Mercury inventories and isotopic signatures in sediments from the floodplain of the Connecticut River

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Mercury has long been stored in organic, fine-grained sediment along the various tributaries, ponds, lakes, and coves connected to the Connecticut River. Concentrations rose above background (<80 ppb) by the dawn of the Industrial Revolution and have, at a glance, mirrored the rise and fall of atmospheric mercury in the industrialized Northeastern corridor of North America ever since[1]. Sediment cores from six slackwater sites spanning ~180 km reveal peak mercury accumulation rates that range from approximately 900 ng/cm^2/yr at Barton's Cove, near the Massachusetts-Vermont border, to ~20,000 ng/cm^2/yr near the mouth of the river in Hamburg Cove. This increase is in part explained by the significant rise in sedimentation rates from Barton's Cove (at ~0.5 cm/yr) to Hamburg Cove (at ~4.2 cm/yr). These extremely high rates nearer the Long Island Sound are due to the influence of tidal pumping, allowing for significant sediment fines to accumulate in these depocenters. In both locations, organic content ranges from 4 to 14%, but does not correlate well with mercury concentrations (R^2 = 0.27). Although mercury readily adsorbs onto organic matter, the peaks in mercury are more consistent with atmospheric loading and local mercury inputs than simply TOC. In particular, the concentrations found from ~1940-1965 are greater than one would expect from atmospheric loading alone, and likely represent local sourcing of mercury.

To aid in constraining the source of mercury in these environments we analyzed both the mass dependent (MDF) and mass independent (MIF) fractionation of Hg isotopes within these profiles. Preliminary measurements reveal a correlation of less negative δ^{202}Hg values with the peak of legacy contaminant loading and record similar MDF and MIF signals for both cores. δ^{202}Hg values range from < -1.0‰ in preindustrial sediments with ~20ppb Hg at the bottom of each core to ~ -0.4‰ in sediments from Hamburg Cove with Hg concentrations exceeding 1800ppb. Shifts in the MDF signals from both cores also suggest that Hg isotopes resolve atmospheric Hg inputs from those of local point sources responsible for some of the legacy Hg contamination along the floodplain of the Connecticut River. Based on these results, we suggest that Hg isotopes may record changes in the sources of Hg pollution to the Connecticut River Valley both over time and along its length.

[1] Varekamp (2003) *Environmental Geology* Volume **43**, 268-282