Mercury Isotopic Composition in the Large Anthropogenically Impacted Pearl River, South China

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Though isotope approach was a useful tool for tracing Hg sources and processes in surface environments, Hg isotopes were rarely reported for human-impacted rivers which are important terrestrial ecosystems and transport large amount of materials derived from both natural and anthropogenic processes to the ocean. Here, Hg isotope compositions were systematically investigated for the Pearl River, which locates in a subtropical region and eventually flows into South China Sea. Large variations in both dissolved Hg concentration and its isotopic composition were observed in water samples. Total dissolved Hg concentration varied from 0.45 to 2.44 ng/L, close to the range for natural lake and river waters. All water samples displayed significant negative δ^{202}Hg (-2.89‰ to -0.61‰), slightly positive Δ^{200}Hg (-0.05‰ to 0.52‰), and large variation of Δ^{199}Hg (-2.25‰ to 0.57‰). Our Hg isotope data, together with other geochemical parameters, suggested that the dissolved Hg in the Pearl River mainly derived from atmospheric precipitation and surface soil weathering. Though human activities (urban, industry and mining) largely distributed in the whole basin, their direct contribution to dissolved Hg was limited. Interestingly, we observed the most negative Δ^{199}Hg (down to -2.25‰) of surface waters, which may be attributed to the input of local electronic wastes. This study demonstrated that isotope approach is a powerful tool for tracing Hg sources in large river systems, and the control legacy on Hg contamination at a large basin scale should be made mainly on the atmospheric emission from anthropogenic sources.