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Long-term incubations experiments: Insights about demethylation and role of methylmercury refractory pools

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Methylation and demethylation of mercury (Hg) control the concentrations of monomethylmercury (MeHg) in natural environments, and thus the pool of Hg available for biological uptake and food web biomagnification. Typically, Hg methylation and demethylation are studied in short-term incubation experiments (< 24 h) using isotopically enriched Hg tracers. This approach has been successfully used to e.g. identify environmental hotspots of both of these processes. However, as the tracers are typically added as dissolved Hg complexes, while most ambient inorganic Hg and MeHg in e.g. sediments and soils are adsorbed onto particles, rates are recognised to not reflect true methylation and demethylation rates of ambient Hg. The traditional approach also overlooks the potential existence of refractory MeHg pools, i.e. pools of MeHg not readily available for demethylation. Previous work has, however, indicated the potential role of refractory MeHg concentrations. Jonsson et al. (Nature Com., 2014), for example, suggest up to 70% of the MeHg pool in a brackish sediment system to be in a refractory form. The occurrence of this fraction is also suggested as a key factor mediating MeHg availability in sediments by DiPasquale et al. (Environ. Sci. Technol., 2000).

We have conducted long-term incubation experiments aiming to quantify refractory MeHg pools. In short, isotopically enriched Hg tracers ($Me^{201}Hg$ and ^{198}Hg, pre-equilibrated with natural waters) were incubated with lake, marsh and brackish sea water sediments and forest soils at a temperature of 10 °C for up to 6 weeks. These samples represent contrasting environments with initial MeHg concentrations ranging from 0.01 to 3.9 ng g^{-1} dry weight, and MeHg:Hg ratios of 0.01 to 31%. To quantify refractory pools of MeHg, we will compare steady state concentrations of MeHg:Hg ratios for added MeHg tracer with the MeHg:Hg ratio of ambient Hg. In this presentation, we will discuss the results from this study, as well as the role of refractory MeHg pools.