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Applications of mercury isotope analysis for identifying Hg source and tracking Hg transformations in environment

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Mercury (Hg) concentration in environment has increased since the Industrial Revolution due to anthropogenic emissions such as coal burning and wastes from consumer products. Hg is a global threat to human and environmental health because it is environmentally persistent, tends to be bioaccumulated, and a highly toxic element. International community plans to reduce the Hg emission to environment by signing the Minamata Convention by the end of 2013, and many studies are still required in order to understand details of Hg biogeochemical cycle and develop a proxy for distinguish anthropogenic from natural sources. It has been recognized that Hg isotope analysis is an important new tool for identifying Hg source and tracking Hg transformations in the environment. Hg isotope ratios are varied in different Hg reservoirs and fractionated by a number of biogeochemical processes, including speciation, biomagnification, and redox cycling. For example, d^{202}Hg values of Hg-containing sulfides from Hg ores in Japan are mostly negative, and those from an active submarine hydrothermal region in Okinawa trough are mostly negative as well. On the other hand, d^{202}Hg values of tuna fishes are mostly positive, which indicates that there is a relatively large isotopic fractionation from a source to the fishes. Moreover, odd-even Hg isotope ratios in biological samples often indicate a mass independent fractionation (MIF) induced by photoreduction. Hg isotope analysis is, therefore, a promising analytical tool for distinguishing Hg in environment, helps us understand details of global Hg biogeochemical cycles, and enable us to track Hg in environment.

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