Unusual fractionation of mercury isotopes in the Hongfeng Lake near Guiyang, SW China

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Previous studies have demonstrated both mass-dependent fractionation (MDF) and mass-independent fractionation (MIF) of Hg isotopes in natural samples and during some bio-geochemical processes, highlighting the potential of Hg isotope determinations in biochemistry and geochemistry (1-3). Lakes are of great importance in terrestrial mercury (Hg) biogeochemical cycle. It is a crucial sink and carrier of Hg, from which Hg may transfer to the atmosphere and sediment. Though investigating Hg isotopic composition in lakes can provide useful information for a) verifying the experimental results, b) explaining Hg isotope anomalies (anomalies of odd mercury isotopes) in aquatic organism, and c) identifying the fate of atmospheric Hg, little has been done on mercury isotopes in lake water.

Here, we reported, for the first time, Hg isotopic composition in four water column samples of Hongfeng Lake (SW Guiyang, China) collected from autumn 2012 to spring 2014. All samples showed notable MDF (δ^{202}Hg varying from -1.06 to -0.39‰) and MIF of odd isotopes (Δ^{199}Hg raging from 0.04 to 0.59‰), and no significant MIF of even isotopes (Δ^{200}Hg) was observed. Our results showed that, except for the precipitation contribution, the photo-reduction (1) occurring in the surface water and abiotic dark-reduction (2) from the deep water impacted MIF of odd Hg isotopes as well. Significant difference in Δ^{199}Hg was found between samples collected in spring and in autumn. For the spring samples, the contribution of dark-reduction driven Δ^{199}Hg increased with water depth, while contribution of Δ^{199}Hg caused by photo-reduction at surface decreased. However, the autumn samples showed no distinct trends. This can be probably explained by the fact that the lake water during this period has been mixed evenly and thus the MIF of the mercury isotopes become homogeneous. If the conceptual model of Chen *et al*. (2012) holds, our observation of no Δ^{200}Hg in waters may indicated that, unlike the mid-latitude region in southern Ontario (Canada) (3), the stratosphere incursion may be very limited in this sub-tropical region.

[1] Bergquist and Blum, *Science*, 2007, **318**, 417-420 [2] Zheng and Hintelmann, *J. Phys. Chem*., 2010, **114**, 4238-4245 [3] Chen *et al*. 2012, **90**, 33-46.