Mercury transport along the Tiber River basin (Central Italy)

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The Mt. Amiata Hg district (MAMD) was an area of significant Hg mining up to the 1980s, with a total Hg production exceeding 102,000 tons. High concentrations of Hg were found in rivers, such as the Paglia River, which drains the NE part of the MAMD. In this study, stream sediment, stream water and fish were collected from the Tiber River and its tributaries to evaluate long distance Hg transport downstream from the MAMD. Along the Tiber River, samples were collected both upstream and downstream from the confluence with Paglia River to determine any adverse affects of Hg to the Tiber River.

The highest Hg concentrations in stream sediment, water and fish were found along the Paglia River, which is most proximal to Hg mines, and along the Tiber River just below the confluence with the Paglia River. Overall, Hg generally decreased with increasing distance from the MAMD, suggesting dispersion and dilution of Hg with increasing distance from mined areas. Five sediment samples exceed the probable effect concentration for Hg of 1.06 µg/g, above which harmful effects are likely to be observed in sediment-dwelling organisms. Concentrations of stream water Hg generally correlated with sediment Hg indicating that Hg is dominantly transported as particulates. The Alviano dam, located along the Tiber River, acts as a sink for Hg, where Hg contaminated sediment is deposited.

Of the fish muscle samples collected, 17% exceeded the 0.30 μg/g (wet weight, methyl-Hg) USEPA fish muscle Hg guideline recommended to protect human health. Fish with the highest Hg concentrations were collected from the Paglia River, whereas no fish collected from the Tiber River contained Hg beyond the USEPA guideline. Lower Hg concentrations in fish in the Tiber River are a result of dispersion and dilution of Hg with increasing distance from mined areas, as well as generally low methylation of Hg on the Tiber River.

Controls on the uptake of Mg, Sr and Li in benthic foraminifera *Uvigerina peregrina*

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The uptake of trace elements into benthic foraminiferal calcite is controlled by the temperature and carbonate ion saturation (ΔCO_3^{2-}) of the water in which calcification occurs. Trace element/Calcium ratios can potentially be used to elucidate past changes in bottom water temperature (BWT) and ΔCO_3^{2-}, providing the relationships between trace element uptake and environmental variables can be accurately constrained. Current *Uvigerina peregrina* trace element/Ca calibrations are predominantly based on the super-saturated waters of the North Atlantic. In order to constrain the effects of temperature and ΔCO_3^{2-} on trace element uptake, and assess the fidelity of trace element-temperature/ΔCO_3^{2-} relationships in under-saturated waters we present new core top *Uvigerina peregrina* trace element/Ca data with a focus on the under-saturated waters of the North Pacific.

Core top *Uvigerina peregrina* samples were obtained from the Bering Sea, Cascadia Basin, Gulf of California and Okhotsk Sea in the North Pacific, and the Florida Straits in the North Atlantic. The core top sites were chosen to cover a wide range of bottom water temperatures (2 to 17 ^{o}C) and carbonate ion saturation states (-10 to 135 µmol kg^{-1}). Trace element/Ca ratios were analysed by quadrupole ICP-MS. Our results reveal a significant negative relationship between test size and both Li/Ca, and Sr/Ca ratios, demonstrating an ontogenetic control on trace element uptake, possibly related to changing calcification rate. Mg/Ca, Sr/Ca, and Li/Ca ratios are significantly correlated to both BWT and ΔCO_3^{2-}, however the relationship between trace element/Ca ratios and BWT/ΔCO_3^{2-} differs in under-saturated and super-saturated waters, with Li uptake displaying a higher sensitivity to ΔCO_3^{2-} in under-saturated waters.

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