

Trace metals in suspended particles: high spatial resolution sampling and geochemical dynamics in the Southern East Pacific Rise hydrothermal plume.

Rob Sherrell, Rutgers University (sherrell@marine.rutgers.edu)

Chris German, WHOI (cgerman@whoi.edu)

1. Specific research goals and relevance to the overall objectives of the section:
 - A) Determine **total suspended particulate trace element concentrations** for every station and every depth on the transect in order to quantify the role of particles interacting with dissolved trace elements through varying oceanic regimes that will be captured during this transect. Sampling particles from GO-Flo bottles allows direct comparison with dissolved samples from the same bottles and gives sampling resolution for resolving features such as nepheloid layers, and potential redox cycling (*in situ* precipitation) of Fe/Mn associated with the OMZ/margin and the SEPR hydrothermal plume.
 - B) Apply **complete digestion and ICP-MS techniques** to determine ~35 elements, including key/essential Geotraces trace elements (Fe, Al, Zn, Mn, Cd, Cu, Co) as well as other elements of interest (REEs, P, Ca, Sr, Ni, Ti, ²³²Th, Y, Ba, V, Mo, Ag, Pb, Be, As, and U) to allow investigations of multiple geochemical processes and a complete suite of elemental data for future study.
 - C) Focus interpretational effort on **trace element dynamics within the hydrothermal plume** to address solution/particle dynamics (e.g. do REEs undergo continual scavenging or are they “locked in” to plume particles at some point?) with distance from the ridge crest. Quantify elemental sources and sinks resulting from plume interaction with the deep water column.
 - D) **Collect surface sediment samples** using a small, proven, mini gravity corer suspended beneath the ship’s rosette. The top 0.5cm will be removed from the top, homogenized and split, with subsamples provided to the Geotraces community upon request. Aliquot splits of this material will be analyzed for multi-trace elements using the same methods used for water column samples to quantify the compositional relationships between particles in the deep water column, and those recently (~1000y) accumulated in the surface sediment. Remainder of core material will be frozen and archived.
 - E) Maintain the **transmissometer** during the transect and supervise collection and interpretation of data to calibrate beam attenuation signals against major particulate phase concentrations. Use optical data for spatial interpolation of suspended matter between samples.
2. Sample requirements: Full volume (11.5L) of one TM-clean Go-Flo bottle to filter through 0.45µm Supor membrane under <8psi air/N₂ pressure. Filtrate can be used for dissolved TE’s as on the recent Atlantic section, e.g. Hg species.
3. Berth requirements: this project will require two berths (in addition to cruise Co-Chief C. German), one to work with the Super-Techs to carry out the Go-Flo filtrations on each Go-Flo CTD cast, and one to maintain the coring device, process the core samples, and supervise maintainance of the transmissometer. Demands on the second person may allow her/him to be a shared position.
4. Anticipated collaboration and synergies: We will coordinate closely with the Lam-Severmann-Toner group (in-situ pumping) to match depths and complement the more limited vertical coverage of the pumps in a manner arrived at by group consensus. If Ben Twining is funded to determine TEs in the upper 500m, we will hand these samples to his lab. Similarly, if Severmann or another PI would like to control filtration in the OMZ, we will be happy to pass on this responsibility for relevant stations. While we intend to analyze all samples from the entire transect, our primary interest is to focus on the role of plume particles to modify hydrothermal inputs and scavenge elements from the ambient deep water column. Thus we will interact closely with PIs proposing to study scavenged nuclides and Nd/REE, DOC dynamics in the plume, dissolved and colloidal TEs and TE speciation in the plume, and ³He distributions as a measure of plume dilution along the advective path. We will be interested in partnering with all PIs interested in analyzing surface sediments along the transect.