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# Mercury isotopic composition of the Eocene Arctic Ocean: No evidence for volcanic loading signal at the PETM?

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A review of mercury abundances and isotopic compositions in Arctic Ocean marine sediments [1], including the 56 Ma PETM, is placed in the context of recent studies. The Cenozoic Arctic Ocean dataset, representing a variety of depositional environments, water depths and stratigraphic ages, is summarized here. Total range of mass dependent fractionation (MDF) and odd-mass independent fractionation (odd-MIF) of Hg stable isotopes was: $\delta^{202}$Hg (MDF) = −2.34‰ to −0.78‰; $\Delta^{199}$Hg (MIF) = −0.18‰ to +0.12‰ [n = 33]. Pleistocene-age Central Arctic Ocean sediments had average $\delta^{202}$Hg = −1.94‰ ± 0.29‰ (1sd) and positive $\Delta^{199}$Hg (+0.03‰ ± 0.07‰, 1sd), while Eocene sediments (Lomonosov Ridge IODP302) had the least negative $\delta^{202}$Hg values (average $\delta^{202}$Hg = −0.98‰ ± 0.12‰, 1sd) and $\Delta^{199}$Hg (MIF) = 0.00‰ ± 0.06‰ (1sd). A sample of the Arctic Ocean PETM from Lomonosov Ridge ($\delta^{202}$Hg = −1.32‰; $\Delta^{199}$Hg = −0.09‰) is distinct from both Arctic Ocean Pleistocene and Eocene signatures, but similar to Holocene-age Arctic marine sediments (average $\delta^{202}$Hg = −1.38‰ ± 0.22‰; $\Delta^{199}$Hg = −0.05‰ ± 0.06‰, 1sd). Correlated Hg isotopic trends in MIF space ($\Delta^{201}$Hg vs $\Delta^{199}$Hg) for these samples indicate the presence of primarily inorganic Hg that underwent some degree of photochemical reduction via the magnetic isotope effect. Together with TOC data, these Hg isotope signatures were interpreted as a terrestrially-dominated Hg source input, consistent with a) independent flux estimates of Hg delivered by rivers to the paleo Arctic Ocean, and b) spatial patterns and down-core variability in Hg isotope signatures. It is concluded that the Arctic Ocean PETM Hg isotopic signature is most consistent with enhanced erosion and delivery of terrestrially-derived Hg to the paleo Arctic Ocean, rather than volcanic loading from the North Atlantic Igneous Province. More Hg isotope data are needed to complement ongoing Hg/TOC concentration work at global PETM sites, and to constrain potential influences of volcanic loading on the marine environment during PETM-related hyper-thermal events.

[1] Gleason et al. (2017) Geochim. et Cosmochim. Acta 197:245-262.