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US GEOTRACES GP17 cruises—letter of intent

I am interested in being involved in both legs of GP17 to collect size fractionated particles by in-situ pumps and/or analyze collected size-fractionated particles for major and minor phase composition. For the GP17-OCE leg, I am interested in how particle distribution varies with depth in different environmental conditions, such as nutrient supply, productivity, and dust inputs, and how that affects the efficiency of the biological pump and the internal cycling of particulate TEIs. For example, crossing through the most oligotrophic waters of the South Pacific will be very interesting for understanding the role of particle concentration on scavenging of TEIs. Further, sampling in the Polar Frontal Zone will provide the long-awaited high opal global endmember to assess the importance of diatoms and opal in the cycling of many TEIs. For the GP17-ANT leg, the polynyas in the Amundsen Sea have the highest rates of production per nit area on the Antarctic. What is the source of the Fe fueling these blooms? The speciation and mineralogy of suspended and sedimentary particulate iron may help to answer that. What is the fate of the POC? Answering these questions will require the chemical characterization of size-fractionated particles from my lab in partnership with parameters measured by many other PIs, including multiple thorium and radium isotopes, Nd isotopes for provenance, dissolved trace metals, tracers of meltwater, and more.

For GP17-ANT, I am on the management team, and pump management and particle collection will be in the GP17-ANT management proposal for the Feb 2020 deadline. I will focus my PI proposal for the Aug 2020 deadline on chemical characterization of size-fractionated particles collected by in-situ pumps.

For GP17-OCE, in-situ pumps are not included in the management proposal, and I intend to submit a PI proposal that will cover both the pump management aspects and the chemical characterization of size-fractionated particles collected by in-situ pumps.

I have had conversations with Steve Pike at WHOI, who would partner with me (as a subaward or collaborative PI, TBD) to do the hardware aspect of pump management for GP17-OCE.

I have also had conversations with Daniel Ohnemus at Skidaway to explore possibilities of partnering as a collaborative PI to undertake the chemical characterization aspects for GP17-OCE and possibly also share in the particle collection and distribution aspects of pump management for GP17-OCE. All options, including those not listed, still open.

The pump management aspect is summarized here:

1) Provide the McLane in-situ pumps from the WHOI UNOLS pump pool (Pike lead)
2) Provide Vectran cable from which to deploy the McLane pumps (Pike/Lam)
3) Collect and distribute **size-fractionated suspended particles** by dual flow in-situ filtration (Lam/Ohnemus?)

a. 51um polyester prefilter followed by paired quartz fiber (QMA) filters (~1000L through 142mm filters)
b. 51um polyester prefilter followed by paired 0.8um polyethersulfone (Supor) filters (~450L through 142mm filters)

The chemical characterization is summarized here:

1) to determine the **major particle phases** (POC, $CaCO_3$, opal, lithogenics, Fe and Mn oxyhydroxides) and chemical dry weight of size-fractionated particles across the sections
2) to determine the **total concentrations** of key (Fe, Al, Zn, Mn, Cd, Cu) and other trace and interesting elements (Co, Ni, Ti, Ba, P) in size-fractionated particles across the section
3) other possible chemical characterizations pending more information:
    a. weak leaches of particles to determine leachable particulate trace metals
    b. chemical speciation and mineralogy of particulate phases using XRD and/or synchrotron x-ray absorption spectroscopy (e.g. oxidation state and mineralogy of particulate Fe and Mn, calcite vs aragonite)