Statement of Interest in GP17 *Mason*

Air-Sea Exchange of Inorganic and Methylated Mercury in the South Pacific and Southern Ocean

I am interested in participating in both of the proposed legs of GEOTRACES GP17 cruise, doing research in collaboration with others who will submit their own proposals. The research interest is determining the speciation of mercury (Hg) in the atmosphere (aerosols, gaseous Hg speciation, and in wet deposition) and in surface waters (ionic and elemental Hg, and methylated Hg (methylmercury (MeHg) and dimethylmercury)). These measurements, along with those made by others, will allow estimation of the exchange of Hg in all its forms at the ocean's surface and for the Antarctic leg, allow an examination of how sea ice influences the exchange, and what reactions are occurring at this interface. The sampling will be done at high frequency while the ship is underway and thus provides complimentary but more detailed information than what can be collected from the water samples collected only while on station. The proposed research mirrors and expands involvement in previous GEOTRACES cruises (GP15, GP16 and the US Arctic cruises) and will also incorporate new developments and approaches to examining Hg interactions at the air-ice-water interfaces that will be refined on a 2021 NSF Polar Program-funded cruise in the Arctic (Mason and Kadko) looking at air-sea exchange of Hg species, in conjunction with radon, an unreactive dissolved gas. The proposed research would be conducted in support of, and in collaboration with, the atmospheric sampling group (Cliff Buck and colleagues), as done on previous cruises; the mercury group of Hammerschmidt and Lamborg, who will be focusing on water column measurements; and with colleagues doing the Rn measurements.

Mercury is not a "key TEI" in the GEOTRACES Science Plan, but is listed as an element of interest and its measurement has been included on all previous US GEOTRACES cruises. The measurements at the air-sea-ice interface can inform us not only about Hg biogeochemical cycling, but also about how ice impacts gas exchange in polar regions, and further about the impacts from inputs to these remote regions from anthropogenic activities. The ocean concentration and the levels of Hg, as MeHg, in biota have been increased dramatically as a result of human activities, and also from climate-driven changes to the ocean's surface layers and the chemistry of the atmosphere. Predicting how MeHg levels will change in the future is an important environmental and human health concern, and changes in polar waters are occurring more dramatically than elsewhere. The Southern Hemisphere has been little studied and there are few measurements in the South Pacific at high latitudes. While there have been previous (non-US) GEOTRACES and other Hg studies in the Southern Ocean, this upcoming cruise provides a unique opportunity to build on and expand these previous investigations.

If funded, the group would seek/need:

1 Berth

Lab space to set up the continuous bubbling system and analyzer for the measurement of dissolved gaseous Hg species. Additional space for a laminar flow hood if no other clean room facility space is available. Space for compressed gas cylinders. Lab space for the equipment needed to measure atmospheric Hg speciation as well as space for deployed samplers on deck. Wet deposition and aerosol samples from the atmospheric sampling group, as done previously.