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Mercury cycling in the Baltic Sea: can stable isotopes help us ?

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Mercury (Hg) is a toxic element of global environmental concern, released by both natural and anthropogenic activities. In aquatic and terrestrial ecosystems, Hg can be converted to mono-methylmercury (MMHg), a potent neurotoxin bioaccumulated and bioamplified in food webs. Over the past two decades, research on stable isotopes of Hg has improved process understanding and sources tracking of Hg in the environment [1].

The Baltic Sea is a shallow, complex aquatic ecosystem that covers a large range in salinity, redox conditions and microbial activities. It receives substantial inputs of terrestrial OM and nutrients, which makes it prone to eutrophication and deoxygenation, as well as Hg and MMHg inputs from multiple sources [2]. In this work, Hg concentrations and stable isotopes were determined in sediments, fish and plankton collected from various sub-basins of the Baltic Sea to better elucidate the complex cycling of Hg in this coastal sea ecosystem. Here, we will discuss Hg stable isotope variations in perspective of Hg sources and processes affecting MMHg production and degradation. Hg stable isotopic composition in sediments ($d^{202}Hg$ from - 2.3 to - 0.1 ‰) demonstrates that Hg in the Baltic Sea results from a rather homogeneous mixing between pre-industrial "background" inputs of Hg with lighter isotope signature, and recent anthropogenic inputs with heavier signature. Herring populations from the various sub-basins are well discriminated by their mass dependent ($d^{202}Hg$ from - 0.29 to 0.73 ‰) and/or mass-independent fractionation ($D^{199}Hg$ from 0.33 to 3.04 ‰) induced by processes affecting MMHg before its uptake by biota. The Hg isotopic composition of plankton shows intermediate values between sediments and fish, partly explained by their relative content of MMHg (average 27 % HgT). Overall this study provides insights into the origin and cycling of MMHg found in pelagic fish that forage in distinct Baltic Sea basins. It demonstrates that the bioaccumulated MMHg pool originates from variable inputs from terrestrial and/or anoxic waters and undergoes substantial photodegradation.

REFERENCES

[1] Blum et al., Annu. Rev. Earth Planet. Sci. 2014. 42:249–69. [2] Soerensen et al., Global Biogeochem. Cycles 2018. 32: 1498-1513.