Mercury isotopic signatures to unravel the historical contamination of main German waterways over the last decades

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Hg concentrations are still high in many European water systems. Hg is identified as a priority hazardous substance under the European Water Framework Directive. At present, legal requirements including the respective monitoring programs and water quality standards mainly deal with total Hg concentrations in biota. At present, in many river systems of Germany, the Hg concentration in fish tissues integrating the variability of Hg concentration in waters are still significantly high to be of concern. Results obtained for the last two decades, mercury concentrations in fish muscle from the Elbe river and its tributaries indicated a significant decrease attributed to the shutdown of the industry after the German re-unification. However, Hg concentrations in fish tissues still remain above the environmental quality standards. The recent developments of multicollector ICP/MS and associated speciation capabilities has opened the way to renew our understanding of Hg biogeochemistry in the environment. In order to question the evolution of Hg in these river systems, we have followed the isotopic signature of total and speciated Hg concentration in fish samples collected over the years. Hg isotope compositions measured in geochemical records like sediments and suspended particulate matter indicated no variation in the sources of initial mercury in the system over time and space. Temporal mass dependent fractionations measured in fish muscles presented significant spatial trends. In respect of the inorganic sources of Hg, the variations in fish muscles are assumed to reflect changes of the ratio of production versus degradation of methylmercury in the system. An Elbe's tributary was found to be responsible for the contamination of the main Elbe River for decades 1995 - 2000. These results may allow us to define the environmental timescale for a contaminated ecosystem to recover after contamination.