X-ray Fluorescence Mapping of Mercury on Suspended Mineral Particles and Diatoms in a Contaminated Freshwater System

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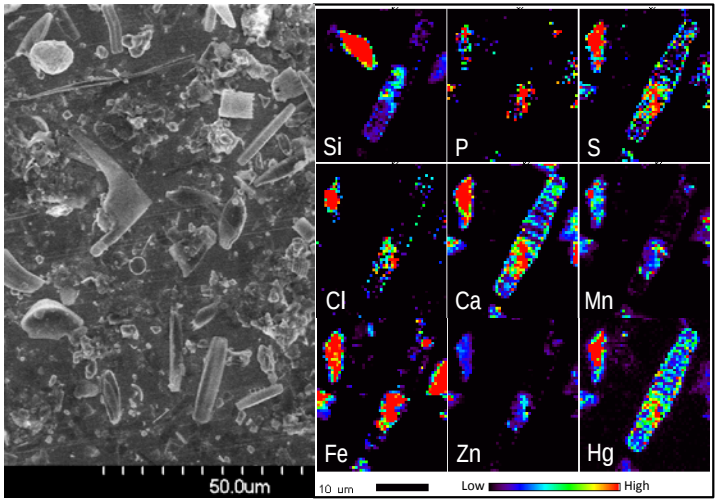

Objective

- Determine mercury (Hg) distributions and correlations with multiple elements of interest on both diatoms and mineral particles from a Hg contaminated freshwater freshwater system.

New Science

- For the first time, X-ray fluorescence (XRF) microscopy was used to map the localization of Hg on suspended diatoms and mineral particles in natural water
- The diatom-bound Hg is mostly found on outer surfaces of the cells, suggesting passive sorption of inorganic Hg on diatoms.
- Mercury is heterogeneously distributed on mineral particles that are rich in iron oxides and natural organic matter (NOM), possibly as Hg-NOM-iron oxide ternary complexes.

Significance

- Localized sorption of Hg onto suspended particles, including diatoms and NOM-coated mineral particles, is an important sink for Hg (as well as a potential source for methylation) in natural aquatic environments.

Gu, B., B. Mishra, C. Miller, W. Wang, B. Lai, S.C. Brooks, K.M. Kemner, and L. Liang. 2014. X-ray fluorescence mapping of mercury on suspended mineral particles and diatoms in a contaminated freshwater system. Biogeosci. 11:75,21-7540 (doi:10.5194/bgd-11-7521-2014).

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Mercury (Hg) bioavailability and geochemical cycling is affected by its partitioning between the aqueous and particulate phases. We applied X-ray fluorescence (XRF) microprobes to directly visualize and quantify the spatial localization of Hg and its correlations with other elements of interest on suspended particles from a Hg contaminated freshwater system. Up to 175 µg/g Hg is found on suspended particles. Mercury is heterogeneously distributed among phytoplankton (e.g., diatoms) and mineral particles that are rich in iron oxides and natural organic matter (NOM), possibly as Hg-NOM-iron oxide ternary complexes. The diatom-bound Hg is mostly found on outer surfaces of the cells, suggesting passive sorption of inorganic Hg on diatoms. Our results indicate that localized sorption of Hg onto suspended particles, including diatoms and NOM-coated oxide minerals, is an important sink for Hg in natural aquatic environments.

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