

Statement of Interest: Mercury Studies on the US GEOTRACES Arctic Cruise

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We are interested in participating in the proposed GEOTRACES Arctic cruise to collect and analyze water, particles and aerosols for mercury (Hg) species (total Hg, Hg⁰, CH₃Hg⁺ and (CH₃)₂Hg). Two of these species (Hg⁰ and (CH₃)₂Hg) are dissolved gases and which must be analyzed at-sea, thus we would be requesting two berth spaces as well as samples. In the North Atlantic work, as well as our currently proposed Eastern Tropical South Pacific work, we're also making measurements of dissolved and particulate thiols (e.g., cysteine and glutathione), which are reputed to be important complexing agents for Hg and other chalcophilic metals (e.g., Cu, Zn, Cd).

Mercury species would be a particularly interesting metal to include in an Arctic cruise, and participation would be an important addition to our growing data sets for the following reasons:

- There are some data that suggest the concentrations of Hg in fish in the Arctic are increasing, though atmospheric deposition of this metal does not appear to have changed much recently. But there is a lack of high quality data to even begin to model Hg cycling in this ocean basin. A current mass balance model exists, but is based on limited and, in our opinion, highly flawed data. Among the many reasons to understand Hg concentrations in biota of the Arctic is the observation that many indigenous peoples of the region rely on fish and marine mammals for their diets.
- There are large putative inputs of Hg to the region through so-called Arctic Mercury Depletion Events that occur in Spring which have been hypothesized to make the Arctic a large sink of Hg on a global scale. Studying the Arctic Ocean would be a critical part of testing this hypothesis.
- Changing ice conditions could have an enormous impact on the Hg cycle in this region as one of the major features of the cycle is the sea-to-air evasion of Hg⁰, which we expect to be enhanced in a more ice-free future.
- While riverine inputs of Hg to the ocean are not generally considered important for most basins, the Arctic is unique among oceans in its large receipt of river water. Thus, and as the warming of the Arctic is generally assumed to increase fluvial flow, the impact of rivers on the Arctic Ocean marine Hg cycle is important to study. Furthermore, and as the increased fresh water flow from the Arctic in the short-term is expected to derive from thawing permafrost, we expect that new increases of freshwater input to the ocean will carry a disproportionately high Hg concentration compared to the current condition. Participation in the Arctic GEOTRACES cruise will therefore represent an important "baseline" assessment of Hg cycle prior to a potentially large perturbation.