

Controls on the Distribution of Trace Elements in Estuarine Sediments and Bottom Waters of Mobile Bay, Alabama.

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The distribution of trace elements in the estuarine environment is controlled by numerous physical, chemical, and biologic processes. In terms of its freshwater discharge, Mobile Bay is the fourth largest estuary in the United States. The Bay is home to numerous, diverse biological species, and is economically important for shipping, recreational, and commercial fishing. Understanding the distribution of potentially toxic trace elements in this complex estuary system is therefore of critical importance. This study seeks to improve our understanding of factors that control the distribution of trace elements in estuarine sediments and bottom waters by determining the grain size, mineralogy, and chemical composition of surface sediment samples and the chemical composition of bottom water samples collected from Mobile Bay, Alabama.

Surface sediment (N = 116) and bottom water (N = 94) samples were collected on a 4 km grid from Mobile Bay. Sediment particle size analysis was performed using a laser diffraction instrument. Sediment mineralogy was characterized by X-ray diffraction and mineral percentages determined by Rietveld refinement. The mobile fraction of sediment sample was extracted by microwave-assisted acid digestion using USEPA Method 3051A, followed by ICP-OES analysis of the digestate solutions. Sediment mercury concentrations were measured using a cold vapor atomic fluorescence mercury analyzer. Bottom water salinity, T, DO, pH and conductivity were measured *in situ* using a digital multimeter. The composition of bottom water samples was determined by IC and ICP-OES analyses.

Extractable concentrations of many trace elements (B, Be, Co, Cr, Ni, Pb, V, Zn) are strongly correlated with sediment Al and Fe contents, suggesting that their distributions are primarily controlled by adsorption on clays and iron oxides. XRD and PSA analyses of sediment mineralogy and grain size support this interpretation. Potential sources of trace elements in Mobile Bay sediments include coal mining, agriculture, industry and urbanization. Locally elevated concentrations of these trace elements are found in sediment and bottom water samples collected near the western and central eastern shoreline, corresponding to areas with higher urbanization and industrialization. These results provide insights into the processes controlling the distribution of trace elements in estuarine sediment and bottom water samples.