Using organic matter gradients to predict mercury cycling in perturbed coastal seas

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The biogeochemical cycling of mercury (Hg) includes redox and methylation transformation reactions, largely mediated by microorganisms. These reactions are decisive for mobility and bioavailability of Hg in ecosystems. Organic matter (OM) plays several critical roles in these important transformation reactions.

In coastal sea systems, the composition of OM is naturally diverse and dynamic, and subject to further alternations due to ecosystem changes induced by climate, eutrophication, land use, and industrial activities. We will present how changing characteristics of OM along natural salinity and carbon gradients control Hg methylation and reduction reactions, as well as bioaccumulation processes, in coastal seas. We will further discuss potential changes to Hg cycling in coastal seas following ecosystem perturbations which alter the amount and characteristics of OM.

The presentation will focus on recent research advancements describing how: (i) the binding of Hg to thiol functional groups in OM controls the chemical speciation of Hg, and thereby its availability for chemical reactions and uptake in biota, (ii) the composition of OM is a primary controlling factor for methylation and reduction rates of divalent Hg by electron donation and shuttling processes, (iii) the amount and characteristics of dissolved OM affect the structure and productivity of the pelagic food web, and thereby the biomagnification of methylmercury.