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"Measurement of helium isotopes, noble gases, tritium, and radiocarbon to elucidate OMZ ventilation and biogeochemical TEI processing, and the transport and transformation of hydrothermally injected TEIs"

My goals are twofold:

(1) While I have interest in the large scale 3He distribution in the abyssal Pacific, my primary motivation is to more closely relate the distributions and inter-relationships of 3He, Fe (and other trace metals) and 14C in the deep waters. Some work that I have ongoing with Ed Boyle (in the western South Pacific) and Mak Saito (in the South Atlantic) and of course the North Atlantic GEOTRACES cruise (planned in the vicinity of the TAG site) indicate a large variation in Fe:3He ratios that has important implications for understanding the global hydrothermal budgets for Fe and other related tracers. 3He is an important tool, both as a dilution gauge, and as a global flux gauge for hydrothermal fluxes of these important metals. Whether the order of magnitude difference in Fe:3He we observe between the S.A. and the S.P. is related to water-mass age, in situ evolution, or slow/fast spreading center tectonics/water-rock ratio (i.e., source ratio) remains an important unknown and a key interest for me. A primary strategy for this work would involve downstream deep water mapping of the inter-relationship of 3He with the important metal tracers to separate dilution from other possible in situ removal processes, and to use 14C as a probe of remineralization input.

(2) Quantifying ventilation and upwelling rates in the OMZ. This work would focus on tritium, tritiugenic and primordial 3He, and radiocarbon as probes of those processes. We do have a good idea of the general distributions of these tracers from the WOCE and CLIVAR surveys, and intensive local sampling will prove a powerful adjunct to other ventilation tracers (CFCs and SF6 in particular) and will be a vital data set for the construction of models that will be used to interpret trace metal and nutrient transport and transformation. Another potentially useful tool-set will be the noble gas abundances. These have been valuable in diagnosing air-sea exchange processes, and may set useful constraints on the gas exchange dynamics of upwelling cold water in the OMZ. This would be important for constructing dissolved oxygen and nitrogen budgets. Also of value would be to combine precision noble gas abundances with dissolved N2 data as a diagnostic tool for denitrification.