US Geotraces Peru-Tahiti Section, Letter of Intent, 12/27/11
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Manganese, vanadium, rare earth elements, and gallium

Research goals:
We will determine the distributions of Mn, V, rare earth elements (REEs) and Ga in the proposed US GEOTRACES Peru-Tahiti Zonal Section. This section has been carefully constructed to allow researchers to investigate trace elements in various oceanic processes/phenomena including: a) redox cycling in the suboxic waters of the Eastern Tropical South Pacific, b) hydrothermal cycling associated with the East Pacific Rise, c) boundary scavenging and cross shelf transport across the Peru margin, d) large surface water gradients in biogeochemical processes, and e) carbon cycling across a highly productive upwelling margin. The elements we propose to study will most especially allow us to investigate cross margin exchanges, redox processes and atmospheric inputs. While each element can be studied individually, the combination of these particular elements allows for some synergy. For example, redox processes affect Mn, V, and REEs (i.e., the Ce anomaly), but each in somewhat different ways. Likewise, Ga can be help separate the reducing and atmospheric inputs of Mn. Furthermore, Ga, as a less-reactive analogue for Al, provides a useful counterpoint to using Al as a tool for understanding dust inputs to the ocean. And Mn, which has similar sources to Fe but a slower oxidation rate, can be used to shed light on the source and potential availability of nano-nutrient Fe.

Some specific objectives of this work include: 1) examine the discrepancy between surface water Ga and Al distributions and estimates of dust input, 2) confirm the relationship observed in the North Pacific between the surface ocean Ga/Al ratio and the chlorophyll distribution, 3) compare the surface ocean Mn distribution with that of Ga and Al as a means of separating shelf and dust inputs, 4) determine if there is evidence of shelf V removal which contributes to the surface ocean V depletion, 5) determine if changes in both REE concentrations and anomalies (e.g., Ce anomaly, light/heavy REE ratios) are associated with environmental gradients in particle flux and productivity, and 6) test for hydrothermal influences on V and REE distributions downstream from the EPR hydrothermal field.

Sample requirements:
125 mL filtered samples from Go-flos (all depths/all stations plus surface water transect)

Berth requirements:
None

Collaboration/synergies:
Other workers examining atmospherically-derived TEI's such as Al, other redox-sensitive TEI's, and neodymium isotopes are likely to have interest in our data. We do expect some replication of these analyses by other workers (e.g., several other groups are likely to be determining Mn); however, that sort of replication is useful in overall Geotraces data verification.