Helium Isotope, noble gas, and tritium measurements on GP17

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We have four primary objectives for making measurements on both GP17 cruise sections. Clearly some objectives are better addressed with one or the other of the sections but there is sufficient overlap to warrant measuring all properties on both sections. The scientific motivations are:

1. Characterization of the fluxes and persistence (against scavenging) of hydrothermal iron and other metals as they upwell in the southern ocean (SO). Recent calculations using ^{3}He indicate that upwelling timescales are comparable to those expected for scavenging.
2. Refine our knowledge of the ^{3}He/^{4}He ratio distribution in the deep waters (we also need noble gas measurements to do this right), and characterize any hydrothermal inputs/sources in the SO. The South America end of G17-OCE and GP17-ANT will focus on the southeast leakage of PDW toward and into the Drake Passage [1].
3. Determine shallow circulation and ventilation time-scales using tritium and ^{3}He, examine air-sea exchange and shallow dissolved gas dynamics using noble gases. The latter is potentially important for evaluating the oxygen/argon methodology for productivity determination.
4. Characterize sea-ice and glacial meltwater inputs and sources using the noble gas solubility spectrum such as done by Brice Loose and coworkers [2, 3, 4, 5] and Nick Beaird [6, 7, 8]. All of those measurements were made in our laboratory. He and Ne measurements from prior (WOCE/CLIVAR/GOSHIP S4P) cruises in this area will allow a time-series of meltwater inputs to be constructed.

There are a number of other targets, including mode, intermediate, and bottom water characterization as well as constraining biological new/net/export production.

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