Statement of Interest for US GEOTRACES GP17 Section Cruises

Trace metal (Fe, Zn, Cd, Ni, Cu) isotopes and concentrations

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We express interest in a joint proposal by the Conway Lab (USF) and John Lab (USC) to measure key TEIs along both OCE and ANT legs of the GP17 section, focusing on concentrations and isotope ratios of the biologically important trace elements Fe, Ni, Cu, Zn, and Cd.

The GP17-ANT transect offers a unique opportunity to explore the cycling of these metals on the shelf and nearshore environment of Antarctica, and provides an excellent complement to our prior work evaluating shelf sources of these metals in other environments. Specific questions of interest include evaluating the supply of Fe from continental and ice sources with Fe isotopes, investigating the effects of Fe-limitation/temporal/seasonal changes on the biogeochemical cycling of nutrient-type elements such as Zn, Cu, Ni, and Cd, constraining whether isotope effects for biological uptake change with differences in community composition and productivity, and lastly how such processes in the Antarctic drive the global distribution of TEIs and their isotopes via transport of Antarctic preformed signals via intermediate water masses.

Work on the GP17-OCE transect will build on these findings by evaluating the distal effects of such processes on the broad scale distribution of these elements and their isotopes. Data from GP17 will complement our previous analyses of δ^{56}Fe, δ^{60}Ni, δ^{65}Cu, δ^{66}Zn, and δ^{114}Cd on the North Pacific GP15 transect, providing a stunning whole-basin picture of the biological and geochemical cycling of these elements and their isotopes in the Pacific Ocean. For Fe and δ^{56}Fe, the broad scale interest is evaluating the important of different Fe sources to this region, including whether Fe from marginal environments on Antarctica makes it to the surface Fe-limited Southern Ocean, assessing the importance of different aerosol sources of Fe in the North and South Pacific basins as seen in dFe and δ^{56}Fe, and tracing the spread of hydrothermal Fe through the Southern Pacific with δ^{56}Fe. This should provide a comprehensive picture of Fe cycling throughout the whole Pacific Basin.

Other principle areas of interest on both sections are the relative importance of biological uptake and scavenging in setting the global distribution of 'nutrient' type trace metals such as Zn and Ni and the effect of those processes on δ^{66}Zn and δ^{60}Ni, the uptake of Cd and Cd isotopes by heterotrophs in the mesopelagic, and the possibility of the formation of inert Cu and δ^{65}Cu with aging of the deep Pacific Ocean waters. For all five metals, datasets spanning the entire latitudinal gradient from the Southern Ocean to the North Pacific provides a window into how their biogeochemical cycling varies depending on latitude, water-mass age, oxygen concentration, and other parameters.