ARCTIC GEOTRACES

Letter of Intent

^{3}He plumes around hydrothermal vent systems

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We propose to measure the distribution of ^{3}He in the deep waters of the Arctic Ocean basins. We have shown in early cruises (e.g., Polarstern ARK IV/3, Oden 1991, Louis St. Laurent 2004, Polarstern 1996, Oden 2005) that the helium isotope signatures in the deep basins are distinctly different between the Eurasian and Canadian basins. Whereas mantle He is injected along the Gakkel Ridge in the Eurasian basin, there is a signature of crustal He in the Canadian Basin with a sharp separation along the Lomonosov Ridge. The far field ^{3}He distribution in the Eurasian Basin shows the large scale spreading of a weak ^{3}He plume away from the Gakkel Ridge. Later measurements confirmed these features. The helium isotope data can be used to separate effects of circulation and mixing from those of chemical reaction and adsorption to particles in the TEI distributions. If combined with models, basin-scale mantle ^{3}He fluxes can be estimated and fluxes of other TEIs can be calculated if the ^{3}He/TEI ratios are determined.

Our emphasis during GEOTRACES would be on the near field distributions and the sampling program would be closely coordinated with that for other chemical elements and TEIs injected at the hydrothermal vent systems.

Logistics

Samples for helium isotopes and neon will be collected in copper tubes following standard procedures and measured in the Lamont-Doherty Noble Gas Laboratory using a dedicated helium isotope mass spectrometer. The sampling will be performed by the transient tracer group.