Characterizing the redox environment of the eastern tropical Pacific Ocean: US GEOTRACES Peru-Tahiti section Gregory A. Cutter, Dept of Ocean, Earth, and Atmospheric Sciences, Old Dominion University, Norfolk, VA 23529; <u>gcutter@odu.edu</u>

Research Objectives and Relevance

The oxygen deficient zone that extends from coastal Peru well into the tropical Pacific Ocean has been described as "suboxic" but some have also speculated that it can be anoxic at times. This redox poise strongly affects the solubility/stability of a wide variety of trace elements and therefore their vertical and horizontal transport – all GEOTRACES-relevant topics. The problem is that "suboxic" is not well defined, but certainly represents a very wide range of redox conditions (pɛ). Moreover, the presence of reduced chemical species (e.g., FeII) in the "suboxic" water column can be due to both in situ processes and horizontal advection from sediments, further confusing the actual redox poise of the water column. I am therefore proposing the following **Objectives**:

- (1) Establish the redox poise of the oxygen deficient water column, and hydrothermal plume of the East Pacific Rise, by determining dissolved iodate/iodide, As(III)/As(V), Se(IV, VI) + particulate Se(0), and nano- to picomolar hydrogen sulfide speciation (total, free/uncomplexed), combined with measurements of species like nitrate and nitrite (management team), and work by other PIs on nitrous oxide, Fe(II,III), etc.
- (2) Evaluate the contribution of in situ reduction versus horizontal advection of these redox species using vertical profiles along the transect in combination with rates and pathways of mixing from the suite tracers measured by other PIs.
- (3) Estimate the oxidation rates of these redox species ("signal fidelity/residence time") in the EPR hydrothermal plume via transect data and mixing tracers by other PIs

Sample and berthing requirements

Capsule filtered (0.2-0.4 μ m) water from either GO-FLOs or Niskins will be used: 150 mL for I, 250 mL for As, 500 mL for H₂S, and 1000 mL for Se. Punches from the in situ pump filters will be needed for Se(0) determinations.

Since the redox speciation for all parameters but Se is not stable with storage, shipboard determinations are required. Therefore, 2 dedicated analysts are needed.

Synergies/collaborations

Objective 1: collaborations with TEI redox studies (e.g., Moffett, Resing and Sedwick) and those examining other redox species (e.g., Casciotti et al. N project; management team measurements of nitrate/nitrite)

Objectives 2 and 3: collaborations with projects studying mixing tracers (e.g., Buesseler et al., Fine, Jenkins, and Kadko)

Overall, the results of these proposed redox studies will have synergies with all of the other TEI studies (e.g., solubility of TEIs under different redox scenarios), and in particular the Hg (e.g., Hammerschmidt et al.), FeII (Moffett), and the speciation of particulate metals (Lam et al.) projects will benefit from the hydrogen sulfide results.