Chromium geochemistry in Lake Erie sediments

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Chromium (Cr) is a trace metal that displays two key oxidation states in natural settings: Cr(VI), highly toxic, and Cr(III). Within oxygenated bottom water and porewater, Cr is generally soluble as Cr(VI). Removal processes usually involved are either precipitation as Cr oxyhydroxides, adsorption on iron (Fe) and mangenese (Mn) oxyhydroxides, or association with organic matter (OM). Under anoxic conditions, Cr remains insoluble as Cr(III). Trace metal geochemistry in sediments from the Great Lakes have been largely ignored; despite the risk of toxic metal remobilization in the water column if when sediment was to be rexposed to oxygen.

In recent history Lake Erie has been affected by hypoxia as a result of eutrophication. Harmful Algal Blooms (HABs) have developed each summer for several decades. These events are large (~100 km), often starting in the western basin and reaching into the central basin of the lake. The HABs, basinal depth, and proximity to industrial centers and major rivers can influence the input of Cr in each basin. Our primary research objectives were to: 1) Measure the concentrations of Cr and other important trace elements in dated sediment cores from each basin; 2) Compare the spatial distribution between the western, central, and eastern basins of Lake Erie; 3) Estimate the importance of anthropogenic Cr for each basin over time. To accomplish this, we measured total Cr and other relevant trace metal concentrations (e.g. Fe, Mn, Ti) in all sediment cores, including enrichment factor and sediment mixing calculations. Sediment dating was achieved by measuring ^{210}Pb activity in sediment samples.

Our preliminary results show that anthropogenic activities have significantly contributed to Cr enrichment in 2 of the 3 basins. Moreover, the basins cuurently affected by hypoxia may become a source of Cr if the redox regime was to shift to fully oxygenated conditions posing a potential risk for the Lake Erie ecosystem as well as for human health.