

U.S. GEOTRACES: Mercury Speciation and Cycling in the Pacific Ocean (GP15)

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We propose to investigate mercury (Hg) cycling and air-sea exchange during the U.S. GEOTRACES cruise between Alaska and Tahiti. This region is of particular interest for studying the cycling of Hg on a global scale. This is because the proposed cruise track will examine both the effects of different productivity regimes and oxygen minimum zones (OMZs) have on TEIs through high resolution spatial sampling along a section that spans oligotrophic gyres and more productive equatorial and subarctic regions. The cruise track will therefore represent an excellent opportunity for us to test some of the putative controls on Hg distribution and methylation in the ocean, where concentrations of mono- and di-methylmercury have been observed to peak at the same depth as local oxygen minima and often in oxic water associated with chlorophyll maxima. During the U.S. GEOTRACES cruise in the tropical South Pacific (GP16), we found that methylated forms of Hg were greatest in the eastern part of the section underlying productive surface waters (Peru upwelling). Given the connections to ocean productivity, we expect to observe dramatic differences in the horizontal and vertical distributions of Hg species (particulate and dissolved total Hg and CH_3Hg^+ , Hg^0 and $(\text{CH}_3)_2\text{Hg}$) and fluxes across the meridional section. Additionally, measurements of Hg in intermediate, deep, and bottom waters of the South and North Pacific will allow us to better constrain our recent estimate of the inventory of anthropogenic Hg in the global ocean. Finally, the proposed track will pass through the heart of the “Pacific Garbage Patch,” a region noted for the high concentrations of suspended microplastic particles. We have preliminary data suggesting such particles may play an important but complex part in Hg cycling, and the opportunity to collect and measure plastic-hosted Hg (and provide samples for other TEIs) on this track is one not to be missed.

We will be interested in receiving samples of filtered water and large/small suspended particles (for Hg and genomic analysis), aerosols and rain, surface water plastics, and we also will be interested in operating an underway system for dissolved gaseous Hg species and atmospheric Hg. This last function could and should be performed in collaboration with Rob Mason.