Mercury isotopic compositions in water column of lake systems

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Lakes are important ecosystems where mercury (Hg) may be methylated into methylmercury (MMHg) which can pose serious threat on aquatic ecosystem through food web bioaccumulation. Therefore, it's crucial to understand the sources and biogeochemical processes of Hg in lake systems. Recent studies demonstrated that mercury isotope composition is a powerful tool for tracing its behaviors in the environment (1). Nevertheless, limited by pre-treatment method of dilute Hg in natural water, few studies were carried out on Hg isotope compositions in lake systems (2), and weather the Hg isotopic fractionation could be triggered by post-depositional in-lake processes remain still unclear.

Here, we reported Hg isotopic compositions in surface and/or deep water samples collected from different lakes located in North America, China, Europe with variable geological background. In general, the stratification phenomenon is obvious in these lakes in summer. All samples display large variations of both MDF and MIF. In fact, the positive Δ^{200}Hg and the Δ^{199}Hg/ Δ^{201}Hg ratio of 1.03 (very close to that found in the photoreduction of Hg^{2+} (3)) would suggest a strong contribution of rainwater. The materials from water-rock interaction in the catchments would be another potential contributor. While most lake waters display a relatively constant Hg isotope variation in the water column, the samples from the water column of the high latitude forested lakes show a concomitant decrease of δ^{202}Hg and Δ^{199}Hg values deep toward, likely caused by the various isotopic fractionations induced by in-lake processes at different layers. Thus, the application of mercury isotopes may be helpful for better understanding the biogeochemical cycle of Hg in complicated lake systems.

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