytoplankton species, with resultant effects on the oceanic ecosystem and elemental cycling. Thus, this work is relevant to GEOTRACES Theme 2 (internal cycling).

We will make high resolution measurements (upper 500 m at all stations and from the towed fish in surface waters) of dissolved arsenic speciation (As III, V, and monomethyl and dimethyl As) combined with the existing hydrographic determinations of nanomolar phosphate (Management Proposal). These measurements will be complimented by determinations of phytoplankton pigments (Management Proposal) and species composition made by other PIs. Water volume requirements are 0.5 L per sample for all species and one berth will be needed to make the shipboard determinations (As species are not stable with storage).

Selenium biogeochemistry in suboxic waters of the tropical Pacific Ocean undergoing denitrification

The most oxidized form of dissolved selenium is selenate (+6) and existing profiles show that it behaves like nitrate, with surface depletion (uptake) and mid-depth enrichment (regeneration). It also undergoes reduction to particulate elemental selenium in suboxic waters where denitrification is occurring ("deselenification"), but very few profiles have documented this. The extensive suboxic waters in the upwelling margin of Peru afford the opportunity to quantify this selenate removal mechanism and its relationship with nitrate and denitrification. This information on selenate/nitrate can then be applied to the use of selenate/sulfate in marine barite as a paleoproxy for upper ocean nitrate concentrations (i.e., upwelling region and central gyre profiles of nitrate and selenate will provide a more complete correlation between these two species under "conventional" and suboxic conditions). Calibrating the selenate proxy for nitrate falls under GEOTRACES Theme 3 (paleoproxies).

For this work, one liter, filtered samples from each depth of the vertical profiles will be needed, but no berth will be required.