Spatial and Temporal Variations in the Mercury Content of Narragansett Bay Sediments (RI, USA)

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Marine and estuarine sediments can provide a historical record of heavy metal contamination in the environment. In this study, stratigraphic profiles of sediment mercury concentrations were examined at four sites in the Narragansett Bay Estuary (Rhode Island, USA). Sediment cores were collected in May and June 2019 using a push piston corer, and in the laboratory, cores were sectioned at 2-cm increments. Sediments were then lyophilized and analyzed for total mercury content (Hg; ppm dry weight) and total organic carbon (TOC; % dry weight) using atomic absorption spectroscopy and loss-on-ignition, respectively. Overall sediment Hg concentrations and depth profiles varied across sites. The highest Hg concentrations were observed in the Providence River near Fields Point (maximum Hg = 2.02 ppm), followed by Greenwich Bay (0.85 ppm), Mt. Hope Bay (0.65 ppm), and mid-Bay, north of Conanicut Island (0.06 ppm). These patterns likely reflect each site's proximity to anthropogenic sources of Hg, as well as spatial variations in sediment TOC levels (range = 1.3 to 5.5%), i.e., Hg was observed to have a high affinity for organic material ($R2 = 0.574$; $p < 0.0001$). The depth of maximum Hg content also differed across sites (range = 1 to 51 cm), and this is attributed to site-specific sedimentation rates. Finally, sediment Hg concentrations were generally lowest in the deepest portions of the cores, coinciding with the pre-industrial period (< 1820s). In conclusion, the stratigraphic analysis of Hg and TOC in this study provided spatio-temporal insights into the history of Hg contamination in Rhode Island and surrounding waters.

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