

Measurement of He isotopes on the US GEOTRACES Pacific Meridional Transect

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We propose to sample for and measure helium isotopes (along with dissolved He and Ne concentrations) to WOCE/CLIVAR standards in collaboration with Emeritus Research Scholar W.J. Jenkins on the full and super stations of the US GEOTRACES Pacific Meridional Transect. Measurements would be made in the Isotope Geochemistry Facility at WHOI, for which one of us is an advisory board member. The IGF has provided measurements for the US GEOTRACES NAZT and EPZT section studies. Measurements will be made for tritium- ^3He in the shallow casts to constrain ventilation and water mass formation rates, and noble gas concentrations will be measured on a selection of stations. We will also collect ^{14}C samples for analysis at NOSAMS.

Our primary motivations for this work would be:

- (a) to use ^3He as a dilution-scale tracer in abyssal hydrothermal plumes and, specifically, to enable an investigation (like-for-like inter-comparison) of the diversity of TEI: ^3He and $^3\text{He}/^4\text{He}$ ratios in the persistent/distal portions of four separate hydrothermal plume signals: near 2500m at 15°S and 10°N sourced from the East Pacific Rise, near 1000m at $\sim 20^\circ\text{N}$ sourced from Loihi seamount (Hawaii hot-spot) and near 2000m at $30\text{-}35^\circ\text{N}$, West of the Juan de Fuca Ridge;
- (b) to use radiocarbon to characterize abyssal ages, mixing, and circulation, along with shallow ventilation
- (c) to use tritium- ^3He as a measure of shallow water ventilation and subduction, and
- (d) to use noble gas concentrations to characterize air-sea exchange, mixing, and ice-water interaction (the last in NPIW).

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

Helium isotopes and/or noble gases: 0.75 liters

Tritium: 1 liter

Radiocarbon: 1 liter

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