Collaborative Research: Measurement of helium isotopes, tritium, noble gases and radiocarbon on the U.S. GEOTRACES Eastern Pacific Zonal Transect.

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I propose to sample for and measure helium isotopes, tritium, noble gas concentrations, and radiocarbon on the full and demi-stations for the U.S. GEOTRACES Eastern Pacific Zonal Transect. The major objectives of this work is to

(a) Characterize the ventilation rates of the Oxygen Minimum Zone (OMZ) using tritium-^{3}He (in cooperation with the SF_6-CFC team). This can be used in tandem with the TEI measurements to estimate rates of transformation in the OMZ.

(b) Use the full suite of noble gases to diagnose diapycnal mixing (using the curvature of the solubility functions of Ar, Kr, and Xe, as well as the concentrations of He and Ne to correct for bubble trapping effects). This will be coupled with the OMZ ventilation measurements as well as the hydrothermal plume characterization.

(c) Use surface water ^{3}He and ^{14}C to characterize regional scale upwelling and flux-gauge estimates of nutrient transport to the OMZ. This will be done in concert with ^{7}Be-measurers and provides shorter timescale (^{3}He) and longer timescale (^{14}C) constraints compared to ^{7}Be.

(d) Use ^{3}He as a dilution-scale tracer in the abyssal hydrothermal plume, coupled with the Fe and Mn measurements to characterize end-member ratios and evidence of elemental scavenging along the transect. In addition, characterization of the Fe:^{3}He ratios will be an important adjunct to the observation of regional changes in this ratio (a more than order of magnitude difference between the Boyle/Jenkins determination in the western South Pacific and the Saito/Jenkins estimate for the South Atlantic). Is this difference a result of water mass aging, seafloor spreading rates, or both? The Fe:^{3}He ratio could be used for a flux-gauge based estimate of the net hydrothermal Fe flux for the global ocean.

(e) Use of ^{14}C to estimate the downstream velocities and remineralization rates in the hydrothermal plume. This will be combined with ^{3}He and the noble-gas based estimates of abyssal diapycnal mixing rates to characterize downstream mixing rates.

Samples will be drawn from the ODF 30 liter Niskins, with the following requirements:

(1) Helium isotopes and noble gases: 0.75 liters

(2) Tritium: 1.25 liters

(3) Radiocarbon: 1 liter (or 0.5 liters if drawn in combination with ^{13}C samples)

One berth would be required, with ~6 feet of bench space.