

Letter of intent for the US GEOTRACES Eastern Tropical Pacific Zonal Transect: the redox speciation and geochemistry of size-fractionated suspended particles collected by in-situ filtration
Phoebe J. Lam (WHOI, pjlam@whoi.edu) Silke Severmann (Rutgers University, silke@marine.rutgers.edu), Brandy M. Toner (University of Minnesota, brandy.toner@gmail.com) plan to submit a collaborative proposal to collect size-fractionated suspended particles by in-situ filtration and determine their geochemical composition.

1. Research goals and relevance to the overall objectives of the section.

Our objectives are several fold:

- a. to collect **size-fractionated suspended particles** by dual flow in-situ filtration
 - i. 142mm 51um polyester prefilter followed by paired quartz fiber (QMA) filters (~1000L/sample)
 - ii. 142mm 51um polyester prefilter followed by paired 0.8um polyethersulfone (Supor) filters (~500L/sample)
- b. to determine the **major particle phases** (POC, CaCO₃, opal, lithogenics) and chemical dry weight of size-fractionated particles across the section
- c. to determine the **total** and **acid-leachable concentrations** of key/essential (Fe, Al, Zn, Mn, Cd, Cu, Co) and other trace and interesting elements (Ni, Ti, Ba, P, Ag, Mo, V, Cr) in size-fractionated particles across the section
- d. to determine the distributions of **particulate Fe(II)** and **particulate sulfides** in the oxygen deficient zone and hydrothermal plume
- e. to use **iron isotopes of particulate iron** to trace the influence of reducing margin sediments as a source of iron into the open ocean

2. Sample requirements

The sample analyses proposed will require ~0.375 of the Supor filter (~190L) and ~0.375 of the QMA-side prefilter (~375L) for the <51um and >51um particulate trace metal, opal, and Fe isotope analyses, and a 25mm punch of the QMA filter (~30L) for <51um POC and PIC analyses. >51um POC and PIC analyses will be measured on the same subsample taken for 234Th after final background counting. These sample requirements are similar to what was allocated for the major, minor, and Fe isotope analyses for the US NAGZT.

3. Berth requirements

We request two berths from this proposal: one person will be responsible for general on-board processing and subsampling of in-situ pump particle samples; the other person will be responsible for any on-board redox measurements of Fe(II) and sulfide in particles and careful preservation of redox conditions from samples from the oxygen deficient zone in the eastern half of the transect and from hydrothermal plume particles on the western half of the transect. Both participants will be actively involved in the overall deployment, recovery, and maintenance of in-situ pumps on board. As on the US NAGZT, the management and operation of the McLane in-situ pumps will be part of the short-lived Ra and Th isotopes proposal submitted by Matt Charette, Billy Moore, and Ken Buesseler, and the particle group (this proposal) will be responsible for everything to do with the particle collection aspect of in-situ pumping. This division of labor between the Lam group and the Charette/Buesseler group worked efficiently and successfully on the US NAGZT cruises. The short-lived Ra and Th isotope group will be requesting 3 berths for their work and for on-board in-situ pump management, for a total of 5 people in the overall pumping group, as on the 2011 US NAGZT.

4. Anticipated collaboration and synergies

We anticipate several ways in which this proposal will contribute to the overall GEOTRACES effort:

1. We will distribute particle subsamples to funded investigators measuring TEIs not covered in this proposal. On the US NAGZT, we distributed particle subsamples to 10 PIs for the measurement of

eNd, $^{231}\text{Pa}/^{230}\text{Th}$, ^{232}Th , ^{234}Th , ^{228}Th , Pu, Hg, $^{210}\text{Pb}/^{210}\text{Po}$, Fe isotopes, bioactive trace metals, and proteins. We will coordinate with investigators to do the same for the Pacific section.

Investigators interested in particle subsamples from the Pacific section are asked to contact Phoebe Lam (pjlam@whoi.edu) with their volume and filter type requirements.

2. Particles are central to the cycling of almost all TEIs, so we expect that the data collected as part of this proposal will be of interest to many. For example, the acid-leachable particulate TEI concentrations will be of interest to those modeling the scavenging behavior of dissolved TEIs; major particle composition will also help with understanding scavenging of many TEIs, and be especially interesting for the interpretation of paleo-records of $^{231}\text{Pa}/^{230}\text{Th}$; particle dynamics as inferred by size fractionated total particulate TEI concentrations will help interpret the external sources and internal cycling of many TEIs.
3. We will coordinate with the dissolved redox group for sample collection, handling and on-board measurement of particulate sulfides and Fe(II). Sulfide formation in the water column will potentially affect distribution and scavenging of TEIs in the OMZ and the hydrothermal plume.